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МАТЕМАТИЧЕСКИЙ МОДЕЛЬ ЗАДАЧИ АВТОКОЛЕБАНИЙ (ФЛАТТЕРА) ВЯЗКОУПРУГОГО СТЕРЖНЯ С УЧЕТОМ ФИЗИЧЕСКОЙ И АЭРОДИНАМИЧЕСКОЙ НЕЛИНЕЙНОСТЕЙ

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Аннотация. Рассматривается проблема автоколебаний физически нелинейного вязкоупругого стержня в потоке газа с учетом нелинейных зависимостей. Приведена постановка задачи и метод решения проблемы плоской вязкоупругой стержня с учетом физической и аэродинамической нелинейности. Построена математическая модель задачи. С помощью метода Бубнова-Галёркина, основанного на многочленной аппроксимации прогибов, задача сводится к рассмотрению системы нелинейных интегро-дифференциальных моделей типа Вольтерра. Для решения полученной системы, при слабо-сингулярном подходе Колтунова-Ржаницына, применяется следующий метод, основанный на использовании квадратурных формул.

Annotatsiya: Nochiziqli bog'liqliklarni hisobga olgan holda gaz oqimidagi fizik chiziqli bo'lmagan viskoelastik novdaning o'z-o'zidan tebranishlari muammosi ko'rib chiqiladi. Jismoniy va aerodinamik nochiziqlilikni hisobga olgan holda tekis viskoelastik novda muammosining bayoni va yechish usuli keltirilgan. Muammoning matematik modeli tuziladi. Bubnov-Galerkin usulidan foydalanib, burilishlarning polinomial yaqinlashuviga asoslangan holda, muammo Volterra tipidagi chiziqli bo'lmagan integrodifferensial modellar tizimini ko'rib chiqishga qisqartiriladi. Olingan sistemani yechish uchun kuchsiz singulyar Koltunov-Rjanitsin yondashuvidan foydalangan holda, kvadratura formulalaridan foydalanishga asoslangan quyidagi usul qo'llaniladi.

Tayanch so'zlar: qovushqoq elastiklik, viskoelastik tayoq, o'z-o'zidan tebranishlar, tebranishlar, fizik nochiziqlik, aerodinamik nochiziqlik, Bubnov-Galerkin usuli, relaksatsiya yadrosi, sonli usul, chiziqli bo'lmagan integro-differensial tenglama.

Ключевые слова: вязко упругость, вязкоупругая стержень, автоколебания, флаттер, физическая нелинейность, аэродинамическая нелинейность, метод Бубнова-Галёркина, ядро релаксации, численный метод, нелинейное интегро-дифференциальное уравнение.

Annotation. The problem of self-oscillations of a physically nonlinear viscoelastic rod in a gas flow is considered, taking into account nonlinear dependencies. The problem statement and method for solving the problem of a plane viscoelastic rod are presented, taking into account physical and aerodynamic nonlinearity. A mathematical model of the problem is constructed. Using the Bubnov-Galerkin method, based on polynomial approximation of deflections, the problem is reduced to considering a system of nonlinear integral-differential models of the Volterra type. To solve the resulting system, using the weakly singular Koltunov-Rzhanitsyn approach, the following method is used, based on the use of quadrature formulas.

Key words: viscoelasticity, viscoelastic rod, self-oscillations, flutter, physical nonlinearity, aerodynamic nonlinearity, Bubnov-Galerkin method, relaxation kernel, numerical method, nonlinear integral-differential equation.

Введение. Новые материалы, обладающие нелинейной диаграммой деформирования, например, композиты, сплавы и некоторые виды металлов широко применяются в различных областях современной техники: строительстве, авиастроении, машиностроении т.д. Поэтому исследования конструкций на колебания и динамическую устойчивость с учетом физической нелинейности материала являются актуальными.

В [7] излагается методы решения линейных и нелинейных квазистатических и динамических задач теории вязко упругости. Показана эффективность метода степенного ряда для решения линейных и нелинейных слабо-сингулярных интегральных уравнений наследственной теории вязко упругости. На основе метода Бубнова-Галеркина в сочетании с методом степенного ряда разработан и реализован на ЭВМ единый вычислительный

алгоритм для исследования широкого класса краевых задач статики и динамики теории вязкоупругости балок, пластин и оболочек в геометрически и физически нелинейной постановке.

В [9] приведены новые постановки задач флаттера пластин и оболочек, суть которого заключается в том, что, существенно уточняя известную формулу поршневой теории слагаемыми получено выражение для давления аэродинамического взаимодействия. Разработан численно-аналитический метод позволяющий исследовать новые классы задач флаттера пластин и оболочек, произвольных в плане. Обнаружены новые механические эффекты.

В [10] изложены основные положения динамики стержней, дан вывод уравнений движения стержней в линейной и нелинейной постановке при детерминированных силах и моментах. Изложена теория и приведены численные методы решения задач взаимодействия стержней с потоком воздуха или жидкости, т.е. аэро-упругие задачи механики стержней.

В [11] приводятся некоторые методы решения физически нелинейных задач, в частности, приведены решения физически нелинейной задачи о плоском напряженном состоянии тонкой пластинки методом малого параметра. Показано, что учет физически нелинейности приводит к уменьшению наибольшего напряжения σ_x по сравнению с линейным решением.

В [12] исследуются условия возникновения уединенных продольных волн в физическом и геометрически нелинейных вязкоупругих стержнях.

Метод возмущений применяется [13] для исследования дисперсионных волн в геометрически нелинейных стержнях из линейно- и нелинейно-вязкоупругого материала. Выведены эволюционное уравнение Кортевега де Вриза–Бюргерса для линейно-вязкоупругого и модифицированное уравнение для нелинейно-вязкоупругого стержня.

Теория вязкоупругости получила широкие применения в расчетах стержней, пластин и оболочек. При этом необходимо иметь в виду, что учет времени является, вообще говоря, обязательным при решении почти любой задачи расчета тонкостенных конструкций.

Высокие темпы строительства, создание уникальных конструкций и сооружений, необходимость выполнения весьма сложных заказов промышленности и ее техникой требуют дальнейшего развития теории расчета конструкций типа стержней, пластинок и оболочек.

В связи с этим правильный учет свойств материала такие как пластичность, наследственность, неоднородность, анизотропность, нелинейность и т.п. имеет большое теоретическое и практическое значение, гарантирует приближение теории, расчета конструкции к фактическим условиям, обеспечивает надежность и долговечность конструкций при наименьших затратах материалов.

Применение персональных компьютеров для решения вышеназванных задач позволяет глубже изучить истинную картину процессов в случае реальной диаграммы деформирования материала и его неоднородных, анизотропных и вязкоупругих свойств.

Постановка задачи. Рассмотрим задачу флаттера наследственно-деформируемого стержня с учетом физической (1) [7]

$$\sigma = (1 - R^*)(m_1 \varepsilon + m_2 \varepsilon^3), \quad \varepsilon = u_x, \quad u = -zw_x \quad (1)$$

где

$$R^* f(t) = \int_0^t R(t - \tau) f(\tau) d\tau$$

или

$$\sigma = (1 - R)(-m_1 zw_x - m_2 z^3 w_{xx}^3) \quad (2)$$

где m_1 и m_2 упругие постоянные, определяющие в процессе испытаний материала на растяжение или кручение, причем $m_2 < 0$ для материала мягких, а $m_2 > 0$ жестких характеристик, $R(t)$ – ядро наследственности, имеющее слабо-сингулярные особенности типа Абеля.

Следует учитывать также влияние аэродинамических нелинейностей. Учет этих нелинейностей важен при больших числах M . Так как колебания конструкций летательного

аппарата в полете вызывают изменения аэродинамического давления на колеблющейся поверхности, что в свою очередь сказывается на характере самих колебаний. При больших скоростях $\bar{U}$ движения потока, если числа Маха $M = \bar{U}/C_0 > 2$ (C_0 - скорость звука на бесконечности), для определения нормального давления на поверхности принимается так называемая «поршневая» теория [8].

По одномерной теории газа давление газа на поршень [5]

$$p = p_0 \left(1 + \frac{\chi - 1}{2} \frac{\bar{U}^2}{c_0^2} \right)^{\frac{2\chi}{\chi - 1}} \quad (3)$$

где $\bar{U}$ - скорость движения поршня

$$\bar{U} = V \frac{\partial w}{\partial x} + \frac{\partial w}{\partial t} \quad (4)$$

p_0 и c_0 - давление и скорость в невозмущенном потоке, w - перемещение системы по нормали к первоначальной ее поверхности [1]. Применим для уравнения (3) формулу бинома Ньютона

$$\begin{aligned} \frac{p}{p_0} &= 1 + \chi \frac{\bar{U}}{c_0} + \frac{\chi(\chi + 1)}{4} \left(\frac{\bar{U}}{c_0} \right)^2 = 1 + \frac{\chi}{c_0} V \frac{\partial w}{\partial x} + \frac{\chi}{c_0} \frac{\partial w}{\partial t} + \\ &+ \frac{\chi(\chi + 1)}{4c_0^2} \left[V^2 \left(\frac{\partial w}{\partial x} \right)^2 + 2V \frac{\partial w}{\partial x} \frac{\partial w}{\partial t} + \left(\frac{\partial w}{\partial t} \right)^2 \right] \\ p - p_0 &= \frac{\chi p_0}{c_0} V \frac{\partial w}{\partial x} + \frac{\chi p_0}{c_0} \frac{\partial w}{\partial t} + \frac{\chi(\chi + 1)p_0}{4c_0^2} V^2 \left(\frac{\partial w}{\partial x} \right)^2 + \\ &+ \frac{\chi(\chi + 1)p_0}{4c_0^2} \left[2V \frac{\partial w}{\partial x} \frac{\partial w}{\partial t} + \left(\frac{\partial w}{\partial t} \right)^2 \right] \end{aligned}$$

Считая, что величины $\frac{\partial w}{\partial x} \frac{\partial w}{\partial t}$ и $\left(\frac{\partial w}{\partial t} \right)^2$ малыми, поэтому эти величины будем пренебрегать, то есть

$$\frac{\chi(\chi + 1)p_0}{4c_0^2} \left[2V \frac{\partial w}{\partial x} \frac{\partial w}{\partial t} + \left(\frac{\partial w}{\partial t} \right)^2 \right] = 0.$$

Тогда, получим

$$p - p_0 = \frac{\chi p_0}{c_0} V \frac{\partial w}{\partial x} + \frac{\chi p_0}{c_0} \frac{\partial w}{\partial t} + \frac{\chi(\chi + 1)p_0}{4c_0^2} V^2 \left(\frac{\partial w}{\partial x} \right)^2$$

Введем обозначения

$$q = p - p_0, \quad k = \frac{\chi p_0}{c_0}, \quad \chi_1 = \frac{\chi(\chi + 1)}{4c_0}$$

и во втором приближении получим [5]:

$$q = k \left[V \frac{\partial w}{\partial x} + \chi_1 V^2 \left(\frac{\partial w}{\partial x} \right)^2 + \frac{\partial w}{\partial t} \right] \quad (5)$$

Вместо уравнения (5) можно использовать выражения

$$q = k \left[V \frac{\partial w}{\partial x} + \chi_1 V^2 \left(\frac{\partial w}{\partial x} \right)^2 + z \frac{\partial w}{\partial t} \right] \quad (6)$$

где, для квазиустановившегося течения $z = (M^2 - 2)/(M^2 - 1) \rightarrow 1$, а для квазистатического случая $z=0$, в линейном приближении $\chi_1=0$.

Решим задачу об автоколебаниях в нелинейной вязкоупругой постановке учитывая физические и аэродинамические нелинейности. С этой целью построим математическую модель для исследования наследственно-деформируемого стержня в потоке газа с учетом этих нелинейностей.

В данном случае, принимая гипотезу плоских сечений для изгибающего момента используем следующую формулу [7]:

$$M_x = \int_{-h/2}^{h/2} b(x) \sigma_x z dz \quad (7)$$

(2) поставим в (7) и получаем:

$$M_x = -b(x)(1 - R^*) \int_{-\frac{h}{2}}^{\frac{h}{2}} (m_1 z w_{xx} + m_2 z^3 w_{xx}^3) z dz = -b(x)(1 - R^*) \times \\ \times \left[m_1 w_{xx} \frac{h^3}{12} + m_2 w_{xx}^3 \frac{h^5}{80} \right] = -(1 - R^*) [m_1 J_2(x) w_{xx} + m_2 J_4(x) w_{xx}^3].$$

$$M_x = -(1 - R^*) [m_1 J_2(x) w_{xx} + m_2 J_4(x) w_{xx}^3] \quad (8)$$

где, для балок шириной $b(x)$ и высотой $h(x)$

$$J_2(x) = \frac{b(x)h^3(x)}{12}, \quad J_4(x) = \frac{b(x)h^5(x)}{80}.$$

Подставляя (8) в уравнение равновесия [7], т.е.

$$\frac{\partial^2 M_x}{\partial x^2} = m(x) \frac{\partial^2 w}{\partial t^2} + q(x, t) \quad (9)$$

и перейдя к безразмерным координатам и опуская штрихи имеем

$$(1 - R^*) \frac{\partial}{\partial x^2} [J_2(x) w_{xx} + Q_1 J_4(x) w_{xx}^3] + F(x) w_{tt} + P w_x + \\ + Q_2 P^2 w_x^2 + \gamma w_t = 0 \quad (10)$$

где

$$w = h_0 \bar{w}, x = a \bar{x}, t = t_1 \bar{t}, m = m_0 F(x), h(x) = h_0 \bar{h}(\bar{x}), b(x) = b_0 \bar{b}(\bar{x}), \\ J_2 = J_2^0 J_2(x), J_4 = J_4^0 J_4(x), J_2(x) = \bar{b}(\bar{x}) \bar{h}^3(\bar{x}), J_4(x) = \bar{b}(\bar{x}) \bar{h}^5(\bar{x}), \\ J_2^0 = \frac{b_0 h_0^3}{12}, \quad J_4^0 = \frac{b_0 h_0^5}{80}, Q_1 = \frac{m_2 J_4^0}{m_1 J_2^0 h_0^2} \left(\frac{h_0}{a} \right)^2, Q_2 = \frac{m_1 b_0 (\partial \lambda + 1)}{48 k c_0} \left(\frac{h_0}{a} \right)^4, \\ P = \frac{k V a^3}{m_1 J_2^0}, t_1 = \sqrt{\frac{m_0 a^4}{m_1 J_2^0}}, \gamma = \frac{k z a^4}{m_1 J_2^0 t_1}$$

Нелинейные ИДУ в частных производных (10), вместе с граничными [8] в случае консоли

$$w=0, \quad w_x=0 \text{ при } x=0 \\ w_{xx}=0, \quad w_{xxx}=0 \text{ при } x=1 \quad (11)$$

и начальными

$$w|_{t=0} = d_0(x), w_t|_{t=0} = d_1(x) \quad (12)$$

условиями представляют математическую модель задачи об автоколебаний (флаттере) наследственно-деформируемого стержня с учетом физической и аэродинамической нелинейности. Требуется найти критические скорости $P_{кр}$ приводящий к нарастающему амплитуде колебаний.

Метод решения.

Из-за нелинейности точное решение поставленной задачи представляет значительные математические трудности. Поэтому приближенное решение построим методом Бубнова-Галеркина. Представим решение ИДУ (10) в виде

$$w = \sum_{k=1}^N u_k(t) \varphi_k(x) \quad (13)$$

где $\varphi_k(x)$ - известные, базисные функции, удовлетворяющие заданным граничным условиям, $u_k(t)$ - неизвестные функции от времени, подлежащие определению.

Для нахождения неизвестных функций $u_k(t)$ подставляем (13) в (10)

$$(1 - R^*) \left\{ \sum_{k=1}^N u_k(t) [J_2(x) \varphi_k''(x)]'' + Q_1 \sum_{k=1}^N \sum_{j=1}^N \sum_{q=1}^N u_k(t) u_j(t) u_q(t) \times \right. \\ \times [J_4(x) \varphi_k''(x) \varphi_j''(x) \varphi_q''(x)]'' \Big\} + F(x) \sum_{k=1}^N \ddot{u}_k(t) \varphi_k(x) + P \sum_{k=1}^N u_k(t) \varphi_k'(x) + \\ + Q_2 P^2 \sum_{k=1}^N \sum_{j=1}^N u_k(t) u_j(t) \varphi_k'(x) \varphi_j'(x) + \gamma \sum_{k=1}^N \dot{u}_k(t) \varphi_k(x) = 0$$

умножая на $\varphi_i(x)$, проинтегрируем по x и для интегралов вводим обозначения и получим следующие нелинейные системы обыкновенных ИДУ

$$\sum_{k=1}^N \left\{ a_{ki} \ddot{u}_k(t) + \gamma b_{ki} \dot{u}_k(t) + \omega_{ki} (1 - R^*) u_k(t) + P d_{ki} u_k(t) + Q_2 P^2 \sum_{j=1}^N m_{kji} \times \right. \\ \times u_k(t) u_j(t) + Q_1 (1 - R^*) \sum_{j=1}^N \sum_{q=1}^N n_{kjqi} u_k(t) u_j(t) u_q(t) \Big\} = 0, i = \overline{1, N} \quad (14)$$

где

$$a_{ki} = \int_0^1 F(x) \phi_k(x) \phi_i(x) dx, \quad b_{ki} = \int_0^1 \phi_k(x) \phi_i(x) dx, \\ \omega_{ki} = \int_0^1 [d(x) \phi_k''(x)]'' \phi_i(x) dx, \quad d_{ki} = \int_0^1 \phi_k'(x) \phi_i(x) dx, \\ m_{kji} = \int_0^1 \phi_k'(x) \phi_j'(x) \phi_i(x) dx, \\ n_{kjqi} = \int_0^1 [d_2(x) \phi_k''(x) \phi_j''(x) \phi_q''(x)]'' \phi_i(x) dx$$

Интегрирование нелинейной системы (10) при ядре Ржаницына - Колтунова $R(t) = A \cdot e^{-\beta t} t^{\alpha-1}$, $A > 0$, $\beta > 0$, $0 < \alpha < 1$ в широких пределах изменения физико-механических параметров стержня, выполнялось численным методом основанном на новом подходе аналитических преобразований [4], позволяющем эффективно вычислить слабо-сингулярный интеграл по известным квадратурным формулам. Согласно этому методу, численные значения искомых функций $u_k(t) = u_{kl}$ находятся из решения следующей рекуррентной системы линейных алгебраических уравнений

$$\sum_{k=1}^N \left[a_{ki} + \gamma \frac{\Delta t}{2} b_{ki} \right] u_{kl} = \sum_{k=1}^N [(a_{ki} + \gamma t_l b_{ki}) u_{0k} + t_l a_{ki} \dot{u}_{0k}] - \\ - \sum_{i_1=1}^{l-1} \left\{ \sum_{k=1}^N \left[\gamma A_{i_1} u_{ki} + A_{i_1} (t_l - t_{i_1}) \left(\omega_{ki} \left(u_{ki_1} - \frac{\varepsilon}{\alpha} \sum_{i_2=1}^{i_1} B_{i_2} e^{-\beta t_{i_2}} u_{k, i_1-i_2+1} \right) + P d_{ki} u_{ki_1} \right) \right] + \right. \\ + A_{i_1} (t_l - t_{i_1}) \left[\sum_{k=1}^N \sum_{j=1}^N \left(Q_2 P^2 m_{kji} u_{ki_1} u_{ji_1} + Q_1 \sum_{q=1}^N (n_{kjqi} u_{ki_1} u_{ji_1} u_{qi_1} - \right. \right. \\ \left. \left. - \frac{\varepsilon}{\alpha} \sum_{i_2=1}^{i_1} B_{i_2} e^{-\beta t_{i_2}} u_{k, i_1-i_2+1} u_{j, i_1-i_2+1} u_{q, i_1-i_2+1} \right) \right] \Big\}, \quad i = \overline{1, N} \quad (15)$$

Заключение.

Рассмотрена постановка задачи и алгоритм построения математической модели автоколебаний для вязкоупругого стержня с учетом физической и аэродинамической нелинейностей. (15) представляет собой систему алгебраических уравнений для определения критической скорости $P_{кр}$ вязкоупругой стержня с физическими и аэродинамическими нелинейными свойствами.

Разработан общий вычислительный алгоритм построения исходных соотношений метода Бубнова-Галеркина применительно к краевым задачам динамического расчета стержней из физически нелинейно вязкоупругого материала.

Список литературы

- [1]. Болотин В.В. Неконсервативные задачи теории упругой устойчивости. Физматгиз М. 1991. 339с.
- [2]. Болотин В.В. О критических скоростях в нелинейной теории аэроупругости. Научные доклады высшая школа «Машиностроение и приборостроение». 1958. №3.
- [3]. Болотин В.В. Нелинейный флаттер пластин и оболочек. Инженерный сборник. Т.28. 1960.
- [4]. Бадалов Ф. Б. Методы решения интегральных и интегро-дифференциальных уравнений наследственной теории вязко упругости. Ташкент, «Мехнат», 1987. 269с.
- [5]. Abdikarimov R.A., Mansurov M.M. Flutter of a viscoelastic rigidly restrained bar with account for nonlinearities. International Conference on Actual Problems of Applied Mechanics - APAM-2021 AIP Conf. Proc. 2637, 030003-1–030003-6; <https://doi.org/10.1063/5.0121701> Published by AIP Publishing. 978-0-7354-4229-0/\$30.00
- [6]. Mansurov M., Abdikarimov R., Mirsaidov M. Self-oscillatory process of a viscoelastic elongated plate; 2022; Construction of Unique Buildings and Structures; 96 Article No 9600. doi: 10.4123/CUBS.96.0
- [7]. Бадалов Ф.Б. Метод степенных рядов в нелинейной теории вязко упругости. Ташкент, «ФАН» 1980. 221с.
- [8]. Ильющин А.А. Закон плоских сечений в аэродинамике больших сверхзвуковых скоростях. ПММ. 1956. Т.20 № 6 с 733-755.
- [9]. Алгазин С.Д., Кийко И.А. Флаттер пластин и оболочек. М.: Наука, 2006. – 247 с.
- [10]. Светлицкий В.А. Строительная механика машин. Механика стержней. В 2 т. Т.2. Динамика. – М.: Физматлит, 2009. – 304 с.
- [11]. Ильин В.П., Карпов В.В., Масленников А.М. Численные методы решения задач строительной механики: Справочное пособие. Мн.: Выш.шк., 1990. – 349 с.
- [12]. Аршинов Г.А. Математическая модель продольных колебаний для нелинейно-вязкоупругого стержня // Научный журнал КубГАУ,
- [13]. Аршинов Г.А., Елисеев Н.И. Уединенные волны в физически линейных и нелинейных вязкоупругих стержнях // Научный журнал КубГАУ, №01 (1), 2003
- [14]. Mansurov M.M. Fizik chiziqli qovushoq elastik sterjenning avtotebranish jarayonlarining matematik modeli. Universal journal of technology and innovation, VOLUME 1 ISSUE 7, pp. 234-238, 2023
- [15]. Mansurov M.M., Akbarov U.Y. SELF-OSCILLATIONS OF A LINEAR VISCOELASTIC CANTILEVER ROD. Galaxy International Interdisciplinary Research Journal, Vol. 10 No. 12 (2022): GIIRJ, pp. 252–258.

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**АНАЛИЗ УСЛОВИЯ РАБОТЫ МАСЛЯНЫХ ФИЛЬТРОВ И ХАРАКТЕРИСТИК
ЗАГРЯЗНЯЮЩИХ ВЕЩЕСТВ В СИСТЕМАХ СМАЗКИ ДВИГАТЕЛЕЙ
ВНУТРЕННЕГО СГОРАНИЯ**

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Аннотация: Масляные фильтры являются важными компонентами любого автомобиля, отвечающими за фильтрацию загрязняющих веществ из моторного масла, тем самым защищая двигатель от повреждений.

Данная научная статья проводит анализ условия работы масляных фильтров и характеристик загрязняющих веществ в системах смазки двигателей внутреннего сгорания. Рассматривается роль масляных фильтров в обеспечении чистоты масла и защите двигателя от износа, а также описываются основные виды загрязняющих веществ.

Ключевые слова: эксплуатация автомобилей, двигатели внутреннего сгорания, масляный фильтр, фильтрующий элемент, загрязнения.

Abstract: Oil filters are essential components of any vehicle, responsible for filtering out contaminants from the engine oil, thus protecting the engine from damage.

This scientific article analyzes the operating conditions of oil filters and the characteristics of pollutants in lubrication systems of internal combustion engines. The role of oil filters in ensuring oil cleanliness and protecting the engine from wear is considered, and the main types of pollutants are described.

Key words: car exploitation, internal combustion engines, oil filter, filter element, pollution.

Annotatsiya. Moy filtrlari har qanday transport vositasining muhim tarkibiy qismi bo'lib, dvigatel moyidan ifloslantiruvchi moddalarni filtrlash uchun javobgardir va shu bilan dvigatelni shikastlanishdan himoya qiladi.

Ushbu ilmiy maqolada moy filtrlarining ish sharoitlari va ichki yonuv dvigatellarining moylash tizimlaridagi ifloslantiruvchi moddalarning xususiyatlari tahlil qilinadi. Moy tozaligini ta'minlash va dvigatelni eskirishdan himoya qilishda moy filtrlarining roli ko'rib chiqiladi va ifloslantiruvchi moddalarning asosiy turlari tavsiflanadi.

Kalit so'zlar: avtomobilning ekspluatatsiyasi, ichki yonuv dvigatellari, moy filtri, filtr elementi, ifloslanish.

Введение

Система смазки двигателя внутреннего сгорания играет ключевую роль в обеспечении его надлежащей работы и продолжительного срока службы. Масляные фильтры в этой системе имеют важное значение, так как они осуществляют удаление загрязнений из масла, что позволяет сохранить его свойства и обеспечить эффективную смазку двигателя.

Состояние моторного масла в двигателе зависит от наличия различных загрязнителей, включая органические кислоты, металлические частицы, воду, топливо, охлаждающую жидкость, сажу и асфальтены. Масло играет ключевую роль в уменьшении трения, но его свойства могут ухудшаться из-за разнообразных примесей. Загрязнения масла могут возникать из-за низких температур и недостаточного контроля, что приводит к износу компонентов и сокращает срок его службы и ресурс двигателя.

Загрязнители классифицируются на органические и неорганические, а процесс загрязнения масла подробно описан в предыдущих работах. Рисунок 1.2, вероятно, представляет схему этого процесса.



Рис. 1.2. Схема процесса старения моторного масла

Основная часть

Методы и средства исследований

Для проведения анализа условия работы масляных фильтров и характеристик загрязняющих веществ в системах смазки двигателей внутреннего сгорания был использован комплексный подход, включающий следующие методы и средства исследования:

Литературный обзор: Проведен обзор научных статей, технических отчетов и других публикаций по теме с целью изучения существующих знаний и результатов исследований в данной области.

Анализ данных: Полученные данные были подвергнуты статистическому анализу с использованием соответствующих методов обработки данных для выявления закономерностей.

Результаты и обсуждение

Органические загрязнения преимущественно происходят за счет образования продуктов неполного сгорания топлива, термического разложения, а также окисления и полимеризации нефтепродуктов. Дополнительно в масло могут проникать вода, соединения серы и свинца. В свою очередь, неорганические загрязнения включают в себя частицы пыли, остатки сгорания зольных присадок, металлические частицы износа двигателей, а также различные технологические примеси.

Важно отметить, что загрязнение дизельного топлива отличается от загрязнения бензинового и газового моторного масла более высоким содержанием сажи. Предыдущие исследования показали, что выхлопные газы дизельных двигателей содержат частицы размером от 0,007 до 0,4 мкм с удельной поверхностью 65-90 м²/г, что способствует

адсорбции износостойких и противозадирных присадок и снижает противоизносные свойства [1-2].

Таблица 1.2.

Физико-химические свойства отработанных моторных масел

Наименование показателя	Значение показателя		
	Shell 5W-30 (API SL, ACEA A3/B4)	Ecomobil 10W-40 (API SF/CD/CF)	Micking 5W-30 (API SN)
Плотность при 200С, г/см ³	0,8387	0,8633	0,849
Содержание воды, %	0,01	0,02	0,06
Механические примеси, %	0,009646	0,0018601	0,02922
Температура вспышки, °С	190,7	205,7	195,8
Кинематическая плотность при t ₅₀ °С, мм ² /с	42,2812	61,5678	42,1223
Динамическая плотность, мП	34,63	51,9693	34,9489

В процессе эксплуатации масло изменяется из-за разных условий работы, частоты использования и воздействия факторов. В соответствии с Государственными стандартами исследуются следующие физико-химические свойства отработанных моторных масел как относительная плотность (ГОСТ 3900-85), кинематическая вязкость (ГОСТ 31391-2009), содержание воды (метод Дина-Старка), количество механических примесей (ГОСТ 6370-2018).

В то же время отработанное масло содержит мелкие частицы, возникающие в процессе эксплуатации, а также различные присадки (табл. 1.2) [3-5].

В табл. 1.3 приведен состав загрязняющих примесей в отработавшем масле и отработанных масляных фильтрах различных двигателей.

Таблица 1.3

Состав загрязняющих примесей в отработанном масле в %

Загрязняющие примеси	бензиновые двигатели	дизели	Газовые двигатели
Асфальтены (количество в %):			
Минимальное.....	5	3	18
Максимальное.....	30	10	38
Среднее.....	19	8	27
Карбены, карбоиды и сажа (количество в %):			
Минимальное.....	37	80	17
Максимальное.....	85	90	29
Среднее.....	70	85	24
Несгораемые (количество в %):			
Минимальное.....	4	4	42
Максимальное.....	38	17	58
Среднее.....	11	8	49

Из таблицы видно, что загрязняющие примеси в отработанном масле – углеродистые (карбены, карбоиды и сажа) и составляют до 90% всех примесей [14-15].

От 80 до 90% органических частиц загрязнения имеют диаметры около 0,8-2,0 мкм [16-17]. Это свидетельствует о их высокой дисперсности и указывает на то, что отработанные масла представляют собой углеродисто-масляную суспензию.

В таблице 1.4 представлены результаты исследований оптическим методом

определения элементов, входящих в состав существующих механических частиц в отработанных маслах [6-9].

Таблица 1.4

Показатели загрязнённости исследуемого моторного масла (SAE 10W-40)

Элемент износа, мг/кг	Наработка (пробег), км		
	0	10000	12500
Железо (Fe)	0	26	31
Хром (Cr)	0	0	0
Олово (Sn)	0	4	6
Алюминий (Al)	1	9	9
Никель (Ni)	0	3	4
Медь (Cu)	0	0	6
Свинец (Pb)	0	0	0
Молибден (Mo)	0	3	3

Изучение размеров неорганических частиц представляет определенные трудности из-за сложности их отделения от общей массы примесей. Некоторые авторы высказывают мнение, что при удовлетворительной фильтрации масла в двигателе размеры индивидуальных загрязнений обычно не превышают 2 мкм.

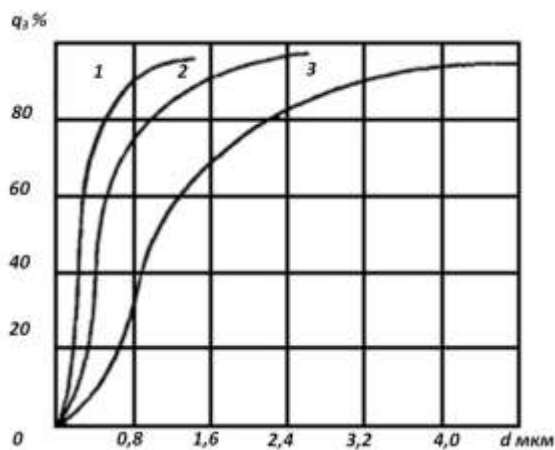


Рис. 1.3. Дисперсный состав загрязняющих примесей в моторном масле. 1- железо; 2 - неорганические (несгораемые); 3 - органические

Проведенные исследования дисперсного состава загрязняющих примесей в отработавшем масле методом седиментометрического анализа на лабораторной суперцентрифуге показали, что 80% частиц имеют диаметры, не превышающие: для органических примесей - 2 мкм, для неорганических - 1 мкм, и для частиц железа - 0,5 мкм (см. рисунок 1.3). Размеры частиц износа чугуна не превышают 2,5 мкм. Тем не менее, в работающем масле можно обнаружить отдельные частицы загрязнения, такие как кварц размером более 100 мкм.

Загрязнение масла в двигателе является непрерывным процессом, особенно при наличии влаги, когда частицы могут слипаться и образовывать отложения на деталях.

Диспергирующая способность масла, зависящая от его типа и присадок, предотвращает слипание частиц.

Таблица 1.5

Скорость загрязнения масла

Тип двигателя	Скорость		Средняя скорость	
	в мг/(л. с. ч.)	в мг/(л. с. км)	в мг/(л. с. ч.)	в мг/(л. с. км)
Дизели	16–60	0,5–2,0	45	1,5
Бензиновые двигатели:				
- легковых автомобилей	5–30	0,1–0,6	15	0,3
- грузовых автомобилей	6–40	0,2–1,5	20	0,7
Газовые двигатели	1,5–8,0	0,04–0,30	4	0,14

Исследования [10,17] показывают, что масла с низкой диспергирующей способностью могут образовывать колонии частиц размером 30-40 мкм. На скорость загрязнения масла

также влияют тип двигателя, его конструкция, техническое состояние, качество топлива и режим эксплуатации.

Характер работы двигателя и используемое топливо сильно влияют на загрязнение масла углеродистыми примесями. У дизельных двигателей характерным загрязняющим продуктом является сажа. Переход на газообразное топливо снижает загрязнение масла и отложения на деталях, продлевая срок службы масла и уменьшая количество отложений. При одинаковой мощности дизельных двигателей количество загрязняющих примесей из-за сажи в 2-5 раз больше, чем у бензиновых, и в 10-20 раз больше, чем у газовых двигателей (см. табл. 1.5).

Согласно данным НАМИ, масло после 10 тыс. км пробега в автомобиле с газовым двигателем имеет более высокие показатели, чем масло после 5 тыс. км пробега с двигателем, работающим на бензине. Концентрация загрязняющих примесей в масле газового двигателя после 5 тыс. км составляет 0,07%, а после 10 тыс. км - 0,11%, в то время как у двигателя, работающего на бензине, концентрация после 5 тыс. км составляет 0,44%. Известно, что коэффициент избытка воздуха (α) примерно одинаков для двигателей, работающих на бензине и газе [11-15].

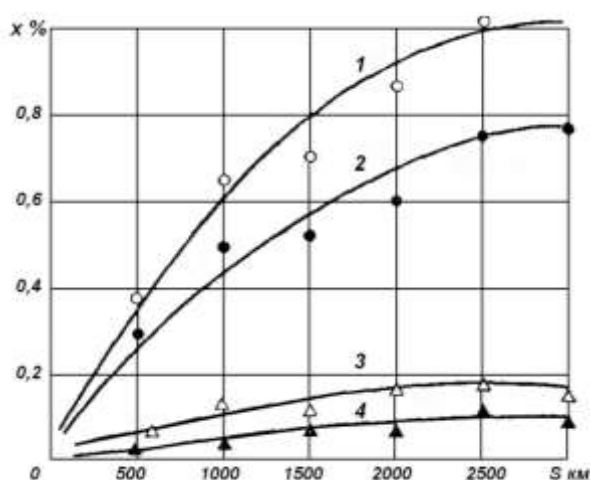


Рис. 1.4. Изменение концентрации загрязняющих примесей в масле двигателя в зависимости от пробега автомобиля: 1- суммарных; 2 - карбенов и карбоидов; 3 - асфальтенов; 4- несгораемых,

тракторов [18,22-25].

Защита от абразивного износа является главным резервом для повышения долговечности двигателей. Около 80% двигателей требуют капитального ремонта из-за износа, при этом абразивный износ обычно составляет более половины процесса и до 90%.

Система смазки автомобиля представлена замкнутым контуром с моторным маслом, смазывающим и охлаждающим детали двигателя и фильтрующим примеси через масляный фильтр. Масляный фильтр (МФ) устанавливается на блоке цилиндров двигателя, и производит очистку масла от этих элементов.

Заключение

Масляные фильтры играют важную роль в системе смазки двигателя внутреннего сгорания, обеспечивая чистоту масла и защищая двигатель от износа и повреждений. Понимание условий работы масляных фильтров и характеристик загрязняющих веществ позволяет разработать более эффективные системы смазки и повысить надежность и долговечность двигателей. Дальнейшие исследования в этой области могут привести к разработке новых технологий и материалов для улучшения работы масляных фильтров и смазочных систем в целом.

Следовательно, любой фактор, ухудшающий полноту сгорания топлива в процессе эксплуатации двигателя или увеличивающий попадание газов из камеры сгорания в картер, способствует интенсивному загрязнению масла продуктами неполного сгорания. В двигателях нарастание содержания загрязняющих примесей в масле происходит постепенно и со временем может полностью прекратиться (см. рис. 1.4). Это объясняется добавлением свежего масла вместо сгоревшего и выпадением части примесей в осадок.

В современных автомобилях концентрация загрязняющих примесей обычно составляет 0,4–0,6% в бензиновых двигателях и 1,0–1,2% в дизелях при пробеге 3000–6000 км автомобилей или 120–240 часов работы

Список литературы

- [1]. Техническая эксплуатация автомобилей/Под ред. О. Н. Дидманидзе. М. : ФГБНУ «Росинформагротех». 2017. 564 с.
- [2]. Базаров, Д. И., Шарипов, К. Р., & Холмурзаев, Б. Х. (2002). Турбулизаторы топливовоздушной смеси и показатели двигателя с искровым зажиганием. Автомобильная промышленность, (11), 27.
- [3]. Новикова К. Н., Занько Н. Г., Цветкова А. Д. К вопросу регенерации и утилизации отработанных масляных фильтров // Вестник МАНЭБ. 2015. № 2 (20). С. 55–56.
- [4]. Bekbolatov, G. Z., Shingisbayeva, Z. A., Tulenov, A., Kokayev, U. S., Bazarov, B. I., & Shoibekov, B. (2019). Determination of environmental consequences from production processes of motor transport enterprises. EurAsian Journal of BioSciences, 13(1), 167-176.
- [5]. Сафаров Ж.А., Хайитов Р.Р. Исследование физико-химических свойств и химического состава отработанных моторных масел // Universum: технические науки : электрон. научн. журн. 2021. 6(87). URL: <https://7universum.com/ru/tech/archive/item/11898> (дата обращения: 08.03.2024).
- [6]. Imamovich, B. B., Nematjonovich, A. R., Khaydarali, F., Zokirjonovich, O. O., & Ibragimovich, O. N. (2021). Performance Indicators of a Passenger Car with a Spark Ignition Engine Functioning With Different Engine Fuels. Annals of the Romanian Society for Cell Biology, 6254-6262.
- [7]. Сафаров Ж.А., Хайитов Р.Р. Исследование физико-химических свойств и химического состава отработанных моторных масел // Universum: технические науки : электрон. научн. журн. 2021. 6(87). URL: <https://7universum.com/ru/tech/archive/item/11898> (дата обращения: 08.03.2024).
- [8]. Варнаков Д. В., Афонин М. А. Определение фактической загрязнённости моторного масла применением устройства оперативной оценки // Известия Оренбургского государственного аграрного университета, (1 (69)) 2018, С 109-111.
- [9]. Bazarov B. I., Khusanjonov A. S. Analysis of common oil filters faults // Web of Scientist: International Scientific Research Journal (WoS) ISSN: 2776-0987, Volume 4, Issue 3, Mar., 2023. P. 39–51.
- [10]. Базаров Б. И., Хусанжонов А. С., Особенности эксплуатации масляных фильтров современных легковых автомобилей // Научный журнал транспортных средств и дорог, 2022 №4. С. 70–77.
- [11]. Bazarov B. I., Khusanjonov A. S. Technologies to manage used oil filters of cars in Uzbekistan // Innovative Technologica: Methodical Research Journal (ITMRJ) ISSN: 2776-0979, Volume 4, Issue 3, Mar., 2023. P. 626–635.
- [12]. Базаров Б. И., Хусанжонов А. С., Нишонов Т. М. Анализ состава загрязнений в отработанных масляных фильтрах // НТЖ ФерПИ, 2023, Т.27. спец.выпуск №3. С. 123–127.
- [13]. Новикова К. Н., Занько Н. Г., Цветкова А. Д. К вопросу регенерации и утилизации отработанных масляных фильтров // Вестник МАНЭБ. 2015. № 2 (20). С. 55–56.
- [14]. Базаров Б. И., Хусанжонов А. С. Анализ ключевых тенденций и инноваций в технологии фильтрации автомобильного масла // Международная научно-практическая конференция «Проблемы современного машиностроения и инженерного образования». Андижан, 8 июня, 2023 г. С. 1006–1009.
- [15]. Базаров Б. И., Хусанжонов А. С. Определение оптимальной частоты замены для повышения эффективности // Международная научно-практическая конференция «Проблемы современного машиностроения и инженерного образования». Андижан, 8 июня, 2023 г. С. 306–309.
- [16]. Базаров Б. И., Хусанжонов А. С. Оценка влияния старения моторного масла на характеристики двигателя // Международная научно-практическая конференция «Проблемы современного машиностроения и инженерного образования». Андижан, 8 июня, 2023 г. С. 309–312.
- [17]. Т Базаров Б.И., Хусанжонов А.С. Влияние качества моторного масла на характеристики двигателя масла // Международная научно-практическая конференция «Проблемы и перспективы инновационной машины и технологий в агропродовольственной сети». Ташкент, 20-21 апреля 2023 г. С. 106–108.
- [18]. Imamovich, B. B. (2023). Analysis of common oil filters faults. Open Access Repository, 4(03), 39-51.c.
- [19]. Imamovich, B. B. (2023). Technologies to manage used oil filters of cars in Uzbekistan. Open Access Repository, 4(3), 627-635.
- [20]. Vozorov, B. I. (Техническая эксплуатация автомобилей / Под ред. О. Н. Дидманидзе. М. : ФГБНУ «Росинформагротех». 2017. 564 с.
- [21]. Bazarov B. I., Khusanjonov A. S. Technologies to manage used oil filters of cars in Uzbekistan // Innovative Technologica: Methodical Research Journal (ITMRJ) ISSN: 2776-0979, Volume 4, Issue 3, Mar., 2023. P. 626–635.
- [22]. Базаров Б. И., Хусанжонов А. С., Нишонов Т. М. Анализ состава загрязнений в отработанных масляных фильтрах // НТЖ ФерПИ, 2023, Т.27. спец.выпуск №3. С. 123–127.
- [23]. Vozorov, B. I. (2005). Экологическая безопасность автотранспортных средств. Т.: TADI.
- [24]. Bazarov, B., Magdiev, K., Axmatjanov, R., Sidikov, F., Vasidov, B., & Usmanov, I. (2022, June). Assessment of environmental and energy usage of alternative motor fuels. In AIP Conference Proceedings (Vol. 2432, No. 1). AIP Publishing.
- [25]. Bazarov, B., Axmatjanov, R., Tojiyev, J., & Azimov, A. (2023). The concept of improving the performance indicators of gas-cylinder vehicles. In E3S Web of Conferences (Vol. 434, p. 02008). EDP Sciences.
- [26]. Базаров, Б. И., Абдирашидов А.А.Повышение эффективности очистки воздуха в дизелях карьерных автосамосвалов.// Miasto Przyszłości, 27, 2022. – С.117-120

- [27]. Базаров, Б. И., Абдирашидов А.А., Сидиков Ф. Ш. Анализ повышения эффективности использования смазочных масел в карьерных самосвалах.// Universum: технические науки, № 6(99), Часть 7, 2022, 15-17
- [28]. Магдиев Ш. , Базаров Б.И. О сроках замены моторных масел АТС в горных условиях. // Автомобильная промышленность, 11,2011. - С. 23-24.

AYOLLAR KO'YLAKLARINI KONSTRUKSIYALASH VA MODELLASHTIRISH USULLARINI TAHLIL QILISH

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(Qabul qilindi 12.04.2024 y.)

Annotatsiya. Maqolada ayollar ko'yaglarining modellari tanlanib shu model bo'yicha baza konstruksiyasi qurilgan hamda bir modeldan ikkinchi modelga o'zgartirish orqali zamonaviy bichimga modellashtirilgan .

Tayanch so'zlar. Konstruksiya, model, modellashtirish, andoza, eskiz, bort , taqilma, vitochka.

Аннотация. В статье выбраны модели женских блузок, по этой модели строится базовая конструкция и моделируется путем перехода от одной модели к другой.

Ключевые слова: Конструкция, модель, лепка, шаблон, эскиз, доска, примерка, виточка.

Abstract. In the article, models of women's blouses are selected; a basic design is built on this model and modeled by moving from one model to another.

Key words: Basic words. construction, model, modelling, template, sketch, board, fitting, vitochka.

Kiyimlarni modellashtirishda kiyim modelini ijod qilish va asosiy andozadan model andozasini tayyorlash yo'llari o'rgatiladi. Bunda asos chizmasiga eskiz bo'yicha model chiziqlari kiritilib, yangi model andazasi hosil qilinadi. Modellash — bu turli shakl va bichimdagi kiyim modelining konstruksiyasini ishlab chiqaradigan murakkab ijodiy jarayondir. Turli shakl va bichimdagi modalar konstruksiyasini yaratilayotgan buyumning asosiy konstruksiyasidan olish mumkin. Bu jarayon amaliy modellashtirish yoki texnik modellashtirish deb ataladi. Texnik modellashtirishda asos chizmasiga yangi model chiziqlarini kiritiladi. Modelning fasoni modallar jurnalidan olinadi yoki ijrochining rasm chizib ko'rsatgan taklifiga ko'ra tanlanadi [1].

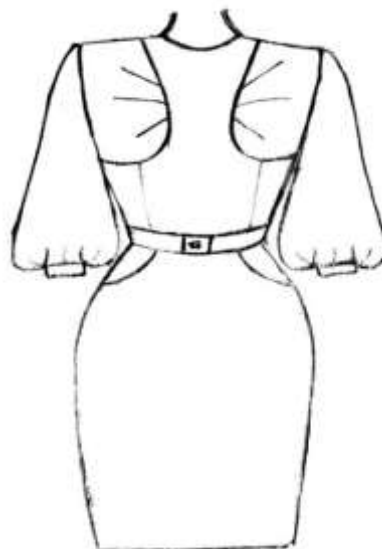
Kiyimning yangi modelga xos xususiyatlariga: vitochkalar, koketkalar, bo'rtma choklarning holati; bo'ksa, bel, etak, bort, taqilma chiziqlari; cho'ntaklar, yoqalar shakli kirib ularni tegishli buyumning asos chizmasiga ko'chiriladi.

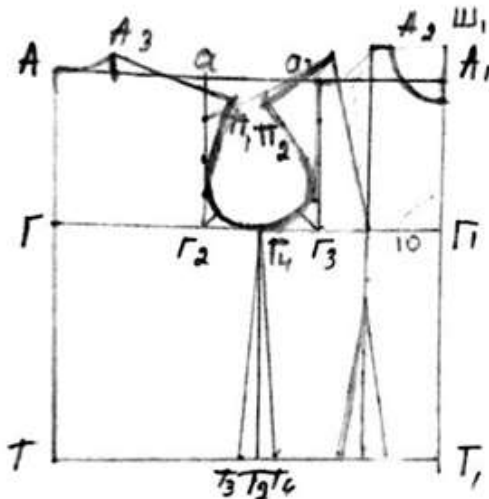
Model chiziqlarining hammasini asos chizmasida xuddi model rasmidagidek joylashtirish kerak. Bunda inson gavda tuzilishining xususiyati, uning mutanosibligi albatta hisobga olinishi kerak. Tanlangan modelimizga ta'rif beramiz.

Ayollar kuzgi ko'fta yubkasi ko'fta fantaziya uslubda

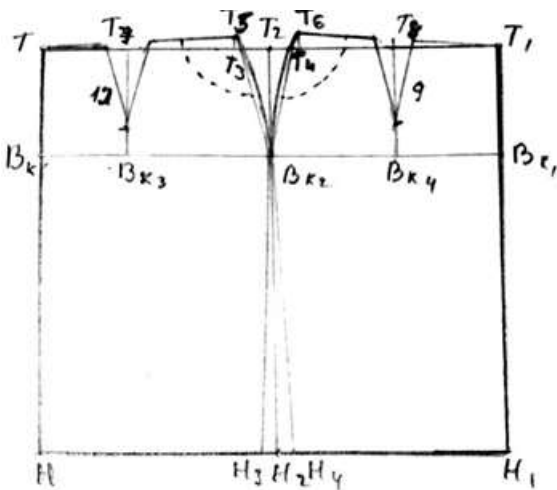
tikilgan ko'krak qismida tahlamlar bilan bezatilgan o'tkazma yeng qismi esa fanarik qilib kengaytirilgan bilak qismida manjeti bor. Yubkasi klassik uslubda tikilgan. Yubkada cho'ntak bezakli qilib tayorlangan. Bel qismida bel bog' bilan bezatilgan. Oldi bo'yin o'mizi yumaloq qilib olingan.

Tanlangan modelim bo'yicha qomatdan o'lcham olib asos konstruksiyasini chizib olamiz. Tekislikda birorta A nuqtani olamiz va unda ko'ylakning uzunligiga ko'ra vertikal chiziq tushuramiz. Bizda ko'ylak uzunligi T nuqta xosil bo'ladi ya'ni belgacha.

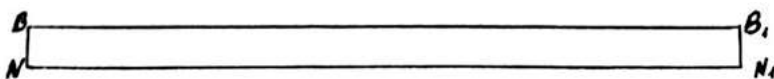




1-rasm Ayollar ko'ylagini konstruksiya chizmasi.



2-rasm Ayollar ko'ylagini yubka qismini chizmasi.



3-rasm Ayollar ko'ylagini belbog' qismini chizmasi.

A nuqtadan A1 nuqtagacha ko'ftaning kengligi ni hisoblash uchun Sg_2 razmerga 4 chok haqqini qo'shib olamiz.

$\Gamma\Gamma_1 = Cr_2 + 4 = 42 + 4 = 46$ so'ng $A\Gamma$ ko'kraggacha bo'lgan masofani topib olamiz.

$A\Gamma = Cr_2 / 3 + 5 = 42 / 3 + 5 = 19$

Va qo'ltiq ostini chiqarib olamiz.

$\Gamma\Gamma_2 = Cr_2 / 3 + 3 = 42 / 3 + 3 = 17$

$\Gamma_2\Gamma_3 = Cr_2 / 4 = 42 / 4 = 10.5$

$AA_3 = C_{III} / 3 + 0.5 = 6.7$

$AT = D_{TC} =$ belgacha bo'lgan balandlik.

Yelka kengligi $A_3\Pi_1 = 12$ so'ngra bo'yin o'mizini chiqarib olamiz. $\Pi_1\Gamma_1 = Cr_2 / 2 + 1 = 22$ [2]

Yubka qismini kontruksiyalash.

TH bu yubka uzunligiga chok haqqi qo'shilmasiga teng. $TH = K_{II} + C_{X}$ Beldan bo'ksagacha balandlikni topib olamiz. Buning uchun belgacha bo'lgan balandlikni 0.5ga ko'paytirib 2 ayrimiz. $TB_K = D_{TC} * 0.5 - 2 = 18.5$ Yubka kengligini topish uchun bo'ksa yarim aylanasi 4 qo'shib olamiz. $B_K B_{K1} = C_B + 4 = 34.5$ Bel kengligini topish uchun bel yarim aylanmasini 2 ga bo'lib 4 qo'shib olamiz. $TT_3 = C_T / 2 + 4 = 14.2$ Ikkinchi tarafi ham huddi shunday hisoblanadi. $T_1 T_4 = C_T / 2 + 4 = 14.2$ Vitichkagacha bo'lgan masofa ko'krak markazigacha bo'lgan masofaga teng. Orqa vitichkagacha bo'lgan masofani topish uchun old vitichkagacha bo'lgan masofadan 1 ayriladi. $TT_7 = K_M - 1 = 9$ $T_1 T_8 = K_M = 10$ $T_3 T_5 = 1.5$ $T_4 T_6 = 1.5$

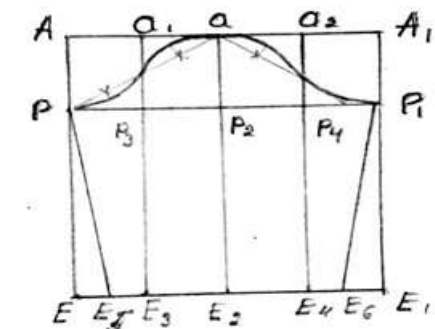
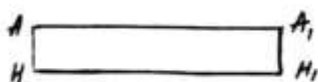
Belbog'ni ham konstruksiyasini o'zingiz qilmoqchi bo'lsangiz uzunligi va kengligini hohishga ko'ra qilishingiz mumkin.

Yengni kontruksiyalash

Yeng kengligini topish uchun razmerdi 3ga bo'lib 3 qo'shib olamiz. $AA_1 = (Cr_2 / 3 + 3) * 2 = 34$ Qo'ltiq osti P gacha bo'lgan masofani topish uchun razmerdi 3ga bo'lib 1 ayrib olamiz. $AP = Cr_2 / 3 - 1 = 13$

Manjeti esa hohishga ko'ra bo'lishi mumkin. Bilak qismi aylanasi 16.7 bo'lsa bunga chok haqqi qo'shilib kengligi hohishga ko'ra olinishi mumkin.

$AA_1 = 16.7 + 4 = 20.7$ AH hohishga ko'ra olinadi.



4-rasm Ayollar ko'ylagini o'tkazma yeng konstruksiya chizmasi.

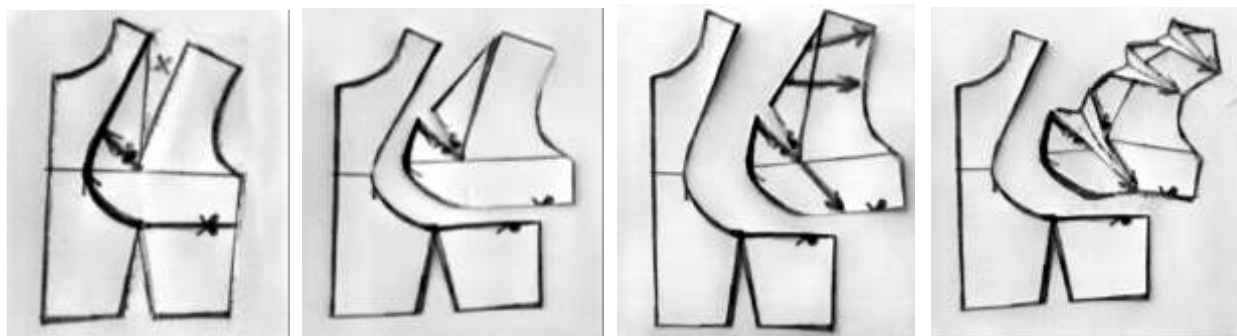
Ayollar ko'ylagini texnik modellash.

Ko'krak vitochkasini ko'chirish qoidasi. Ko'ylak fasoniga binoan ko'krak vitochkasi detalning istalgan qirqimida bo'lishi mumkin. Bu vitochkani old bo'lak o'rtasi, yeng o'mizi qirqimi, yoqa o'mizi qirqimi, yon qirqimi va bel chiziqlariga ko'chirish mumkin. Vitochkani fasonga muvofiq, yangi holatga ko'chirish uchun avval vitochkaning ko'chirilish chizig'i asos chizmasida o'tkazilishi kerak. Bu chiziq doim ko'krak vitochkaning uchidan, ya'ni ko'krak markazi bilan vitochka ko'chiriladigan qirqimdagi nuqtadan o'tishi kerak.

Old bo'lak andozasining shabloni kiritilgan yangi chiziq buylab qirqiladi-da, ko'krak vitochkasi yopiladigan qilib suriladi. Vitochka tomonlarini bir-biriga to'g'rilab to'g'nag'ich bilan to'g'naladi. Qirqilgan chiziq bo'ylab xuddi asosiy vitochka kengligiga teng yangi vitochka hosil bo'ladi. Bu vitochka birmuncha kalta yoki uzun bo'lishi mumkin, lekin bu vitochka xuddi asosiy vitochka hosil kilganidek, hajm hosil qiladi.

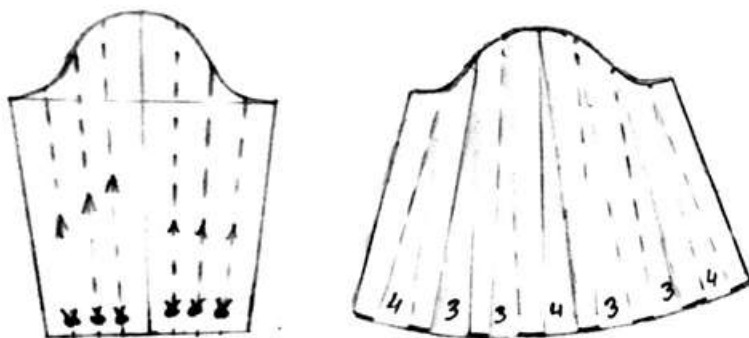
Ko'krak vitochkasini istalgan chiziqlaiga ko'chirib modellar hosil qilinadi. Lekin kiyim detallarini parallel va konussimon shakllarda kengaytirish hisobiga ham yangi model hosil qilinishi mumkin[5]

Tayorlab olgan konstruksiyadan foydalanib kiyimni modellashtirib olamiz.5-rasimda ko'rsatilgandek kesib old vitichkani yopib olamiz.so'ng 5-rasmda ko'rsatilgandek chiziq tortib teng bo'lib olamiz. Matoga yoyib joylashtiramiz, modelda ko'rsatilgandek tahlamalar hosil bo'ladi.



5-rasm Ko'ylak old bo'lagini modellashtirish.

Yenglarni modellashtirish



6-rasm Yengni konstruktiv modellashtirish.

Turli shakldagi yenglaming loyihasi xuddi shunday bichimdagi yeng loyihasi asosini texnik modellash usuli bilan hosil qilinadi[3]

Xulosa ayollar kiyimini konstruksiyalash jarayoni murkkab jarayon bo'lib insondan maxorat talab qiladi Maqolada ayollar kiyimini konstruksiyasini tayorlab modelni konstruktiv modellashtirish

oldi bo'lak vitochkalarini ko'chirish jarayonlari bajarilgan

Adabiyotlar

- [1]. "Tikuvchilik buyumlarini loyhalash va modellashtirish asoslari"Q.M.Abdullayeva Toshkent 2007 yil.
- [2]. Sh.Shumkarova, M.Rajapova. "Tikuv buyumlarini konstruksiyalash".
- [3]. Abdusattorovna, M.G, & Kasimjonovna, UN (2020). Product-an object of artistic thinking. ACADEMICIA: An International Multidisciplinary Research Journal, 10(11), 1172-1176.
- [4]. Mirboboyeva G. Creating new modern models using the gamut of colors" Spes vipusk 15 2022.
- [5]. Mirboboyeva Gulhayo Abdusattorovna, Tursunov Davron "Types of paints for painting gas and their selection" Jizzakh Polytechnic Institute. Innovative solutions to technical, engineering and engineering-technological problems of production October 28-29, 2022.

JUNNI TOZALASH USKUNASINING TA'MINLASH MEKANIZMIGA XOMASHYO BUNKERI O'RNATISH ORQALI TOLA TIQILISHINI OLDINI OLIISH VA TOZALASH SAMARADORLIGINI OSHIRISH TAHLILI

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Annatsiya. Bu maqolada jun tolasini titish va tozalash uskunasi ta'minlash mexanizmidagi uchraydigan muammolar tahlil qilingan va yechim topishga qaratilgan. Muammoni hal qilish maqsadida transportyor va ta'minlovchi rolik orasiga tebranuvchi xomashyo bunkeri o'rnatilgan.

Kalit so'zlar: Jun, tola, transportyor, ta'minlovchi valik, xomashyo bunkeri, tozalash.

Аннотация. В этой статье анализируются проблемы, возникающие в механизме обеспечения оборудования для титрования и очистки шерстяного волокна, и делается упор на поиск решений. Чтобы решить эту проблему, между транспортером и подающим роликом устанавливается вибрирующий бункер для сырья.

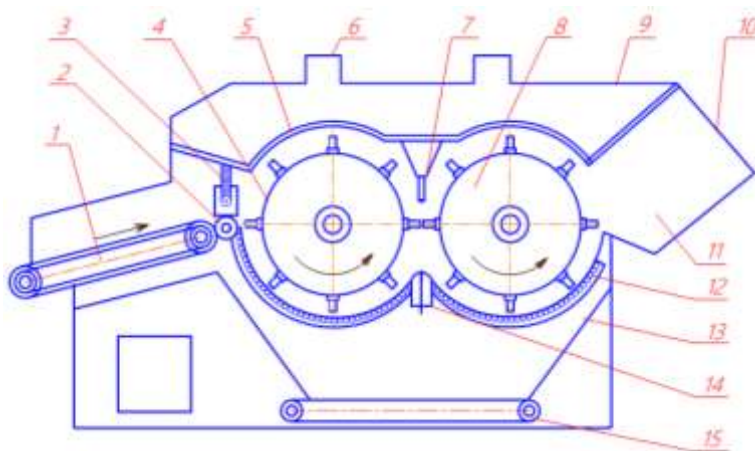
Ключевые слова: Шерсть, волокно, транспортер, подающий валик, бункер для сырья, очистка.

Abstract. The paper analyzed and focused on finding solutions to problems found in the mechanism of wool fiber traction and cleaning equipment. In order to solve the problem, a vibrating raw material bunker is installed between the transporter and the supply roller.

Keywords: Wool, fiber, transporter, supply roller, raw material bunker, cleaning.

Kirish. Junni dastlabki ishlash korxonalariga keltirilgan yuvilmagan jun tarkibida ikki xil ifloslik mavjud bo'ladi. Ularga hayvonning o'zidan ajralib chiqqan ifloslik va hayvonga bog'liq bo'lmagan iflosliklar kiradi. Hayvonning o'zidan ajralib chiqadigan iflosliklar deb - yog', ter, qazg'oq, go'ng qoldiqlari va hokazolarga aytiladi. Hayvonga bog'liq bo'lmagan ifloslikka - ma'danlar, o'simliklar, ozuqalar, tuproq kabilarning bo'laklari kiradi [1; 26 b.]. Bu iflosliklar aralashib tolani mayda va yirik tutam holatiga olib keladi. Ta'minlash mexanizmidagi bu kabi har xil hajmdagi tola tutami tiqilib qolish holati yuzaga keladi [2].

Tadqiqot metodologiyasi. Mahalliy jun tolasiga dastlabki ishlov berish jarayonida titish-tozalash agregatlari muhim o'rin egallaydi. Sababi, tola iflosliklardan yaxshi tozalanmasa, tola sifatiga, toladan olinadigan mahsulotlarni sifat ko'rsatkichlariga salbiy ta'sir ko'rsatadi. Hozirgi kunda mamlakatimizdagi junni qayta ishlash zavodlarida TP-90-Sh1, 2BT va 2BT-150-Sh rusumidagi titish-tozalash agregatlari ishlatilmoqda.



1-rasm. 2BT-150-Sh rusumli titish agregati sxemasi

1-ta'minlovchi konveyr; 2-ta'minlovchi rolik; 3-prujina; 4, 8-qoziqchali barabanlar; 5-teshikli to'r; 6-quvur; 7-harakatlanuvchi qoziqlar; 9-korpus; 10-qopqoq; 11-chiqish novi; 12-to'rli panjara; 13-bunker; 14-ustun; 15-ifloslik konveyri.

2BT-150Sh rusumli titish-tozalash agregati 2BT rusumidagi agregat asosida, undagi kamchiliklarni bartaraf etish maqsadida tayyorlangan [3]. Agregat ta'minlovchi transportyor, ta'minlovchi bir juft silindr, ustki silindrni bosuvchi ikkita prujina, ikkita titish barabani, qobirg'ali panjara, chang o'tuvchi teshikli yuza, chang chiqaruvchi qisqa quvur, qo'zg'almas qoziqli planka, chiqindi chiqarish transportyori hamda tola chiqarish quvuridan iborat (1-rasm) [4].

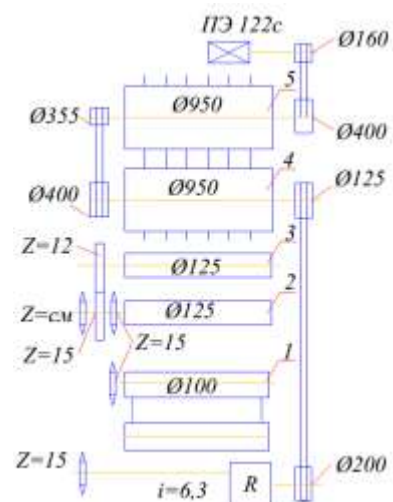
2BT-150Sh titish-tozalash uskunasi ishlash prinsipi quyidagicha: yuvilmagan jun tolasini

bir xil qalinlikda ta'minlash tasmasi 1 ga tashlaydi (1-rasm). Tasma 0,067-0,133 m/s tezliklarda harakatlanadi. Ta'minlash valigi 2 (yuqorigi-riflali, pastki-silliq) diametri Ø-125 mm bo'lib, jun tolasini mahkam siqadi va titish-tozalash kamerasiga uzatadi. Ta'minlash valiklarining siqilishini bir juft prujina 3 bilan hosil qiladi va uning siqish kuchi 1,75 kN ga teng.

Yuqori valik jun bo'laklarini siljishi va rostlanishini ta'minlab, pastki valikka nisbatan tezroq aylanadi. Birinchi baraban 4 da sakkiz qator qoziqlar mavjud bo'lib, 12,5 m/s tezlikda, ikkinchi baraban 8 esa 14,3 m/s tezlikda aylanadi. Ta'minlash valigi siqilgan jun bo'lakchalarini birinchi qoziqchali barabanga uzatadi. Qoziqchali baraban jun bo'lakchalarini kolosnikli panjara 12 ustidan sudrab o'tib, ikkinchi barabanga uzatadi. Ikkinchi baraban jun tolasini titib, iflos aralashmalardan tozalaydi. Jun tutamidan ajralgan ifloslik kolosnikli panjara tirqishlaridan ifloslik bunkeri 13 ga tushadi, so'ngra transportyor 15 yordamida uskuna ostidan chiqarib tashlanadi. Baraban qoziqlari ildirib olgan jun bo'laklari prizma 14 ga urilishi titish jarayonini jadallashtiradi.

Jun tolasini titish va tozalashdan so'ng barabanning markazdan qochma kuchi tezligini yo'naltirgich 10 so'ndiradi va uchib chiqish traektoriyasini o'zgartiradi. Birinchi barabandan ikkinchisiga o'tishda jun tutamining ayrim qismlari qo'zg'almas qoziq 7 da ushlanib qoladi, qoziq bilan ikkinchi baraban ta'siri natijasida jun qo'shimcha titiladi. 2BT-150Sh titish-tozalash uskunasi kinematik sxemasi asosida ish unumdorligi aniqlanadi (2-rasm).

2BT-150Sh titish-tozalash uskunasi valiklarning aylanishlar sonining o'zgarishi yulduzcha tishlariga bog'liq bo'lib, quyidagi 1 –jadvalda keltirilgan.



2-rasm. 2BT-150Sh titish-tozalash uskunasi kinematik sxemasi.

1- ta'minlash tasmasi; 2 - ostki ta'minlash valigi (silliq); 3 - ustki ta'minlash valigi (riflali); 4 - birinchi qoziqli baraban; 5 - ikkinchi qoziqli baraban.

1-jadval

2BT-150Sh rusumli titish-tozalash uskunasi valiklarning aylanishlar sonining o'zgarishi

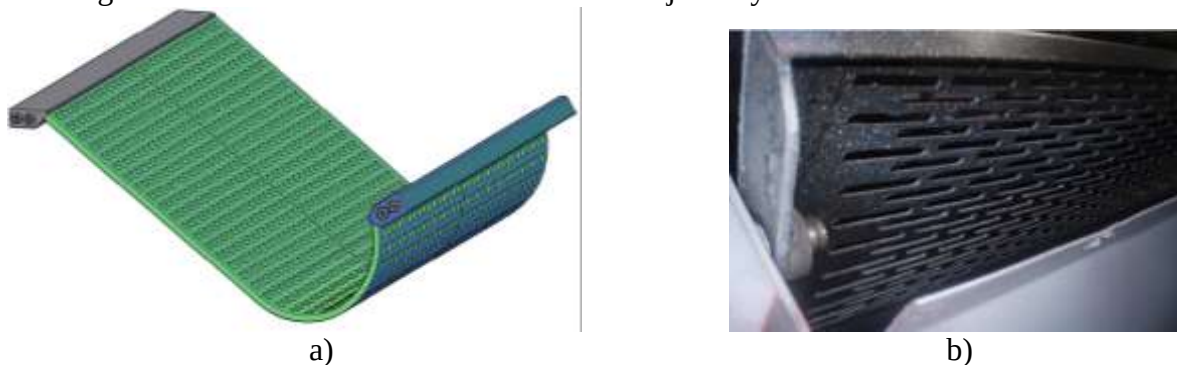
y_{sm}	Ta'minlash tasmasi		Silliq valik		Riflali valik	
	n, s^{-1}	$v, m/s$	n, s^{-1}	$v, m/s$	n, s^{-1}	$v, m/s$
14	0,42	0,13	0,42	0,17	0,5	0,2
16	0,37	0,11	0,37	0,15	0,45	0,175
19	0,31	0,1	0,31	0,12	0,38	0,15
22	0,27	0,08	0,27	0,11	0,33	0,12
25	0,24	0,075	0,24	0,09	0,29	0,11

Uskuna ishchi organlarini harakatlantirishda A02-61-8 elektrodvigateldan foydalaniladi, uning aylanish tezligi 750 r/min Ta'minlash valiklarining aylanish tezligi yulduzcha tishlarining soniga bog'liq bo'ladi— $y_{sm}=14; 16; 19; 22; 25$ tish.

2BT-150Sh rusumli titish-tozalash uskunasi eng katta kamchilligi, ta'minlash mexanizmi konstruksiyasi to'la bir hil me'yorda ta'minlamaydi, natijada uskuna bekorga energiya sarflanishiga, vaqt sarfiga va tola sifatining pasayishiga sabab bo'ladi. Bundan tashqari transportyordan kelgan yuvilmagan tola ta'minlovchi valikka uzatilish qismida tola tiqilishi sodir bo'ladi (5-rasm).

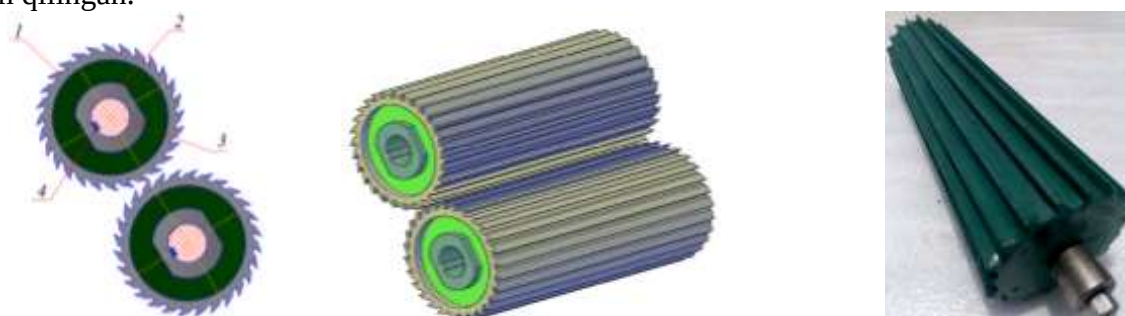
Tahlil va natijalar. Yuqorida ko'rsatib o'tilgan muammolarni hal qilish maqsadida uskuna ta'minlash mexanizmi takomillashtirildi. Transportyor va ta'minlovchi rolik orasiga tebranuvchi xomashyo bunkeri o'rnatildi va tola tutamini tiqilish holati oldi olindi. Tebranuvchi xomashyo bunkeri (3.a,b-rasm) asosi to'rtli panjaradan yasalgan bo'lib, bu yerga tushayotgan va qisman to'plangan jun tolasini tebranma harakat qilib yengil organik va mineral aralashmalardan tozalaydi [5]. Bundan tashqari bunkerda doimiy zaxira tola mavjud bo'ladi, bu uskunaga uzluksiz

tola uzatilishini ta'minlab beradi, ya'ni bu ish inson harakat omilidan qisman yiroqlashadi. Uskunaga bunker o'rnatilishining yana avzalligi shundan iboratki, ta'minlovchi mexanizmlarda ishchi xodimlarga bo'lgan xavfni oldi olinadi va tola uskunaga uzatilishi bir me'yorda bo'ladi. Xomashyo bunkeri qalinligi 5 mm bo'lgan po'lat listdan tayyorlangan bo'lib, aylana teshikchalardan iborat (3.b-rasm). Bu teshiklarni diametri 12-15 mm, jun tolasi tarkibidagi yengil aralashgan iflosliklar bunker tebranma harakati natijasida yelanadi va tozalanadi.



3-rasm. Tebranuvchi (vibratsiya) xomashyo bunkeri tuzilishi
a) yaqqol ko'rinishi; b) ustidan ko'rinishi.

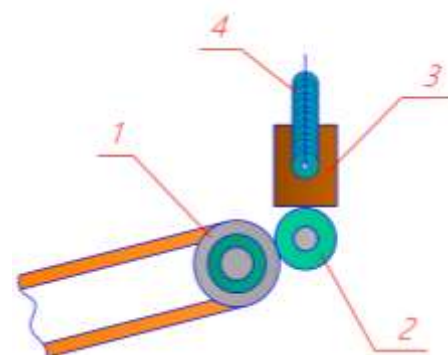
Xomashyo bunkeriga tushgan jun tolasini, tezligi 0-14 r/min. bo'lgan ta'minlovchi valiklar 7 bir-biriga qarab aylanib, ilashtirib oladi. Ta'minlovchi valik hajmi kattalashtirilgan va diametri 200 mm qilingan.



4-rasm. Ta'minlovchi valiklarning ko'rinishi
1-ta'minlovchi valik tishlari; 2-qistirma; 3-val; 4-shponka.

Ta'minlovchi valik tishlari 40° gradus burchak ostida qiya qilib o'rnatilgan, tishlar soni 28 tadan iborat. Ta'minlovchi valik uskunaga 55° gradus qiyalikda xomashyo bunkeriga moslab o'rnatilgan (5-rasm). Xomashyo bunkeri ta'minlash mexanizmiga o'rnatilgandan so'ng quyidagi ko'rinishda bo'ladi.

Taklif etilayotgan takomillashtirilgan titish-tozalash uskunasi quyidagicha ishlaydi: saralangan jun tolasi ta'minlovchi transportyor 1 yordamida tola kirish novi orqali xomashyo bunkeriga 3 tushadi. Bunker asosi, to'rtli panjara 2 jun tarkibidagi chuqur aralashmagan yengil iflosliklardan tozalaydi. Ajralgan ifloslik nov 8 orqali ifloslik kozerogiga 10 tushadi va uskunadan tashqariga olib ketiladi. Bunkerdagi tola ta'minlovchi valiklarning 4 plankali tishlari yordamida tola zichligini kamaytirib beruvchi kichkina valiklarga uzatiladi. Silliq yuzali valik 6 va kichkina valik 5 prujina 7 yordamida harakatga kelib rostlanib turadi, hamda junni ishchi kameradagi qoziqchali barabanga 11 tashlab beradi. Qoziqchali barabanlarning asosiy vazifasi jun tolasini kolosnikli panjara 12 ustidan sudrab o'tishi va qoziqchalar tolani urishi natijasida titiladi, iflosliklardan tozalanadi. Ishchi kamerada ajralgan yengil chang va ifloslik bo'lakchalari to'rtli qopqoq 13 tirqishlaridan o'tib, chang chiqish quvuri 14 orqali uskunadan tashqariga chiqariladi. Ajralgan



5-rasm. 2BT-150Sh rusumli titish-tozalash agregatini ta'minlash mexanizmi
1-ta'minlovchi transportyor; 2-ta'minlash silindri; 3-tekislovchi silindr; 4-prujina.

og'ir aralashmalar panjara tirqishidan ifloslik noviga 8 o'tadi, novda yig'ilib ifloslik konveyriga 9, so'ng ifloslik kozerogiga 10 uzatilib, tashqariga chiqariladi. 480-500 r/min. tezlikda aylanuvchi qoziqchali barabanlarda titib-tozalangan jun tolasi tola chiqish novi orqali cho'tkali barabanga 17 tashlanadi.

Tola chiqish novini asos qismiga tola tarkibidagi mineral aralashmalarni ushlab qoluvchi magnit 16 va ustki qismiga tola tiqilishini oldini olish maqsadida ochilib yopiladigan qopqoq 15 o'rnatilgan. 50° gradus qiyalikda joylashgan novdan yumshatilgan tola og'irligi va markazdan qochma kuch ta'sirida cho'tkali barabanga 17 tushadi. Tezligi 500-630 r/min. bo'lgan cho'tkali baraban jun tolasini kolosnikli panjara 18 ustidan sudrab o'tishi natijasida chigallangan tola tutamidan taram hosil qiladi va jun tarkibidagi o'simlik aralashmalari ajratiladi. Ajralgan ifloslik kolosnikli panjara tirqishidan ifloslik noviga 8 tushadi va ifloslik kozerogi 10 yordamida uskunadan tashqariga chiqariladi. Cho'tkali baraban yordamida jun tolasi, markazdan qochma kuch ta'sirida nov 19 orqali yuvish agregatiga tashlanadi. Bundan tashqari uskuna korpus 20 va mahkamlash brusslaridan 21 iborat.

Xulosa. To'qimachilik tolalarining sifat ko'rsatkichini tola tozaligi va tozalanish darajasi belgilab beradi. Tozalash uskunalari bir me'yorda sifatli ishlashi asosan, ta'minlash mexanizmlarining ish faoliyatiga bog'liq [7]. Xulosa qilib shuni aytish mumkinki biz taklif qilayotgan xomashyo bunkeri uskunaning ish unumdorligini va tola tozalash samaradorligini oshiradi.

Adabiyotlar

- [1]. S.M.Elmonov. Junni o'simlik aralashmalaridan tozalash mashinasining samarali konstruksiyasini ishlab chiqish va ishchi parametrlarini asoslash: Dis...t.f.f.d.-Toshkent, TTESI, 2018. -25-26 b.
- [2]. D.A.Jurayev., Mahalliy dag'al jun tarkibidagi mayda va yirik iflosliklarni tozalash texnologiyasini takomillashtirish. «AGRO ILM» jurnali. 2-son // 2023
- [3]. Hakimov Sh.Sh., Ismoyilov F.B., Sattarova N.N. «Усовершенствованная трепальная машина для шерсти» UNIVERSUM-тенические науки. №2 (83) 2021y.
- [4]. D.A.Jo'raev., M.K.Urozov., R.Yangiboev. “Усовершенствование узла сортировки и очистки шерстяного волокна”. Универсум. 2023 y.
- [5]. D.A.Jo'raev., M.K.Urozov., N.Urakov. “Junni titish-tozalash uskunasi ta'minlash mexanizmini takomillashtirish orqali uning ish unumdorligini oshirish” Namangan. №2 son maqola. 2023 y.
- [6]. D.A.Jurayev., “Junni tozalash agregatiga cho'tkali baraban o'rnatish hisobiga tozalash samaradorligini oshirish” «AGRO ILM» jurnali. 2-son // 2023
- [7]. Toshbekov O.A., Urozov M.K. “Chorvachilikda yetishtiriladigan dag'al junlarni kimyoviy va mexanik usulda qayta ishlash orqali mayin jun olish texnologiyasini yaratish” // Intelektual mulk agentligi. 2021. № DGU 12949.

QISH-KUZ MAVSUMI UCHUN AYOLLAR USTKI KIYIMININIG ZAMONAVIY MODA YO'NALISHI TAHLILI

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Annotatsiya: Ushbu maqolada ayollar ustki kiyimlarini assartimentining dizayni tahlili jahon brendlari kolleksiyasini ko'zdan kechirgan holda, ustki kiyimlar uchun yoqa turlari haqida so'z boradi. Yoqa turlari shakli va ko'rinishi tahlil qilinadi va har bir model uchun mos keluvchi yoqalar tavsiya qilinadi.

Kalit so'zlar: dizayner, zamonaviy, moda, moda xususiyatlari, mo'yna, charim,, plash, model, palto, yoqa, jaket,, gazlama, zamonaviy kiyim uslublari.

Аннотация: В данной статье анализируется дизайн ассортимента женской верхней одежды и коллекции мировых брендов, а также рассказывается о видах воротников для верхней одежды. Анализируется форма и внешний вид воротников и рекомендуются подходящие воротники для каждой модели.

Ключевые слова: дизайнер, модерн, мода, особенности моды, мех, кожа, плащ, модель, пальто, воротник, куртка, ткань, современные стили одежды.

Abstract: This article discusses the design analysis of the women's outerwear assortment, looking at the collection of world brands, about the types of collars for outerwear. The shape and appearance of collar types are analyzed and suitable collars are recommended for each model.

Key words: designer, modern, fashion, fashion features, fur, leather, cloak, model, coat, collar, jacket, fabric, modern clothing styles.

Kirish:

Ayollar ustki kiyimlarining zamonaviy moda yo'nalishi turli xil uslublar, materiallar va tafsilotlarni o'z ichiga oladi va zamonaviy ayolning ko'p qirrali va dinamik turmush tarzini aks ettiradi. Ayollar ustki kiyimlarining zamonaviy yo'nalishi turli xil qiziqarli variantlarni taklif etadi, bu esa ayollarga fasllarning doimiy o'zgarib turadigan sharoitlarida issiq, qulay va zamonaviy bo'lib, o'zlarining individual uslublarini namoyish qilish imkoniyatini beradi [1].

Asosiy qism:

Ko'ylaklardagi ayollar modasi doimo rivojlanib boradi va tanlash uchun uslublar, tendentsiyalar va dizaynlarning keng doirasini taklif etadi. Mana, so'nggi paytlarda mashhur bo'lgan bir nechta mashhur liboslar dizayn, funksionallik va materiallar jihatidan sezilarli yutuqlarga erishdi [2]. Ayollar ustki kiyimidagi ba'zi muhim yutuqlar:

1. Ishlash matolari: ilg'or ishlash matolarining rivojlanishi ayollar ustki kiyimlarining funksionalligini sezilarli darajada oshirdi. Gore-Tex, Polartec va Thinsulate kabi matolar mukammal izolyatsiya, havo o'tkazuvchanlik va suvga chidamliligini ta'minlaydi, bu esa ayollarning har xil ob-havo sharoitida issiq, quruq va qulay bo'lishini ta'minlaydi.
2. Innovatsion dizayn xususiyatlari: Dizaynerlar funksionallik va qulaylikni oshirish uchun ayollar ustki kiyimlariga innovatsion xususiyatlarni kiritdilar. Ular orasida olinadigan astarlar, shamollatish imkoniyatlari va bir nechta cho'ntaklar mavjud. Ba'zi kurtkalar, shuningdek, smart mosligi va hatto isitish elementlari kabi o'rnatilgan texnologiyalar bilan ishlab chiqilgan.
3. Barqaror va ekologik toza materiallar: Atrof-muhit ongining o'sishi bilan ayollar tashqi kiyimida barqaror va ekologik toza materiallardan foydalanishga o'tish sodir bo'ldi. Qayta ishlangan matolar, organik, paxta, bambuk va kanop kabi o'simlik tolalari ekologik tashqi kiyim variantlarini yaratish uchun tobora ko'proq foydalanilmoqda.
4. Ko'p qirrali va konvertatsiya qilinadigan uslublar: ko'plab ayollar ustki kiyimlari endi konvertatsiya qilinadigan xususiyatlarni taklif qiladi, bu ularni bir necha usulda kiyish imkonini beradi. Misol uchun, yenglari olinadigan yoki uzunligi sozlanishi mumkin bo'lgan kurtkalar har xil ob-havo sharoitlari va holatlariga mos ravishda turli xil uslublarga aylantirilishi mumkin.
5. Modaga mos dizaynlar: Ayollar ustki kiyimlari modaga moslashdi, dizaynerlar zamonaviy elementlar va uslublarni funksional kiyimlarga kiritdi. Bunga qalin ranglar, o'ziga xos naqshlar va zamonaviy qirqimlardan foydalanish kiradi, bu esa ayollarga elementlardan himoyalangan holda moda bayonotini yaratishga imkon beradi.
6. Hajmining turlari ortdi: moda sanoati ayollar ustki kiyimlarida kengroq o'lchamlarni taklif qiluvchi variantlar yanada ko'paydi. Bu har qanday tana tipidagi ayollarning zamonaviy va mos keladigan ustki kiyim variantlarini topishini ta'minlaydi.

Ayollar ustki kiyimidagi bunday yutuqlar ayollarga har xil ob-havo sharoitida moda qulay va himoyalangan bo'lib qolish imkonini berdi, shu bilan birga barqarorlik va o'lchamlarni qamrab olish masalasini hal qildi [3, 4].

Ayollar ustki kiyimi yoqalari bo'yicha tahlili

Yoqa ayollar ustki kiyimining muhim qismi bo'lib, funksional va estetik maqsadlarga xizmat qiladi. Umuman olganda, yoqa zamonaviy ayollarning moda va funksional ehtiyojlarini aks ettiruvchi ayollar tashqi kiyimidagi muhim dizayn elementidir. Yoqa uslublari uzunligi, kesimi va materiali jihatidan juda xilma-xil bo'lib, ularning har biri kiyimga o'ziga xos ta'sir ko'rsatadi. Yoqa boshqa dizayn detallari, shakllar va matolar bilan bir qatorda ustki kiyimning o'ziga xos ko'rinishini yaratishga yordam beradi va foydalanuvchining individual uslubini ta'minlaydilaiydi. U nafaqat tashqi kiyimning uslubi va dizaynini yaxshilaydi, balki turli ob-havo sharoitida himoya va qulaylikni ham ta'minlaydi. Yoqa uslubi, mato, konstruksiya, yopish tizimlari va qo'shimcha funktsiyalar uning umumiy funktsionalligi va ko'p qirrali bo'lishiga yordam beradilar.



Qaychi yoqa keng qo'llaniladigan va tan olingan klassik va ko'p qirrali yoqa variantidir. Ushbu yoqa klassik va murakkab variant bo'lib, u har qanday kiyimga nafislik qo'shadi. Uning mo'tadil tarqalishi nuqtalari uni rasmiy va yarim rasmiy holatlar uchun ko'p qirrali tanlovga aylantiradi



Ko'ylak yoqa. Bu yoqaning eng keng tarqalgan turi bo'lib, uning uchlari uchlari bilan ajralib turadi. Bu ko'p qirrali va turli xil holatlar uchun mos keladi, rasmiydan tasodifiygacha. Ushbu turdagi yoqa ko'pincha yanada rasmiy va murakkab uslub bilan bog'liq. Tarmoq yoqasi sifatida ham tanilgan yoqa tik turgan qisqa va ochilgan yoqadir. U ko'pincha an'anaviy Osiyodan ilhomlangan kiyimlarda qo'llaniladi va rasmiy va kundalik ko'ylaklarga o'ziga xos teginish qo'shishi mumkin [5].



Tik yoqa bo'yinbog'ida vertikal holda turadigan yoqa uslubidir. Bu, odatda, an'anaviy yoqalar kabi qisqa, tasmaga o'xshash yoqa. Tik yoqalar ko'pincha ko'ylaklar, bluzkalar, kurtkalar va ko'ylaklar ustida joylashgan bo'lib, kiyim dizayniga zamonaviy va o'ziga xos tus qo'shadi. Ular kiyimning umumiy uslubi va matosiga qarab ham rasmiy, ham tasodifiy holatlar uchun kiyilishi mumkin.



Piter pen yoqa

ko'ylaklar, bluzkalar paltolar va bolalar kiyimlarida keng tarqalgan yoqa uslubi. U yumaloq va tekis shakli bilan ajralib turadi, old tomonida kichik egri. "Piter Pan yoqasi" nomi J.M.Barrining mashhur pyesasi va romanidagi Piter Pan qahramoni kiygan yoqalardan kelib chiqqan. U har qanday kiyimga joziba qo'shib, uni kundalik va rasmiy liboslar uchun sevimli tanlovga aylantiradi.

Umuman olganda, Piter Pan yoqasi har qanday kiyimga nafislik va o'ynoqilik qo'shadigan yoqimli va ko'p qirrali dizayn elementidir [6].



Tik qaytarma yoqa ko'ylakning bo'ynini o'rab turgan va yuzni o'rab turgan qismini anglatadi. U ko'ylakning umumiy uslubi va rasmiyatchiligini aniqlashda muhim ro'l o'ynaydi. Ko'ylak yoqasining ko'plab variantlari mavjud. Yoqa tanlash shaxsiy imtiyozlarga, vaziyatga va kerakli uslubga bog'liq.



Yoqasiz

buklanmaydigan va bo'yniga tekis yotmaydigan yoqa uslubi. Ushbu uslub hech qanday lapellar yoki yoqalarsiz to'g'ridan-to'g'ri tasmaga o'xshash bo'yin chizig'ini yaratadi, natijada minimalistik va sodda dizayn paydo bo'ladi. Ushbu yoqa uslubi tabiiy va oson ko'rinishga ega bo'lib, qulayroq va qulayroq ko'rinishga intilayotganlar uchun juda mos keladi.



Yaxlit bichilgan tik yoqa ayollar ustki kiyimlariga nafis va professional tus qo'shadigan zamonaviy va murakkab yoqa uslubi. Uning baland bo'yli va tuzilgan dizayni jozibali ko'rinish hosil qiladi, bu uni sayqallangan va mukammal ko'rinishga intilayotganlar uchun mashhur tanlovga aylantiradi.



Shol yoqa paltolar, plashlar, jaketlar va kardiganlarda ko'p uchraydigan yoqa turi. U yoqadan kiyimning old qismigacha cho'zilgan, yelkalariga o'ralgan ro'molga o'xshashligi bilan tavsiflanadi. shol yoqasi kiyimga nafislik qo'shib yanada rasmiylik beradi.



Ro'mol yoqa ko'pincha kurtkalar, kardiganlar va paltolarda uchraydigan yoqa turi. U yoqadan kiyimning old qismigacha cho'zilgan, yelkalariga o'ralgan ro'molga o'xshashligi bilan tavsiflanadi. Ro'mol yoqasi kiyimga nafis va nafislik qo'shib, ko'pincha unga yanada rasmiylik beradi.

Shaxsiy imtiyozlar va holatlarga mos keladigan turli xil uslublar va dizaynlarni tushunish juda foydali. Moda doimo rivojlanib bormoqda, shuning uchun kelajakda qanday yangi va o'ziga xos yoqa uslublari joriy etilishini ko'rish har doim qiziq. Har bir yoqa turi turli moda imtiyozlari va holatlariga mos keladigan o'ziga xos xususiyatlarni taqdim etadi. Moda tendentsiyalari doimo rivojlanib, yangi va ijodiy yoqa dizaynlarini taqdim etishi hayratlanarli. Yoqa uslublarining xilma-

xilligi ayollarga o'zlarining shaxsiy uslublarini ifodalash va tashqi kiyimlari bilan turli xil ko'rinishlarni yaratish uchun ko'plab imkoniyatlarga ega bo'lishini ta'minlaydi.

Xulosa:

- qish-kuz mavsumi uchun ayollar ustki kiyimining zamonaviy moda yo'nalishi tahlil qilindi;

- zamonaviy ayollar tashqi kiyimida moda sanoati doimo rivojlanib bormoqda va yangi yoqa uslublari doimiy ravishda kiritilmoqda. Qaychi yoqasi, klassik qirrali yoqa, ro'molli yoqa, tik yoqasi yoki yaxlit bichilgan tik yoqa bo'ladimi, har bir yoqa uslubi plashlar, paltolar va boshqa ustki kiyimlarga o'ziga xos joziba bag'ishlaydi. Moda bizga o'zimizni ifoda etish va turli uslublar bilan tajriba o'tkazish imkonini beradi va yoqalar kiyimning umumiy ko'rinishini va hissiyotini yaxshilashning ajoyib usuli hisoblanadi. Shunday qilib, moda va zamonaviy tashqi kiyim ko'rinishini yaratish uchun ko'plab yoqa variantlari mavjud.

Adabiyotlar

- [1]. Ergasheva B. A., Yakubov N.J., Abdullayeva Z. O. Dizayni o'zgaradigan yavgi fasondagi ayollar ko'ylagini loyihalash. \ For active participation in the international scientific and technical conference on the topic "Innovative technology and problem solving in textile and light industry (TEXTILE AND LIGHT INDUSTRY-2023)"
- [2]. Ergasheva B. A. Valiyev G. N. Ayollar ustki kiyimini loyihalash // journal of science innovative research in uzbekistan" jurnali volume 1, ISSUE 9, 2023. DECEMBER ResearchBib Impact Factor: 8.654/2023
- [3]. Berdiyeva R.A., Valiyev G.N. O'smir yoshdagi qizlarga zamonaviy kiyim assortimentlari uchun tavsiyalar // «Tikuv-trikotaj sanoatida innovatsion texnologiyalar, ishlab chiqarishdagi muammo, tahlil va sohani rivojlanish istiqbollari» Xalqaro ilmiy-amaliy konferensiyasi maqolalari to'plami. Namangan: NamMTI, 2022. (7-8-oktabr 2022-yil). 1- Tom. 549-b., 203-206 b.
- [4]. Valiev G.N., Karimova X.Dj.. Design of older women's dresses based on analysis of crepedesin Fabrics // Galaxy International Interdisciplinary Research Journal (GIIRJ). Vol. 10, Issue 11, November - 2022. – 319-328 pp. ISSN (E): 2347-6915.
- [5]. Asian Journal of Multi dimensional Research (ADouble Blind Refereed& Peer Reviewed International Journal)DOI: WAYS TO SOLVE PROBLEMS IN THE PRODUCTION OF KNIT WEAR M. M. Ulug'boboieva; X.Sh.Tursunova <http://tarj.in/images/download/ajmr/AJMR-SEPTEMBER-2021-FULL-JOURNAL.pdf>
- [6]. ANALYSIS OF WOMEN'S CLOTHES SEWING - A STUDY TO DEVELOPA NORM OF TIME SPENT ON THE TECHNOLOGICAL PROCESS OF KNITTING PRODUCTION Tursunova Xilola Shuxratjon qizi, Mamatqulova Saida Raxmatovna <https://sciencebring.com/index.php/ijasr/article/view/31https://doi.org/10.37547/ijasr-02-03-03>

КЎП ОМИЛЛИ ТАЖРИБАЛАР ЎТКАЗИШ ОРҚАЛИ ҚУРИЛМАНИНГ РАЦИОНАЛ ПАРАМЕТРЛАРИНИ АНИҚЛАШДАГИ МУАММОЛАРНИ БАРТАРАФ ҚИЛИШ

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Аннотация: Ушбу илмий мақолада илмий-тадқиқот ишлари олиб бораётган тадқиқотчиларда энг кўп учрайдиган муаммолардан бири бўлган тажрибалар ўтказиш давомида ва янги конструкциядаги қурилмаларни ишлаб чиқишда кузатилаётган долзарб муаммолардан уларнинг рационал параметрларини аниқлаш усули келтирилган. Бунда тажрибаларни ўтказиш орқали янги қурилманинг рационал параметрларини аниқлаш учун кўп омилли усуллардан фойдаланиш мисоллар ишлаш орқали тушунтириб ўтилган.

Калит сўзлар: кўп омили, тажриба, такрорланувчи, қиравчи параметрлар, чиқувчи параметрлар, режалаштириш, қурилма, модел.

Аннотация: В данной научной статье представлена методика определения их рациональных параметров на основе реальных проблем, наблюдаемых в ходе экспериментов и разработки устройств новой конструкции, что является одной из наиболее частых проблем, с которыми сталкиваются исследователи, проводящие научные исследования. На рабочих примерах поясняется использование многофакторных методов для определения рациональных параметров нового устройства путем проведения экспериментов.

Ключевые слова: многомерность, эксперимент, повторение, входные параметры, выходные параметры, планирование, устройство, модель.

Annotation: This scientific article presents a methodology for determining their rational parameters based on real problems observed during experiments and the development of devices of new design, which is one of the most common problems faced by researchers conducting scientific research. Working examples explain the use of multifactorial methods to determine the rational parameters of a new device through experiments.

Key words: multidimensionality, experiment, repetition, input parameters, output parameters, planning, device, model.

Кириш

Илмий тадқиқот иши янги билимларни ишлаб чиқиш жараёни, билиш фаолияти турларидан бири. Унга объективлик, ишончлилик, аниқлик хос. Илмий тадқиқот ҳамма шартларга амал қилиб такрорланганда ҳаммаша бирдек натижа бериши, баҳс этилаётган масалани исботлаши лозим. Илмий тадқиқот бир-бири билан боғланган икки қийим-тажриба ва назариядан иборат. Илмий тадқиқотнинг асосий компонентлари: мавзунини белгилаш, мавжуд ахборотни, тадқиқот соҳасидаги шарт-шароит ва методларни, илмий фаразларни олдиндан таҳлил этиш, тажриба ўтказиш, олинган натижаларни таҳлил этиш ва умумлаштириш, келиб чиққан фаразларни олинган далиллар асосида текшириш, янги факт ва қонунларни ифодалаб бериш, илмий башорат юритиш ҳисобланади. Илмий тадқиқотларни фундаментал ва амалий, микдорий ва сифатий, ноёб ва комплекс тадқиқотларга ажратиш кенг тарқалган. Илмий тадқиқотларнинг метод ва тажрибалари фаннинг ўзидагина эмас, балки кўпгина иқтисодий ва ижтимоий масалаларни ҳал қилишда ҳам кенг қўлланилади [1-2].

Илмий тадқиқот ишининг олиб боришда тажрибалар ўтказиш йўли алоҳида ўрин эгаллайди. Айниқса, техника соҳасида илмий тадқиқот ишининг олиб бораётган тадқиқотчилар бирор бир технологик машина устида илмий изланиш олиб боришлари жараёнида охириги натижани юқори самарадорликда бўлиши унинг янги ўлчамларига боғлиқдир. Бунда таклиф этилаётган қурилманинг ишчи органларининг технологик кўрсаткичларининг танлаш турли хил усулдаги тажрибалар ўтказиш орқали аниқланади. Ушбу жараёнда барча тадқиқотчилар учун тушунарли ва аниқлиги юқори бўлган усул кўп омили такрорланмас усул ҳисобланади [3].

Назарий тадқиқотлар

Кўп омили такрорланмас усул ёрдамида янги қурилмаларнинг рационал параметрларининг аниқлаш жараёнининг пахтани дастлабки ишлаш саноатидаги чигит саралаш қурилмасининг янги конструкциясидан ўтказилган тажрибалар миёлида кўриб чиқамиз: мисол тариқасида турли хил ҳажмдаги чигитларни такомиллашган шнек ва турли барабан таъсирида линтерлашга молик бўлмаган чигитларни ажратиш микдори, ва йигирувга яроқли толаси бор чигитларни ажратиш олишнинг янги усулда олинадигани технологик параметрларининг шаклдор чигитларнинг ҳажмдор бўлишига таъсирининг ўрганиш учун керак бўлган математик моделларни қуришни кўриб чиқамиз. Бунинг учун турли Шнек тезлиги, турли барабан тезлиги турли қийматларида, ҳамда турли хил турли барабаннинг диаметрида чигитларни саралаш жараёнининг кўрамиз [4-8]. Тажриба ўтказиш шартлари қуйидаги 1-жадвалда келтирилган.

1-тажрибанинг режаштириш шарти

№	Омилнинг номи, белгиси	Кодлаш- тирилган белгиси	Факторнинг ҳақиқий қийматлари			Ўзгариш оралиғи
			-1	0	+1	
1	Шнек тезлиги, <i>айл/мин</i>	x_1	60	80	100	20
2	Тўрли барабан тезлиги, <i>айл/мин</i>	x_2	30	40	50	10
3	Тўрли барабаннинг диаметри, <i>мм</i>	x_3	330	332	334	2

2-тажрибанинг режаштириш шарти

№	Омилнинг номи, белгиси	Кодлаш- тирилган белгиси	Факторнинг ҳақиқий қийматлари			Ўзгариш оралиғи
			-1	0	+1	
1	Шнек тезлиги, ω_u (<i>айл/мин</i>)	x_1	60	80	100	20
2	Тўрли барабан тезлиги, ω_b (<i>айл/мин</i>)	x_2	20	30	40	10
3	Тўрли барабаннинг диаметри, d (<i>мм</i>)	x_3	326	328	330	2

Тажрибавий изланишлар

Чиқувчи параметр сифатида линтерлашга молик бўлмаган чигитларни ажратиш миқдорини ҳамда йигирувга яроқли толаси бор чигитларни ажратиш олиш миқдори оламиз. Чигитларни ажратиш жараёнида таъсир қилувчи кировчи параметрлар шнек тезлиги, тўрли барабан тезлиги ҳамда тўрли барабан диаметрларини чигитларнинг ҳажмдорлигига қараб саралашдаги давомийлигининг (кирувчи омилларнинг) таъсирини тажриба асосида ўрганамиз [9-13]. Бунинг учун режаштириш матрицаси асосида ҳар бир шароитда 3 маротаба такроран тажрибалар ўтказамиз. Бу ҳолда тажрибалар сони $N = 2^3 = 8$, такрорланишлар сони $m = 3$ ни ҳисобга олсак, умумий тажрибалар сони $N \cdot m = 24$ бўлади. Чиқувчи параметрнинг тажрибавий натижалари ва дисперсиялари 2-жадвалда келтирилган.

Режаштириш матрицаси, тажриба ва ҳисобий натижалар

y	Омиллар						$\bar{y}_u$	S_u^2
	x_1	x_2	x_3	y_{u1}	y_{u2}	y_{u3}		
1	-	-	-	19.05	19.1	19.15	19,1	0.002
2	+	-	-	17.75	17.8	17.85	17,8	0.002
3	-	+	-	22.5	23	23.5	23	0.17
4	+	+	-	22.25	22.45	22.5	22,4	0.01
5	-	-	+	21.25	21.5	21.45	21,4	0.012
6	+	-	+	16.45	16.4	16.65	16,5	0.09
7	-	+	+	18.75	19	18.95	18,9	0.06
8	+	+	+	24,55	23,7	25,55	24,6	0,07

Натижалар таҳлили

1. Ажралиб турган қийматларни статистик усулда чиқариб ташлаш
2-жадвалдаги ҳар бир сатр учун қўлланилади. Бунинг учун ҳар бир сатр учун ўрта қиймат ва дисперсиялар ҳисобланади. Бу қийматлар 5-жадвалда келтирилган. Масалан, биринчи тажриба учун:

$$\bar{y}_1 = \frac{19.05 + 19.1 + 19.05}{3} \quad (1)$$

$$S_1^2 = \frac{(19.05 - 19.1)^2 + (19.1 - 19.1)^2 + (19.15 - 19.1)^2}{3} = 0.0017 \quad (2)$$

$$y_{\min} = 19.05; y_{\max} = 19.15$$

Сўнг формулалар ёрдамида критериянинг чегаравий қийматлари ҳисобланади:

$$V_{R,\max} = \frac{(y_{\max} - \bar{y})}{S\{y\}} \cdot \sqrt{\frac{m}{m-1}} = 1.38; V_{R,\min} = \frac{(\bar{y} - y_{\min})}{S\{y\}} \cdot \sqrt{\frac{m}{m-1}} = 1.38 \quad (3)$$

Кўриниб турибдики, бу қийматлар махсус жадвалдан олинган $V_t = 1.412$ қийматдан кичик. Шунинг учун юқоридаги энг катта ва энг кичик қийматлар кейинги статистик қайта ишлашдан чиқариб ташланмайди.

Кўрилатган мисолда ҳар бир тажриба учун ажралиб турган қийматлар йўқ.

2. Дисперсияларнинг бир жинслилигини текшириш учун формула ёрдамида ҳисобий қиймат ҳисобланади:

$$G_R = \frac{S_{\max}^2\{y\}}{\sum_{i=1}^N S_u^2\{y\}} = \frac{0.09}{0.416} = 0.216 \quad (4)$$

Кохрен критериясининг жадвалининг қиймати

$$G_T(P_D = 0.95; S_u^2 = 2.8) = 0.516$$

Демак, $G_R < G_t$ бўлгани учун дисперсиялар бир жинсли.

Коэффициентларни ҳисоблаш учун 2-жадвалда келтирилган ўрта қийматларидан фойдаланамиз.

Озод ҳад:

$$b_0 = \frac{1}{N} \cdot \sum_{u=1}^N \bar{y}_u = \frac{\bar{y}_1 + \bar{y}_2 + \dots + \bar{y}_N}{N} = \frac{19.1 + 17.8 + 23 + 24.6 + 21.4 + 16.5 + 18.9 + 22.4}{8} = 20.5 \quad (5)$$

Чизикли ҳадлар коэффициентлари:

$$b_i = \frac{1}{N} \cdot \sum_{u=1}^N x_{iu} \cdot \bar{y}_u = \frac{x_{i1} \cdot \bar{y}_1 + x_{i2} \cdot \bar{y}_2 + \dots + x_{iN} \cdot \bar{y}_N}{N}$$

$$b_1 = \frac{-19.1 + 17.8 - 23 + 24.6 - 21.4 + 16.5 - 18.9 + 22.4}{8} = -0.1375$$

$$b_2 = \frac{-19.1 - 17.8 + 23 + 24.6 - 21.4 - 16.5 + 18.9 + 22.4}{8} = 1.7625$$

$$b_3 = \frac{-19.1 - 17.8 - 23 - 24.6 + 21.4 + 16.5 + 18.9 + 22.4}{8} = -0.6625$$

Чизиксиз ҳадлар коэффициентлари:

$$b_{ij} = \frac{1}{N} \cdot \sum_{u=1}^N x_{iu} \cdot x_{ju} \cdot \bar{y}_u =$$

$$= \frac{x_{i1} \cdot x_{j1} \cdot \bar{y}_1 + x_{i2} \cdot x_{j2} \cdot \bar{y}_2 + \dots + x_{iN} \cdot x_{jN} \cdot \bar{y}_N}{N} \quad (6)$$

$$b_{12} = \frac{19.1 - 17.8 - 23 + 24.6 + 21.4 - 16.5 - 18.9 + 22.4}{8} = 1.413$$

$$b_{13} = \frac{19.1 - 17.8 + 23 - 24.6 - 21.4 + 16.5 - 18.9 + 22.4}{8} = -0.213$$

$$b_{23} = \frac{19.1 + 17.8 - 23 - 24.6 - 21.4 - 16.5 + 18.9 + 22.4}{8} = -0.9125$$

$$b_{123} = \frac{-19.1 + 17.8 + 23 - 24.6 + 21.4 - 16.5 - 18.9 + 22.4}{8} = 0.6875$$

У ҳолда куйидаги кўп факторли регрессия моделини оламир:

$$y_R = b_0 + b_1 \cdot x_1 + b_2 \cdot x_2 + b_3 \cdot x_3 + b_{12} \cdot x_1 \cdot x_2 + b_{13} \cdot x_1 \cdot x_3 +$$

$$+ b_{23} \cdot x_2 \cdot x_3 + b_{123} \cdot x_1 \cdot x_2 \cdot x_3 \quad (7)$$

$$y_R = 20.5 - 0.1375 \cdot x_1 + 1.7625 \cdot x_2 - 0.6675 \cdot x_3 + 1.413 \cdot x_1 \cdot x_2 - 0.213 \cdot x_1 \cdot x_3 +$$

$$- 0.9125 \cdot x_2 \cdot x_3 + 0.6875 \cdot x_1 \cdot x_2 \cdot x_3 \quad \text{Л}$$

екин бу моделнинг охириги кўриниши эмас.

Моделнинг охириги кўринишини олиш учун коэффициентларни аҳамиятлигини текширамир. Бунинг учун Стюдент критериясининг формулаларидан фойдаланамиз [3-4].

$$S^2(\bar{y}) = \frac{1}{N \cdot m} \cdot \sum_{i=1}^N S_u^2(y) = \frac{0.416}{24} = 0.017; S^2(b_1) = \frac{1}{N} \cdot S^2(\bar{y}) = \frac{0.17}{8} = 0.02 \quad (8)$$

$$S(b_1) = 0.145$$

Булар ёрдамида критериянинг ҳисобий қийматларини ҳисоблаймир:

$$t_R(b_1) = \frac{|b_1|}{S(b_1)} = \frac{0.1375}{0.145} = 0.94$$

Худди шунингдек:

$$t_R(b_2) = \frac{|b_2|}{S(b_1)} = \frac{1.7625}{0.145} = 12.155; t_R(b_3) = \frac{|b_3|}{S(b_1)} = \frac{0.6625}{0.145} = 4.56;$$

$$t_R(b_{12}) = \frac{|b_{12}|}{S(b_1)} = \frac{1.413}{0.145} = 9.88; t_R(b_{13}) = \frac{|b_{13}|}{S(b_1)} = \frac{0.213}{0.145} = 1.468$$

$$t_R(b_{23}) = \frac{|b_{23}|}{S(b_1)} = \frac{0.9125}{0.145} = 6.3; t_R(b_{123}) = \frac{|b_{123}|}{S(b_1)} = \frac{0.6875}{0.145} = 4.74$$

Стюдент критериясининг жадвалий қиймати

$$t_T[P_D, f(S_u^2) = N \cdot (m - 1)] = t_T[P_D = 0.95; f = 8 \cdot (3 - 1) = 16] = 2.12$$

Демак, $b_2, b_3, b_{12}, b_{23}, b_{123}$ коэффициентларнинг ҳисобий қийматлари жадвалий қийматдан катта, шунинг учун бу коэффициентлар аҳамиятли, қолган коэффициентлар эса аҳамиятсиздир. Натижада куйидаги моделини ҳосил қиламир:

$y_R = 20.5 + 1.7625 \cdot x_2 - 0.6675 \cdot x_3 + 1.413 \cdot x_1 \cdot x_2 - 0.9125 \cdot x_2 \cdot x_3 + 0.6875 \cdot x_1 \cdot x_2 \cdot x_3$ О милларнинг ҳақиқий қийматидан кодлаштирилган қийматига куйидаги муносабатлар орқали

$$x_1 = \frac{\omega_u - 80}{20}, x_2 = \frac{\omega_o - 40}{10}, x_3 = \frac{d - 332}{2}$$

ўтилиб, чикувчи омилнинг ҳисобий қийматлари модель орқали ҳисобланади.

3. Олинган моделнинг адекватлигини текшириш учун Фишер критериясининг формулаларидан фойдаланамиз [13-15].

Бунинг учун чикувчи омилнинг тажрибавий ва ҳисобий қийматларини таққослаймиз:

u	$\bar{y}_u$	$\bar{y}_{Ru}$	$\bar{y}_u - \bar{y}_{Ru}$	$(\bar{y}_u - \bar{y}_{Ru})^2$
1	19.1	19.095	0,005	0,000025
2	17.8	17.817	-0.017	0,000289
3	23	23.017	-0.017	0,000289
4	24.6	24.57	0,03	0,0009
5	21.4	21.382	0,018	0,000324
6	16.5	16.505	-0,005	0,000025
7	18.9	18.905	-0,005	0,000025
8	22.4	22,407	-0,007	0,000049
$\sum_{u=1}^N$	-	-	0,002	0,001945

Демак, моделдаги аҳамиятли коэффициентлар сони $N_k = 4$ ҳисобга олсак,

$$S_{\text{хад}}^2(y) = \frac{0.001945}{8 - 4} = 0.0004862$$

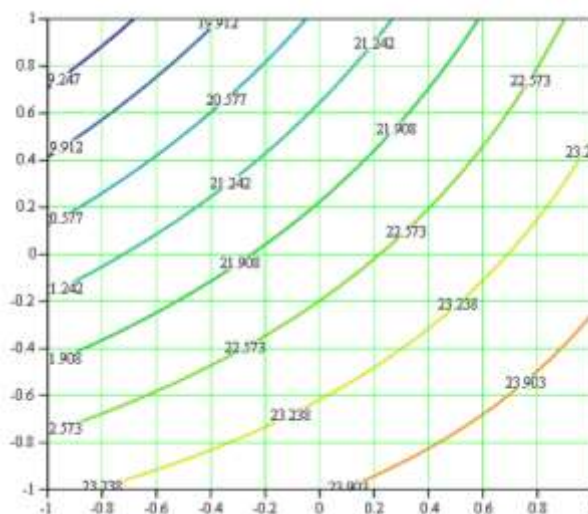
Бу сон $S^2(\bar{y}) = 0.0002708$ сондан катта бўлганлиги учун критериянинг ҳисобий қиймати формула орқали ҳисобланади:

$$F_R = \frac{0.0004862}{0.0002708} = 1.795$$

Фишер критериясининг жадвалий қийматини махсус жадвалдан топамиз:

$$F_T[P_D = 0.95; f(S_y^2) = 16, f(S_{\text{хад}}^2) = 4] = 5.85$$

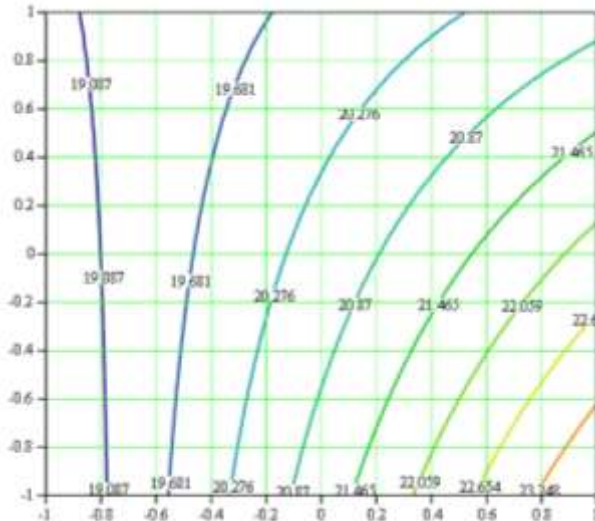
Демак, $F_R < F_T$ бўлганлиги учун модель адекватдир, яъни у чигитларнинг ҳажмдорлигига қараб саралашдаги давомийлигининг таъсирини ишлов бериш жараёнидаги кўрсаткичини ўзгаришини мос ифодалайди (1-расм).



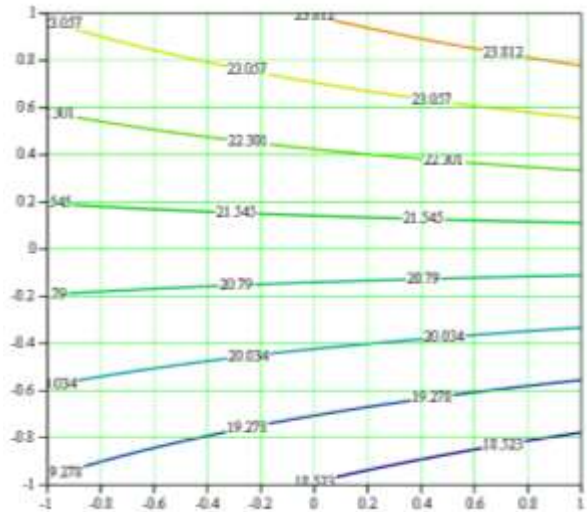
$$Y_R(x_1, x_3) = 20.5 + 1.7625 \cdot x_2 - 0.6675 \cdot x_3 + 1.413 \cdot x_1 \cdot x_2 - 0.9125 \cdot x_2 \cdot x_3 + 0.6875 \cdot x_1 \cdot x_2 \cdot x_3 \quad (9)$$

Шнек бурчак тезлигининг $x_1 = 0.2 \div 1$ гача ошиши тўрли барабан диаметрини $x_3 = -1 \div -0.2$ камайиши ҳисобига чигитларнинг ҳажмдорлигига қараб саралашдаги самарадорлигини ошишини изочизикларда кўришимиз мумкин. Бунда тўрли барабаннинг бурчак тезлигининг энг катта қийматида $x_2 = 1$ эришади.

$$Y_R(x_2, x_3) = 20.5 + 1.7625 \cdot x_2 - 0.6675 \cdot x_3 + 1.413 \cdot x_1 \cdot x_2 - 0.9125 \cdot x_2 \cdot x_3 + 0.6875 \cdot x_1 \cdot x_2 \cdot x_3 \quad (10)$$



2-расм. Тўрли барабан бурчак тезлигини тўрли барабан диаметрига боғлиқлигини чигит саралаш самарадорлигига таъсири.



3-расм. Шнек бурчак тезлигининг тўрли барабан бурчак тезлигига боғлиқлигини чигит саралаш самарадорлигига таъсири.

Тўрли барабаннинг бурчак тезлигининг $x_1 = 0.8 \div 1$ гача ошиши тўрли барабан диаметрини $x_3 = -1 \div -0.6$ камайиши ҳисобига чигитларнинг ҳажмдорлигига қараб саралашдаги самарадорлигини ошишини изочизикларда кўришимиз мумкин. Бунда шнекнинг бурчак тезлигининг энг катта қийматида $x_1 = 1$ эришади [15].

$Y_R(x_1, x_2) = 20.5 + 1.7625 \cdot x_2 - 0.6675 \cdot x_3 + 1.413 \cdot x_1 \cdot x_2 - 0.9125 \cdot x_2 \cdot x_3 + 0.6875 \cdot x_1 \cdot x_2 \cdot x_3$
Шнекнинг бурчак тезлигининг $x_1 = 0.2 \div 1$ гача ошиши ва тўрли барабаннинг бурчак тезлигининг $x_2 = 0.8 \div 1$ гача ошиши ҳисобига чигитларнинг ҳажмдорлигига қараб саралашдаги самарадорлигини ошишини изочизикларда кўришимиз мумкин. Бунда тўрли барабаннинг диаметрининг қийматида $x_3 = -1$ эришади.

Хулоса

Ўтказилган тажриба ва таҳлиллар шуни кўрсатики, ҳар қандай илмий тадқиқот ишини олиб бориш натижасида таклиф этилаётган янги қурилманинг ишчи органларини рационал параметрларини аниқлаш илмий тадқиқот ишини самарадорлигини оширишга хизмат қилади. Бунда янги таклиф этилаётган қурилмаларнинг юқори самарадорлик ҳамда унумдорликда ишлайдиган ишчи органларини тайёрлаб унда бмр неча марта такрорланмас амалий тажрибалар ўтказиб олинган натижаларни кўп омилли усул ёрдамида таҳлил қилиш алоҳида аҳамият касб этар экан.

Адабиётлар

- [1]. Ф.Б.Омонов Пахтани дастлабки ишлаш бўйича справочник (Маълумотнома). “Ўзпахтасаноат” акциядорлик уюшмаси “Пахта тозалаш ИЧВ” ОАЖ “Voriz-nashriyot” Тошкент – 2008.

- [2]. F.Rahimov, N. Gadaev, Kh. Kosimov, R. Muradov Theoretical Studies on the Impact of Cotton and Heavy Mixtures on the Walls of the Working Chamber of the Stone Crusher // Web of Semantic Universal Journal on innovative Education, Volume 2 Issue 3, Year 2023 ISSN: 2835-3048 <https://univerpubl.com/index.php/semantic>.
- [3]. Ф.Рахимов, Н.Гадоев, Р.Мурадов, Х.Косимов Изучения движение хлопка сырца в рабочей камере камнеуловителя // International Conference on Research in Humanities, Applied Sciences and Education Hosted from Berlin, Germany <https://conferencea.org>, June 5th 2022, 352-355 p.
- [4]. R.Muradov, F.Rakhimov, H.Kasymov, A.Karimov "Theoretical Study Of The Movement Of New Impurities And Heavy Impurities" The American Journal of Engineering and Technology, Volume02 Issue07 July 2020. DOI: -10.37547 // tajet. ISSN (e): 2689-0984 DOI <https://doi.org/10.37547/tajet/Volume02Issue07-03>.
- [5]. M.Axmedov, F.Raximov S.Rejabboyev, R.Muradov Analysis of the results of research on the process of cleaning and sorting cotton seeds Galaxy International Interdisciplinary Research Journal, 11(5), 688–694. Retrieved from <https://giirj.com/index.php/giirj/article/view/5209>.
- [6]. M.Axmedov, X.Isoxonov, A.Sarimsakov Development of an experimental installation with a bunker feeder and its description // Development of an experimental installation with a bunker-feeder and its description. Open Access Repository, 11(2), 72–74. <https://oarepo.org/index.php/oa/article/view/4056>.
- [7]. A. Sarimsakov, S. Isroilov, Komilov Sh. (2023). ANALYSIS OF THE INFLUENCE OF DAMAGED SEEDS ON THE ABRASION OF WORKING SURFACES. International Journal of Education, Social Science & Humanities. Finland Academic Research Science Publishers, 11(5), 244–247. <https://doi.org/10.5281/zenodo.7909044>
- [8]. Sarimsakov A., Isroilov S., Komilov Sh. Improving Fiber Quality Output by Improving the Roll Box of the Gin Saw. Engineering.-2023, 15, 261-268. <https://doi.org/10.4236/eng.2023.154020>
- [9]. A. Sarimsakov, S. Rejabboev, R. Muradov // Seed sorting device vibration test research // Международный научно-образовательный электронный журнал "Образование и наука в XXI века" // Выпуск № 38 (том-5) (май, 2023).
- [10]. M. Axmedov, F. Rakhimov, S. Rejabboyev, R. Muradov. (2023). Analysis Of The Results Of Research On The Process Of Cleaning And Sorting Cotton Seeds. Galaxy International Interdisciplinary Research Journal, 11(5), 688–694. Retrieved from <https://giirj.com/index.php/giirj/article/view/5209>
- [11]. Kh. Ahmedkhodjaev, Kh. Isoxonov, A. Sarimsakov. Theoretical analysis of separation of ginning seeds. Экономика и социум. 2023. №8(111). <https://www.iupr.ru/>
- [12]. Kh. Isaxonov, S. Azimov, A. Sarimsakov. Main results of work on the process of trapping undergenined seeds and volitals of raw cotton. Экономика и социум. 2023. №11(114). <https://www.iupr.ru/>
- [13]. Kh. Isaxonov, A. Sarimsakov, S. Rejabboev. (2024). Physical And Mechanical Properties Of Non-Genined Seeds And Their Fibrous Cover. Web of Discoveries: Journal of Analysis and Inventions, 2(2), 29–34. Retrieved from <https://webofjournals.com/index.php/3/article/view/777>.
- [14]. Toshpo'latov M., Komilov Sh., Salomova M., Muradov R. (2024). Paxta chigitini tozalash qurilmalarini ishlash tizimi taxlili. Новости образования: исследование в XXI веке, 2(18), 338–342. извлечено от <https://nauchniyimpuls.ru/index.php/noiv/article/view/14695/>
- [15]. М.Жўраева, Ш.Комилов, А.Саримсаков, Р.Мурадов // Жинлашдан сўнг толадан ажраган чигитларнинг сифат кўрсаткичлари таҳлили. RESEARCH FOCUS. VOLUME-2 ISSUE-4 2023. <https://doi.org/10.5281/zenodo.7932578>.

SUV TA'MINOTIDA QO'LLANILADIGAN NASOSLARDAGI KAVITATSIYA HODISASI

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Annotatsiya: Ushbu maqolada, suv ta'minotida qo'llaniladigan nasoslardagi tashqi omillar tufayli yuzaga keladigan turli nohushliklar jumladan kavitatsiya hodisasi va turli gidrozarbaviy yemirilishlar, nasoslardagi turli shovqinlar, nasoslarning foydali ish ko'fitsienti (FIK) keskin ravishda tushib ketishi choralari haqida ko'rib chiqilgan.

Tayanch so'zlar: Nasos lapatalaridagi gidrozarbalar, quvurlardagi shovqinlar, lapatalrining yemirilishi, kavitatsiya hodisasi, foydali ish koefitsient (FIK) pasayishi, nasoslar qisqa mudat ishlashi.

Аннотация: В данной статье рассмотрены различные неисправности, вызванные внешними факторами в насосах, применяемых в водоснабжении, в том числе явления кавитации и различные гидростатические коллапсы, различные шумы в насосах, меры по резкому падению полезного коэффициента полезного действия (КПД) насосов.

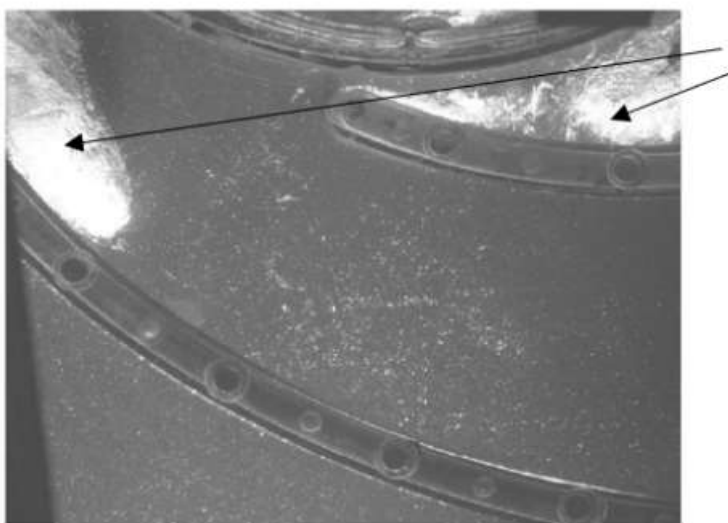
Ключевые слова: Водяные удары на лопасти насосов, шумы в трубопроводах, эрозия лопаток, явления кавитации, снижение коэффициента полезной работы (КФР), кратковременная работа насосов.

Annotation: In this article, various malfunctions caused by external factors in pumps used in water supply, including cavitation phenomena and various hydrostatic collapses, various noises in pumps, measures for a sharp drop in the useful performance coefficient (FIK) of pumps, are considered.

Keywords: Water shocks on the pump blades, noises in the pipelines, erosion of the blades, cavitation phenomenon, reduction of the useful work coefficient (FIK), short-term operation of the pumps.

Kavitatsiya (lot. *cavitas* — bo'shliq)— suyuqlik ichida gaz, bug' yoki ularning aralashmasi bilan to'lgan bo'shliq (kavitatsiya pufakchalari) hosil bo'lish hodisasi. Tez oqayotgan suyuqlikda bosimning ma'lum kritik qiymatgacha kamayishi natijasida yoki suyuqlikda akustik to'lqinlarning o'tishi natijasida sodir bo'ladi. Suyuqlikdagi gaz va bug' pufakchalari cheksiz ortib boradi va katta "kavitatsiya pufakchalari"ga aylanadi. Pufakchalar suyuqlikda gaz erishi tufayli hosil bo'lib, bosim kritik bosimdan yuqori bosim sohasigacha yetganda kamaya boradi va yo'qoladi. Natijada suyuqlik aylanib o'tayotgan jism yaqinida pufakchalar bilan to'lgan chegara — "kavitatsiya zonasi" hosil bo'ladi.[1]

Kavitatsiya gidravlika mashinalarida zararli hodisa bo'lib, uning ishiga salbiy ta'sir qiladi. Ishlash, tebranish va shovqinni keltirib chiqaradi va korroziya shikastlanishiga olib keladi. Markazdan qochma nasosning ichki kavitatsiyasi nafaqat kuchli tebranish va shovqinga olib keladi gidravlika mexanizmlarining ishlashiga salbiy ta'sir ko'rsatishi mumkin, ammo qulash natijasida hosil bo'lgan ta'sir vakuolaning buzilishi, shuningdek, pervanel devori tuzilishiga zarar yetkazadi, bu esa xavfsizlikka jiddiy ta'sir qiladi. Ichki kavitatsiyaning

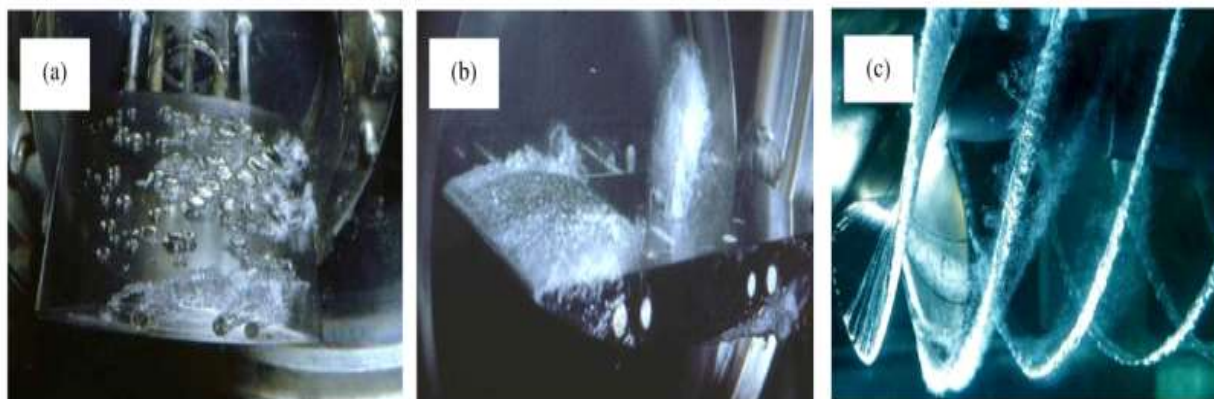


1- rasm Kavitatsiya zonasi.

paydo bo'lishi va rivojlanishining oldini olish gidravlika mexanizmlarining uzoq vaqt kavitatsiya holatida bo'lishiga yo'l qo'ymaslik uchun markazdan qochma nasoslar vaqt, jihozning ishdan chiqishiga yo'l qo'ymaslik va markazdan qochma nasoslarga prognozli xizmat ko'rsatishni amalga

oshirish, shuning uchun gidravlika kavitatsiyasini kuzatish usullarini tadqiq qilish katta ahamiyatga ega. [2,3]

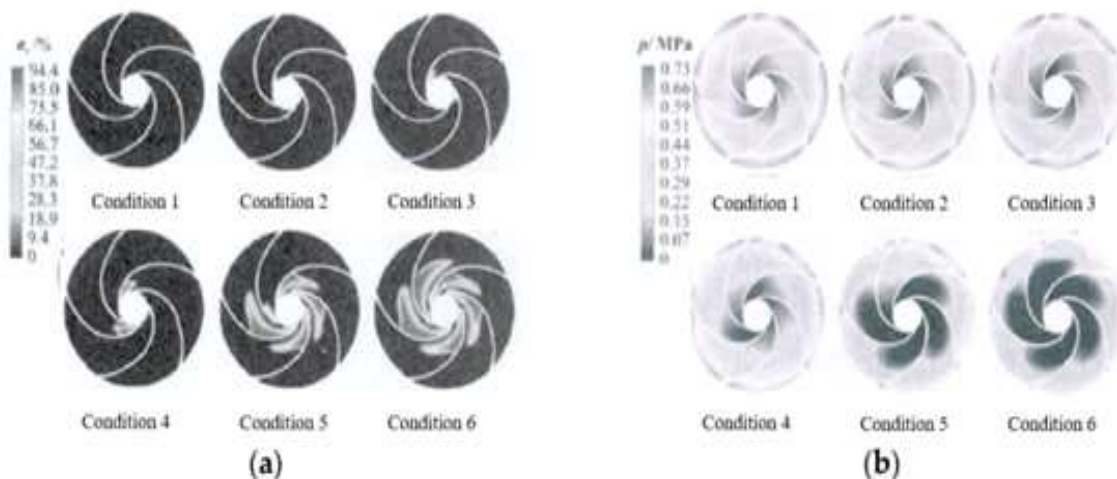
Markazdan qochma nasoslarda bulutli kavitatsiya sodir bo'lganda, u g'ayritabiiy mexanik o'zgarishlar va og'ir kavitatsiya ta'sirini keltirib chiqaradi. Bundan tashqari, birlashtirilgan kavitatsiya bo'lishi mumkin keyinchalik ikki turga bo'linadi: qisman kavitatsiya, bu yerda kavitatsiya havo plyonkasi yoki barg qumining yuzasiga tushadi va superkavitatsiya, bu yerda kavitatsiya quyi oqimga tarqaladi. Havo plyonkasi yoki barg qumining chiqish tomoni. Birlashtirilgan kavitatsiyaning turli shakllari. Vorteks kavitatsiyasi vorteks yadrosi hududida past bosim bo'lganda paydo bo'ladi. Oqim sohasida kuchli siljishni boshdan kechiradi. Ushbu turdagi kavitatsiya uzoqroq davom etadi vortekslarning shakllanishi tufayli, bu bo'shliqlarning umrini va natijasini uzaytiradi [4,5].

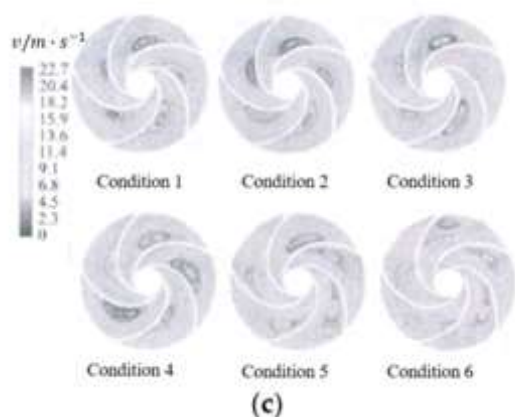


2-rasm. Kavitatsiyaning bir nechta keng tarqalgan turlari: a) aylanib yuruvchi vakuolalar, b) yopishgan kavitasyon, va c) vorteksli kavitatsiya.

Har xil oqim tezligi ostida kavitatsiyaning boshlang'ich nuqtasi va kavitatsiyaning boshlang'ich nuqtalari yuqori tezlikda suratga olish usuli an'anaviy kavitatsiyaning boshlang'ich nuqtasidan kattaroqdir. Suyuqlikdagi pufakchalar avvalroq paydo bo'ladi va kavitatsiyaning boshlang'ich nuqtasini erta aniqlashi mumkin. Shuning uchun, an'anaviy kavitatsiyani aniqlash usuli aniq histerezis va kavitatsiyaga ega.[6]

Bosim pulsatsiyasi usuli yuqori aniqlik, aniq o'lchovlarni taklif qilsa-da ko'pincha to'rt uchli tarmoq usulidan foydalanishni talab qiladi, bu esa bir nechta teshiklarni burg'ulashni talab qiladi quvur liniyasi yoki nasos korpusida. Ushbu protsedura zarar va noqulayliklarga olib kelishi mumkin, muayyan vaziyatlarda uning qo'llanilishini cheklash [7].





4-rasm. a) Har xil bo'lgan pervaneldagi ko'ndalang kesimdagi gaz hajmi tezligi taqsimoti buluti kavitatsiya chegaralari, b) pervaneldagi ko'ndalang kesimdagi statik bosimni taqsimlash buluti turli xil kavitatsiya chegaralari va c) pervaneldagi ko'ndalang kesimdagi oqim taqsimoti turlicha kavitatsiya chegaralari [8].

Hajm fraksiyasining bulutli grafiki ko'rsatilganning pervanel yo'nalishidagi kavitatsiyaning taqsimlanishi nominal tezlikda va turli kavitasyon raqamlari va bosim qiymatlari bilan model nasos. Kavitatsiya sodir bo'ladi to'rt xil bosqichda: boshlang'ich kavitatsiya, kavitatsiya rivojlanish, tanqidiy kavitatsiya va sinish kavitatsiyasi. Shuning uchun, barcha kavitatsiya raqamlari tomonidan tanlangan uchun bu turli xil kavitatsiya bosqichlarini hisobga olgan holda chuqur akustik tahlil. Bundan tashqari, 10% izo-sirt rasmda joylashgan hududning joylashuvi ko'rsatilgan kavitatsiya joylashgan bo'lib, bosim qiymatini ko'rsatadi kavitatsiyaning izo-yuzasi. Mintaqa ko'k rang bilan ko'rsatilgan past bosimli hudud bo'lib, bu kavitatsiyani ko'rsatadi bu hududda ishlab chiqariladi. Bundan farqli o'laroq, qizil rang bilan ko'rsatilgan mintaqa yuqori bosimli mintaqadir, bu shuni ko'rsatadi bu mintaqada kavitatsiya qulab tushganligi. Bundan tashqari, bu hajm ulushi o'rtacha qiymat uchun hisoblanadi Kavitatsiyaning beqarorligi va yoki aylanish jarayonida beqarorlik ta'sirida o'zgarishi mumkin bo'lgan barcha pichoqlar ustida mil chastotasi bilan bog'liq. Kavitatsiya ochilish maydoni ortib ketgandan so'ng (1) va (2) ideal oqim va past Reynolds soni oqimlarining kombinatsiyasi sifatida keltirilgan.

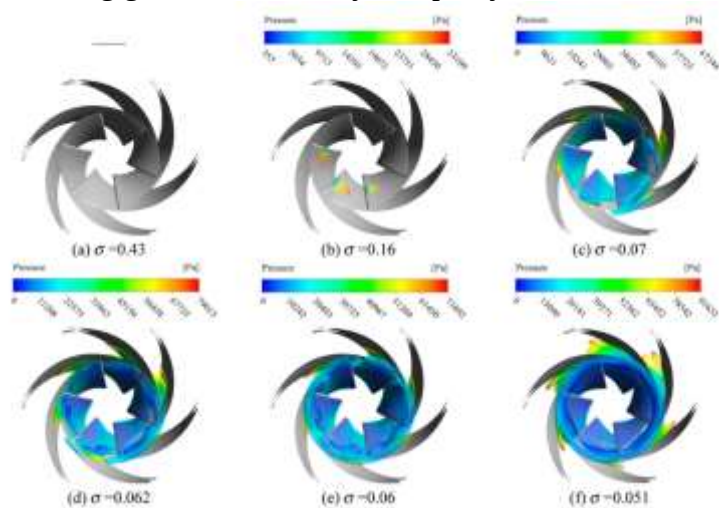
$$Q_l = k_1 \frac{1}{u} P_d + k_2 \sqrt{P_d} \quad (1)$$

bu erda k_1 va k_2 mos ravishda past Reynolds va yuqori Reynolds sonining oqish koeffitsientlari hisoblanadi.

$$Q_d = (1 - k_0 P_d) A_v C_d \sqrt{\frac{2P_i}{\rho}} - k_1 \frac{1}{u} P_d - k_2 \sqrt{P_d} \quad (2)$$

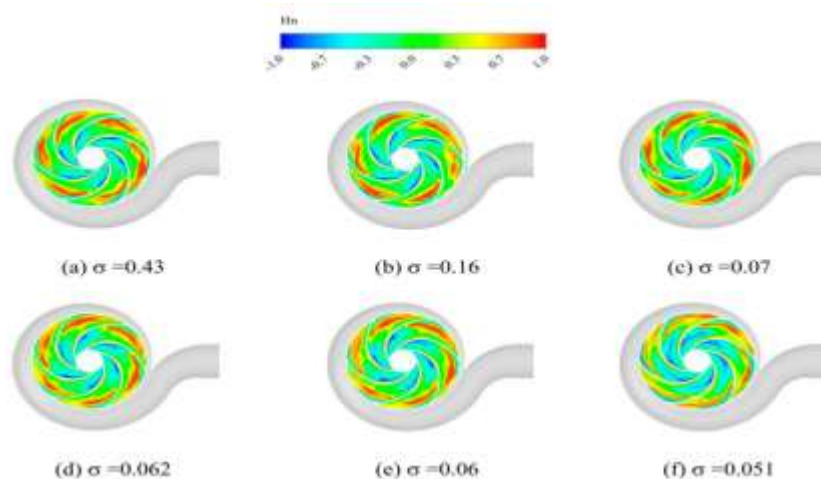
Rasmda ko'rsatilganidek, $s = 0,43$ bo'lganda, pervanel kirish bosimi yuqori va kavitatsiya sodir bo'lmaydi pichoqning oldingi chetida. Biroq, bosim sifatida pervanelning kirish qismi kamayadi ($s = 0,16$ bo'lganda), kichik kavitatsiya maydonining bir qismi pichoqning oldingi chetining assimilyatsiya yuzasida paydo bo'ladi. Bu shuni ko'rsatadiki model nasosining suv kirish joyining mahalliy bosimi bu bosqich to'yingan bug' bosimidan kamroq suv bu haroratda, natijada kavitatsiyani boshlovchi hodisaning yanada kamayishi bilan kirish bosimi ($s = 0,07$ bo'lganda), kavitatsiya paydo bo'ladi pichoqni assimilyatsiya qilish yuzasi bo'ylab pervanel tirgovichiga chiqish. Ushbu bosqichda kavitatsiya deyarli yarmini qoplaydi pichoqni assimilyatsiya qilish maydoni. $s = 0,062$ bo'lganda, kavitatsiya pichoq bosimi yuzasida barqaror ravishda yuzaga kela boshlaydi. Buning sababi shundaki, bunda kavitatsiya yanada kuchliroqdir, bu yerda kavitatsiya pufakchalari bloklana boshlaydi pervanel oqim kanali. Bundan tashqari, $s = 0,06$ bo'lganda va $s = 0,051$, past bosim mintaqasi juda aniq, kavitatsiya hodisasining jiddiyroq ekanligini ko'rsatadi. Bundan tashqari, pervanel oqimidagi past bosimli maydon kanal deyarli butunlay kavitatsiya pufakchalari tomonidan bloklanadi, bu modelning gidravlik ish faoliyatini kamaytiradi. Kavitatsiyaning vorteks tuzilishiga ta'siri nasos ichidagi kavitatsiya odatda hamroh bo'ladi girdoblarning paydo bo'lishi bilan. Bu girdoblar quyidagilardan iborat fazoviy taqsimotni tavsiflovchi vorteks maydoni vortekslar va konsentrlangan girdobga. Mintaqa ko'k rang bilan ko'rsatilgan past bosimli hudud bo'lib, bu kavitatsiyani ko'rsatadi bu hududda ishlab chiqariladi. Bundan farqli o'laroq, qizil rangga bo'yalgan mintaqa yuqori bosimli mintaqadir, bu shuni

ko'rsatadi bu mintaqada kavitatsiya qulab tushadi. Bundan tashqari, bu hajm ulushi o'rtacha qiymat uchun hisoblanadi. Kavitatsiyaning beqarorligi va yoki aylanish jarayonida turg'unlik ta'sirida o'zgarishi mumkin bo'lgan barcha pichoqlar ustida mil chastotasi bilan bog'liq. Rasmda ko'rsatilganidek, $\sigma = 0,43$ bo'lganda, pervanel kirish bosimi yuqori va kavitatsiya sodir bo'lmaydi pichoqning oldingi chetida. Biroq, bosim sifatida pervanelning kirish qismi kamayadi ($s = 0,16$ bo'lganda), kichik kavitatsiya maydonining bir qismi pichoqning oldingi chetining so'rish yuzasida paydo bo'ladi. Bu shuni ko'rsatadiki model nasosining suv kirishining mahalliy bosimi bu bosqich to'yingan bug' bosimidan kamroq suv bu haroratda, natijada kavitatsiya boshlangan hodisaning yanada kamayishi bilan kirish bosimi ($\sigma = 0,07$ bo'lganda), kavitatsiya paydo bo'ladi. Pichoqni assimilyatsiya qilish yuzasi bo'ylab pervanel tirgovichiga chiqish. Ushbu bosqichda kavitatsiya deyarli yarmini qoplaydi pichoqni assimilyatsiya qilish maydoni. $\sigma = 0,062$ bo'lganda, kavitatsiya pichoq bosimi yuzasida barqaror ravishda yuzaga kela boshlaydi. Buning sababi shundaki, bunda kavitatsiya yanada og'irroq vaqt, bu yerda kavitatsiya pufakchalari bloklana boshlaydi pervanel oqim kanali. Bundan tashqari, $\sigma = 0,06$ bo'lganda va $\sigma = 0,051$, past bosim mintaqasi juda aniq, bu kavitatsiya hodisasining jiddiyroq ekanligini ko'rsatadi. Bundan tashqari, pervanel oqimidagi past bosimli maydon kanal deyarli butunlay kavitatsiya pufakchalari tomonidan bloklanadi, bu modelning gidravlik ish faoliyatini pasaytiradi.[9]



5-rasm Turli kavitatsiya raqamlari va bosimlari bo'lgan model nasosidagi ichki kavitatsiyaning evolyutsiyasi.

aylanishi bilan, bu juft girdob doimiy ravishda hosil bo'ladi va qulab tushdi. Kavitatsiyaning paydo bo'lishi va rivojlanishi bilan, qarama-qarshi aylanish yo'nalishi bo'lgan bu juft girdoblar asta-sekin birlashtiriladi. Pervanel tirgovichining kirish qismida pichoq bosimi yuzasi yaqinida, vorteks



6-rasm Model nasosining pervanelning o'rta qismida muntazam spiral (Hn) taqsimoti.

6-rasmda tartibga solinadigan bulutli sxema ko'rsatilgan o'rta qismida spiral (Hn) taqsimoti nominal tezlikda pervanel va turli kavitatsiya raqamlari. Rasmdan ko'rinib turibdiki, soat miliga teskari yo'nalishda aylanish yo'nalishi bo'lgan vorteks bor. Pichoqni so'rish yuzasi yaqinidagi pervanelning chiqish joyi. Pichoq yaqinidagi pervanelning kirish joyida soat yo'nalishi bo'yicha aylanish harakati bilan aylana bor. Bu bir juft vorteks ekanligini ko'rsatadi qarama-qarshi aylanish yo'nalishlari bilan pichoqning assimilyatsiya yuzasida mavjud. Pervanelning davriy mavjud aylanish yo'nalishi soat sohasi farqli o'laroq. Bundan tashqari, kavitatsiyaning uzluksiz rivojlanishi, vortex va pichoqni assimilyatsiya qilish yaqinidagi soat miliga teskari vortex pervanel oqim kanalining chiqish sohasidagi sirt asta-sekin soat miliga teskari vorteksiga birlashadi. Bir xil aylanish yo'nalishi. Ushbu bosqichda, vorteksda pervanel tirgovichining

kirish qismi va aylanish yoʻnalishi ham asta-sekin yoʻqoladi. Yuqoridagi tahlildan shuni aytish mumkinki koʻrinib turibdiki, kavitatsiyaning evolyutsiya jarayoni pervanel yuguruvchisi vorteks yadrosining holatiga muhim taʼsir koʻrsatadi [10].

6-rasmda nominal tezlikda pervanelning oʻrta qismida Q-qiymati taqsimotining bulutli xaritasi koʻrsatilgan va turli xil kavitatsiya raqamlaridan koʻrish mumkin. Q-qiymati diapazoni oʻrtada joylashganligini koʻrsating pervanelning assimilyatsiya yuzasining hududi muntazam ravishda oshadi ichida kavitatsiyaning paydo boʻlishi va rivojlanishi bilan pervanel oqimi kanalining chiqish joyida joylashgan Q-qiymati asta-sekin kamayadi va pervaneldagi kavitatsiya taʼsiri bilan yoʻqoladi, bu Q-qiymatining oʻzgarishiga taʼsir qilishini koʻrsatadi vorteks yadrosining pervanel kanalida taqsimlanishi kavitatsiyaning turli bosqichlari, vorteksning paydo boʻlishi nasosda, asosan, pervanelning aylanish harakati bilan bogʻliq va sezilarli energiya yoʻqotilishi mavjud. Pichoq yuzasi kavitatsiyasini taqsimlash bulut xaritasining 4.1.3-boʻlimi bilan birgalikda shuni aniqlash mumkinki, Q-qiymati taqsimoti va pichoq yuzasi kavitatsiyasi hajmi fraktsiyasi taqsimoti yanada mos keladi. Maʼlum yozishmalar, kirish sohasidagi Q-qiymati pervanel oqim kanali muhim boʻlib, buni koʻrsatadi bunda suyuqlik mikro-klasterlarining aylanishi va kuchlanishi maydon muvozanatda emas, bu oqimning beqarorligiga olib keladi. Bu ham vorteks ekanligini koʻrsatadi kavitatsiya shakllanishiga yordam beruvchi taʼsir koʻrsatadi. Bundan tashqari, kavitatsiya boʻlmagan sohada Q-qiymati oraligʻi kichik yoki manfiy boʻlib, assimilyatsiya yuzasida kavitatsiya sohasida kuchli vorteks harakati mavjud va pichoqning bosim yuzasi, bu kavitatsiya hosil boʻlishiga yordam beruvchi.[11]

Nasos deb, tashqaridan olingan mexanik yoki boshqa turdagi energiyani suyuqlik oqimining energiyasiga aylantirib beruvchi gidravlik mashinaga aytiladi. Nasos, dvigatel, mexanik energiya uzatmasi, soʻrish va bosimli quvurlaridan iborat suyuqlik uzatishga moʻljallangan tuzilmaga nasos qurilmasi deyiladi.[12]

Suvni manbadan olish va isteʼmolchiga mashinalar yordamida uzatib berishni taʼminlovchi murakkab gidromexanik va energetik asbob-uskunalar va gidrotexnik inshootlar majmuasiga nasos stansiyasi deyiladi.

Nasos stansiya binosiga bir nechta murakkab gidromexanik va energetik mashinalar va uskunalar, yordamchi jihozlar, soʻrish va bosimli quvurlar kommunikatsiyalari, yuk koʻtarish qurilmasi, boshqarish va nazorat-oʻlchov asboblari, aloqa va avtomatika vositalari joylashtiriladi.

Adabiyotlar

- [1]. Qiaorui Sia, Asad Ali a, Minquan Liaob, Jianping Yuana, Yuanyuan Guc, Shouqi Yuan a and Gerard Bois // Assessment of cavitation noise in a centrifugal pump using acoustic finite element method and spherical cavity radiation theory // ENGINEERING APPLICATIONS OF COMPUTATIONAL FLUID MECHANICS 2023, VOL. 17, NO. 1, 2173302 <https://doi.org/10.1080/19942060.2023.2173302>
- [2]. Yu Zhu, Lin Zhou, Shuaishuai Lv *, Weidong Shi, Hongjun Ni *, Xiaoyuan Li, Chuazhen Tao and Zhengjie Hou// Research Progress on Identification and Suppression Methods for Monitoring the Cavitation State of Centrifugal Pumps//
- [3]. Захаров, А.В. Автоматизированный программный комплекс «Гидродинамический расчет насосов и турбин» / А.В. Захаров, Г.И. Топаж // Энергомашиностроение. Труды СПбГПУ. 2004. №491. С. 80-99.
- [4]. Пылаев, Н.И. Кавитация в гидротурбинах / Н.И. Пылаев, Ю.У. Эдель. – М., Машиностроение, 1974.
- [5]. Перник, А.Д. Проблемы кавитации. – Государственное союзное издательство судостроительной промышленности, 1963. 335 с.
- [6]. Theoretical Manual FINE™/Turbo v8.7, Flow Integrated Environment, September 2009. p.
- [7]. Delannoy, Y. Two phase flow approach in unsteady cavitation modeling / Y. Delannoy, J.L. Kueny // In ASME Cavitation and Multi-phase Flow Forum. 1990. Vol. 109. Pp. 153-159.
- [8]. Muskevich, G.E. Gidravlicheskie issledovaniya i raschet vodostrujnyh apparatov: dis. ...kand. tehn. nauk / G. E. Muskevich. – Rostov n/D, 1970. – 200 s.
- [9]. Kamenev, P.N. Gidrojelevatory i drugie strujnye apparaty / P.N.Kamenev – M., 1950. – S.58.
- [10]. Mustafin, H.Sh. Kavitatsiya v kol'cevom jezhektore / H. Sh. Mustafin, V. P. Lahtin // Izvestija vuzov. Ser. Jenergetika.–1977.-№7 – 65 s.

- [11]. Taras'janc, S.A. Nasosy dlja transportirovki zhidkostej s tverdymi i voloknistymi vkljuchenijami / S. A. Taras'janc. – Novocherkassk, 1993. – S. 123.
- [12]. Ustrojstvo dlja uvelichenija kavitacionnogo zapasa osevyh nasosov : p. m. 160826 Rossijskaja Federacija : MPK F 04 D 9/06 / Ju. V. Bandjukov, O. I. Rahnjanskaja, Ju. S. Urzhumova, N.A. Ivanova, S.A. Taras'janc; zajavitel' i patentoobladatel' Novocherkasskij inzhenerno-meliorativnyj institut imeni A.K. kortunova FGBOU VO «Donskoj gosudarstvennyj agrarnyj universitet». – №2015129923/06 ; zajav. 20.07.15 ; opubl. 10.04.16, Bjul. № 10.

QUYOSH RADIATSIYASINI ANIQLASH QURILMALARI HAMDA ULARNING ANIQLIK VA NISBIY XATOLIKLARI

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Abstract: Measuring technique is one of the important factors of scientific and technical progress in all spheres of public affairs. Without automatic control of the correct values of technological parameters, technological processes or aggregates cannot be properly managed, and automation cannot be done without measuring tools. is to find with In the process of measurement, the quantity being measured is usually compared with a physical quantity so that it is given a value equal to 1, and it is called a unit of physical quantity or a unit of measurement. The measurement result consists of the value found using the method of comparing the magnitude with the unit of measurement.

Key words: energy, sun, heat exchange, measurement, radiation, actinometer, transparent surface, housing, galvanometer, solar energy, random error, instrumental error.

Аннотация: Измерительная техника является одним из важных факторов научно-технического прогресса во всех сферах общественного дела. Без автоматического контроля правильных значений технологических параметров невозможно правильно управлять технологическими процессами или агрегатами, а автоматизация не может осуществляться без средств измерения. В процессе измерения измеряемую величину обычно сравнивают с физической величиной так, чтобы ей присвоили значение, равное 1, и ее называют единицей физической величины или единицей измерения. Результат измерения состоит из величины, найденной методом сравнения величины с единицей измерения.

Ключевые слова: энергия, солнце, теплообмен, Измерение, Излучение, актинометр, прозрачная поверхность, дело, гальванометр, солнечная энергия, Случайная ошибка, Инструментальная ошибка.

Annotatsiya: O'lchash texnikasi xalq hujaligining barcha sohalarida fan-texnika taraqqiyotining muhim omillaridan biridir. Texnologik parametrlarning to'g'ri qiymatlarini avtomatik nazorat qilmasdan turib, texnologik jarayonlarni yoki agregatlarni to'g'ri boshqarib bo'lmaydi, o'lchov vositalarisiz esa avtomatlashtirib bo'lmaydi. O'lchash-fizik kattaliklarning qiymatlarini maxsus texnik vositalar yordamida tajriba usuli bilan topishdir. O'lchash jarayonida odatda o'lchanayotgan kattalikni shunday fizik kattalik bilan taqqoslanadiki, unga 1 ga teng bo'lgan qiymat beriladi va u fizik kattalik birligi yoki o'lchov birligi deyiladi. O'lchash natijasi – kattalikni o'lchov birligi bilan taqqoslash usuli yordamida topilgan qiymatidan iborat.

Kalit so'zlar: energiya, quyosh, issiqlik almashinuvi, o'lchov, radiatsiya, aktinometr, shaffof yuza, korpus, galvanometer, quyosh energiyasi, tasodifiy hatolik, instrumental hatolik.

Quyoshning qisqa to'liqli radiatsiyasi va yer yuzasining infraqizil yoki uzun to'liqli nurlanishi va atmosferaning qarshi nurlanishini ajratish qabul qilingan. Quyosh radiatsiyasi va uzun to'liqli radiatsiyaning barcha turlari W/m^2 da o'lchanadi.

To'g'ri quyosh radiatsiyasini o'lchash uchun mutlaq angstrom kompensatsion pirgeliometri va nisbiy aktinometrlar asboblari qo'llaniladi. Meteorologik stansiyalarda Savinov-Yanishevskiy termoelektrik aktinometri ishlatiladi.

Bu aktinometrning ishlash tamoyili asbobning qabul qiluvchi qismiga kelayotgan quyosh energiyasini termoelektrik batareya Bu aktinometrning ishlash tamoyili asbobning qabul qiluvchi qismiga kelayotgan quyosh energiyasini termoelektrik batareya yordamida elektr energiyasiga o'zgartirishga asoslangan. Termoelektr yurituvchi tok kuchining termotok EYK kattaligi GSA-1 rusumidagi maxsus sezgir galvanometrlar yordamida o'lchanadi. Quyosh radiatsiyasi ta'sirida galvanometrning strelkasi N bo'laklar soniga buriladi. Shunday qilib to'g'ri radiatsiyaning kattaligi S quyidagiga teng:[1]

$$S = a(N - N_0) \quad (1)$$

bu yerda: N_0 - galvanometr strelkasining nol holati; a - radiatsiya qabul qilgich - galvanometr juftligining o'tkazish ko'paytuvchisi. O'tkazish ko'paytuvchisi aktinometr ko'rsatkichini absolut asbob - piranometr ko'rsatkichiga yoki namunaviy aktinometr ko'rsatkichiga taqqoslash orqali topiladi.

Savinov-Yanishevskiy termoelektrik aktinometri. Aktinometrning qabul qiluvchi qismi kumush folgadan yasalgan. Bu gardish markazida dumaloq teshik ishlangan. Gardishning Quyoshga qaragan tomoni qoraga bo'yalgan. Boshqa tomoniga yulduzcha shakliga ega termoelektrik batareyaning ichki faol kavsharlari yopishtirilgan. Tashqi passiv kavshar mis halqaga yopishtirilgan [2]. Bu halqa termoyulduzchaga qo'yilgan va asbob korpusining ichiga siqilgan. Kavsharni yopishtirishda termoyulduzcha disk va korpusdan papiros qog'ozi bilan izolatsiyalanadi.

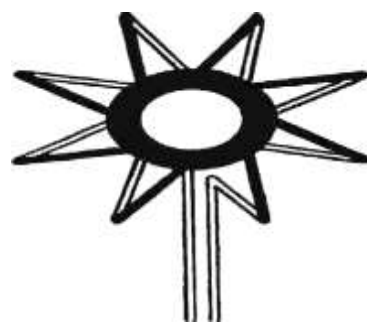
Gardish (aktinometrning qabul qiluvchi qismi) aktinometrning naychasi 2 ga o'rnatilgan kosa 1 ichiga o'rnatilgan. Naycha ichida qabul qiluvchi qismni shamol hamda tarqoq va qaytgan radiatsiya kirishidan saqlovchi beshta diafragma bor.

O'lchash vaqtida kumush gardish Quyosh radiatsiyasini yutadi. Buning natijasida gardish va ichki faol termobatareya kavsharining harorati ortadi. Tashqi passiv kavshar tashqi havo haroratiga yaqin bo'lgan asbob korpusi haroratiga ega. Ichki va tashqi kavsharlar haroratlari farqi ta'siri ostida termobatareya zanjirida galvanometr bilan o'lchanadigan termoelektrik tok yuzaga keladi. O'lchovlar orasida aktinometr naychasi qopqoq 3 bilan yopib qo'yiladi. Bu bilan gardish ifloslanishdan himoya qilinadi. Termoelektrik aktinometr katta bo'lmagan shtativ 4 ga o'rnatiladi.

Bu shtativ asbobni joyning kengligiga, balandligiga va Quyosh azimuti bo'yicha o'rnatish imkoniyatini beradi. Aktinometr joyning kengligi bo'yicha quyidagicha o'rnatiladi: vint 5 bo'shatiladi va sektor 6 ning bo'laklari indeksiga keltiriladi, shundan so'ng vint 5 burab qotirilib qo'yiladi. Atrofida naychani gorizontal burilishi sodir bo'ladigan o'q meridian tekisligida joylashgan bo'lib, kenglikka mos holda shimolga egilgan bo'lishi kerak. Naycha vint 7 va 8 yordamida quyoshga qaratib mo'ljallanadi. Aniq yo'naltirish uchun tashqi diafragmada kichkina dumaloq teshik 9 ishlangan. Bu teshik to'g'risida oq ekran 10 bor. Asbob to'g'ri o'rnatilganda quyosh nuri teshikdan o'tib, ekranning markazida yorug' dog' hosil qiladi.[3]

Xalq hujaligining barcha tarmoqlarida ishlab chiqarish jarayonlarini avtomatlashtirish, fan-texnika tarqqiyotining va mamlakat rivojining asosiy omili hisoblanadi. Avtomatlashtirish borasidagi eng ma'suliyatli ishlar esa, shubhasiz, Muhandis-texnik xodimlar zimmasiga tushadi. Bugungi kun Muhandislari yangi texnologiya va texnikadan foydalanishga, texnologik jarayonlarni avtomatlashtirishni keng joriy etishga ishlab chiqarish rezervlarini aniqlash va uni jadallashtirishga qodir bo'lishlari kerak. O'lchash texnikasini ishlab chiqarishga keng joriy etish uchun har bir Muhandis-texnik xodim, qaysi soha mutaxassisi bo'lishidan qat'iy nazar, o'lchash nazariyasidan, metrologiya asoslaridan, texnologik o'lchash usullari va vositalaridan, hisoblash texnikasidan, o'lchash jarayonlarini avtomatlashtirishda foydalanish imkoniyatlaridan xabardor bo'lishi zarur. Shu maqsadda talabalarga, bo'lg'usi muhandis-texnik xodimlarga "Issiqlik texnika o'lchovlari" fani o'qitiladi.[5]

O'lchash natijasini tenglama ko'rinishida quyidagicha yozish mumkin.



1-rasm. Termoelektrik aktinometr qabul qiluvchi qismining sxemasi (termoyulduzcha).

$$U = \frac{Q}{q} \text{ yoki } Q = Uq \quad (2)$$

bunda Q – o‘lchanayotgan fizik kattalik, U – o‘lchash natijasi, q – fizik kattalik birligi.

(2) tenglama o‘lchashning asosiy tenglamasi yoki o‘lchash natijasi deb yuritiladi. O‘lchanayotgan kattalikning son qiymati bevosita va bilvosita, to‘plamli va birlikda o‘lchash usullari yordamida topiladi. Bevosita o‘lchash deb shunday o‘lchashga aytiladiki, unda o‘lchanayotgan kattalikning izlanayotgan qiymati tajriba ma’lumotlaridan bevosita aniqlanadi. Masalan, haroratni termometr bilan, bosimni manometr bilan, uzunlikni chizg‘ich bilan o‘lchash va hokazo bevosita o‘lchashdan iborat.[6]

Bevosita o‘lchash tenglamasi quyidagi ko‘rinishga ega:

$$Q_n = C_n \quad (2)$$

Q_n – o‘lchanayotgan kattalikning uning uchun qabul qilingan o‘lchov birliklaridagi qiymati; C – raqamli hisoblash qo‘rilmasi shkalasi bo‘linmalarining yoki bir marta ko‘rsatishining o‘lchanayotgan kattalik birliklaridagi qiymati; n – shkala bo‘linmalari hisobida indiqatorli qo‘rilma bo‘yicha olingan sanoq. Bilvosita o‘lchash deb shunday o‘lchashga aytiladiki, unda o‘lchash natijasini o‘lchanayotgan kattalik bilan ma’lum munosabat yordamida bog‘langan kattaliklarni bevosita o‘lchashga asoslangan bo‘ladi. Bilvosita o‘lchash tenglamasi quyidagi ko‘rinishga ega:

$$Q_k = f(Q_1, Q_2, \dots, Q_n) \quad (3)$$

bunda Q_k – o‘lchanayotgan kattalikning izlangan qiymati; $Q_1, Q_2, \dots, Q_n$ – bevosita o‘lchanadigan kattaliklarning son qiymatlari.

Bir nomli kattaliklarning bir vaqtda o‘lchanishiga to‘plamli o‘lchash deb ataladi. Bunda izlanayotgan qiymat kattaliklar birikmasini bevosita o‘lchash paytida hosil bo‘lgan tenglamalar tizimini Yechish orqali topiladi. Bu turdagi o‘lchash usuli tajriba ishlarida va ilmiy tekshirish ishlarida qo‘llaniladi. Birgalikda o‘lchash - bu har xil nomli kattaliklarning o‘zaro nisbatini topish maqsadida bir vaqtda bajariladigan o‘lchashdir. O‘lchanayotgan kattalik Q ning izlanayotgan qiymatining birgalikda o‘lchash usulidagi umumiy ko‘rinishi quyidagi tenglama orqali ifodalanadi:[7]

$$Q = F(x_1, x_2, \dots, x_n) \quad (4)$$

bu yerda F -funksional bog‘lanish; $x_1, x_2, \dots, x_n$ - bevosita o‘lchash yo‘li bilan topilgan kattaliklarning qiymatlari. Birgalikda o‘lchash usuli so‘nggi paytlarda keng tarqalmoqda. Masalan, murakkab, ko‘p tarkibiy qismli aralashmalarni tahlil qilishda shu usul qo‘llaniladi. Hisoblash texnikasi vositalarining rivojlanishi bilan bu o‘lchash turining qo‘llanilishi yana ham kengaydi. O‘lchashlar yana absolyut va nisbiy o‘lchashlarga bo‘linadi: Bitta yoki bir necha asosiy kattaliklarni fizik konstantalaridan foydalanib yoki foydalanmasdan bevosita o‘lchash absolyut o‘lchash deb ataladi.

Biror kattalikning shu ismli birlik nomini o‘ynayotgan kattalikning nisbatini o‘lchash yoki kattalikni shu ismli birlik kattalik deb qabul qilingan kattalik bo‘yicha o‘lchash nisbiy o‘lchash deb ataladi.

Kattalikning o‘lchash usuli bilan topilgan qiymati o‘lchash natijasi deyiladi. O‘lchash natijasi bilan o‘lchanayotgan kattalikning haqiqiy qiymati orasidagi farq o‘lchash hatoligi deyiladi. O‘lchanayotgan kattalik birliklarida ifodalangan o‘lchash hatoligi o‘lchashning absolyut hatoligi deyiladi.[8]

$$\Delta X = X - X_x \quad (5)$$

bunda X – absolyut hatolik; X – o‘lchash natijasi; X_x – o‘lchanayotgan kattalikning haqiqiy qiymati. O‘lchash absolyut hatoligining o‘lchanayotgan kattalikning haqiqiy qiymatiga nisbati o‘lchashning nisbiy hatoligi deyiladi. O‘lchash hatoliklari ularning kelib chiqishi sabablariga ko‘ra muntazam, tasodifiy va qo‘pol hatoliklarga bo‘linadi. Muntazam hatolik deyilganda faqat bitta kattalikni qayta–qayta o‘lchanganda o‘zgarmas bo‘lib qoladigan yoki biror qonun bo‘yicha

o'zgaradigan o'lchash hatoligi tushuniladi. Instrumental hatolik deyilganda qo'llanayotgan o'lchov asboblari hatoliklariga bog'liq bo'lgan o'lchash hatoliklari tushuniladi. Tasodifiy hatolik deganda faqat bitta kattalikni qayta-qayta o'lchash mobaynida tasodifiy o'zgaruvchi o'lchash hatoligi tushuniladi. Qo'pol hatolik deganda berilgan shartlar bajarilganda kutilgan natijadan tubdan farq qiladigan o'lchash hatoligi tushuniladi. Kattalikning sanoqqa ko'ra topilgan qiymati o'lchov asbobining ko'rsatishi deyiladi. Asbobning ko'rsatishi va o'lchanayotgan kattalikning haqiqiy qiymati orasidagi farq o'lchov asbobining hatosi deyiladi. O'lchov asbobining absolyut hatoligi deb shu asbobning ko'rsatishi bilan o'lchanayotgan kattalikning haqiqiy qiymati orasidagi farqqa aytiladi. Agar X_n bilan sanoq ko'rsatishidagi qiymatni ifodalab, X_{nx} bilan haqiqiy qiymatni belgilasak, quyidagi formuladan ΔX absolyut hatolikni topamiz.[9]

$$\Delta X = X_n - X_{nx} \quad (6)$$

Absolyut hatolikning kattalik haqiqiy qiymatiga nisbati nisbiy hatolik deb ataladi.

$$b = \pm \frac{\Delta X}{X_{nx}} \cdot 100\% = \pm \frac{X_n - X_{nx}}{X_{nx}} \cdot 100\% \quad (7)$$

Odatda, X_{nx} –haqiqiy qiymat va X_n –topilgan qiymatlarga nisbatan ΔX juda kichik bo'ladi, shuning uchun quyidagi formulani yozish mumkin:

$$b = \pm \frac{\Delta X}{X_{nx}} \cdot 100\% \approx \pm \frac{\Delta X}{X_n} \cdot 100\% \quad (8)$$

Kattalikning asl qiymatini aniqlash uchun o'lchov asbobining ko'rsatishiga to'zatish kiritiladi. Uning son qiymati teskari ishora bilan olingan absolyut qiymatiga teng:

$$d = X_{nx} - X_n \text{ yoki } D = -\Delta X \quad (10)$$

Asbobning hatoligi shkala diapazonining foizlarida ifodalanadi. Bunday hatoliklar keltirilgan hatolik deyiladi va absolyut hatolikning diapozoniga bo'lgan nisbatiga teng bo'ladi, ya'ni

$$j = \frac{\Delta X}{N} \cdot 100\% \quad (11)$$

N – asbobning o'lchash chegarasi. [10]

Hatolik qiymati o'lchash asbobi aniqligini, demak, o'lchash natijasini ham tavsiflaydi. O'lchov aniq bo'lishi uchun, hatosi kichiq bo'lgan asboblardan foydalanish kerak. Ammo hatosiz asboblar tayyorlash mumkin emas. Hatosi kichik bo'lgan asboblar murakkab bo'lib, ularning bahosi qimmat. Bu asboblar bilan ishlash paytida katta ehtiyotkorlik talab qilinadi. Texnikaviy o'lchashlar uchun muayyan belgilangan qiymatdan oshmaydigan, yo'l qo'yiladigan hatosi bor asboblardan foydalaniladi. Asbob ko'rsatishining standartlar yo'l qo'yadigan eng katta hatosiga yo'l qo'yiladigan hato deb ataladi. Hato miqdori o'lchashlar olib borilayotgan tashqi muhitga atrof muhit harorati, atmosfera bosimi, tebranish va boshqalarga bog'liq bo'lgani sababli asosiy va qo'shimcha hatolar tushunchalari kiritiladi. O'lchov asbobi uchun texnikaviy sharoitida yo'l quyilgan hatolik asosiy hatolik deyiladi. Tashqi sharoit o'zgarishining asboblarga bo'lgan ta'siridan kelib chiqqan hato, qo'shimcha hatodir. O'lchov asboblarining sifati ularning hatolaridan tashqari asboblar variatsiyasi, sezgirligi va sezgirlik chegarasi bilan tavsiflanadi.[11]

Bir kattalikni ko'p marta takroriy o'lchashlar natijasida asbob bir nuqtadagi ko'rsatishlari orasidagi eng katta farq o'lchov asboblarining variatsiyasi deb ataladi. Variatsiya o'lchanayotgan kattalikni ma'lum bir miqdorgacha asta-sekin oshirib va kamaytirib aniqlanadi. Variatsiya asbobning mexanizmi, oraliqlari, gisterezis va boshqa qismlardagi ishqalanishi sababli kelib chiqadi. Variatsiya (ε) asbob shkalasi maksimal qiymatining foizi hisobida ifodalanib, asosiy yo'l quyilgan hato qiymatidan oshib ketmasligi lozim:

$$\varepsilon = \frac{\Delta N}{(N_{\max} - N_{\min})} 100\% \quad (12)$$

bu yerda ΔN –asbob ko'rsatishidagi eng katta farq; $N_{\max}$ va $N_{\min}$ –asbob shkalasining yuqori va pastki qiymatlari. Asbob ko'rsatishining aniqligiga uning sezgirligi ham katta ta'sir qiladi.

Asbob strelkasi chiziqli yoki burchak siljishining shu siljishni hosil qilgan kattalikning o'zgarishiga bo'lgan nisbati asbobning sezgirligi deb ataladi:[12]

$$s = \frac{\Delta n}{\Delta Q} \quad (13)$$

bu yerda s – asbobning sezgirligi; Δn – strelka siljishining o'zgarishi; ΔQ – o'lchanayotgan kattalikning o'zgarishi. Sezgirligi yuqori bo'lgan asboblarda asosan aniq o'lchashlar uchun ishlatiladi. O'lchanayotgan kattalik qiymatining asbob ko'rsatishiga ta'sir qila oladigan eng kichik o'zgarishi sezgirlik chegarasi deyiladi. Shkala va strelkaga ega bo'lgan asboblarda uchun asbobning sezgirligiga teskari bo'lgan kattalik shkalaning bo'linmas qiymati deyiladi:

$$C = \frac{\Delta Q}{\Delta n} \quad (14)$$

bu yerda C -shkala bo'linmasining qiymati.

Ikkita yonma-yon belgi orasidagi farq shkala bo'linmasi deb ataladi. Shkala bo'linmasining qiymati strelkani bir bo'linmaga siljitgan kattalik qiymatining o'zgarishini tavsiflaydi. Ba'zan kattalikning haqiqiy qiymatini topish uchun asbob ko'rsatishi to'zatis koeffitsienti K ga ko'paytiriladi:

$$X_{nx} = K \cdot X_n \quad (15)$$

O'lchash asbobi ko'rsatishining kechikishi uning inertsiyasini, ya'ni kattalik o'zgarishi vaqtidan asbob ko'rsatishining siljishigacha o'tgan vaqtni tavsiflaydi. Asbob ko'rsatishining kechikishi qancha kam bo'lsa, asbobning sifati shuncha yuqori bo'ladi. O'lchash vositalarining umumlashgan tavsifi asosiy va qo'shimcha hatoliklarning chegaraviy qiymatlari bilan ifodalanadigan aniqlik sinfidan iborat. O'lchash vositalarining aniqlik sinfi ularning aniqlik xossalari tavsiflaydi, ammo ular shu vositalar yordamida olib borilgan o'lchashlarning bevosita ko'rsatkichi bo'la olmaydi. Yo'l qo'yiladigan asosiy hatoliklar chegaralari keltirilgan hatoliklar ko'rinishida quyidagi sonlardan aniqlik sinfi beriladi: (1,0; 1,5; 2,0; 2,5; 3,0; 4,0; 5,0; 6,0)10ⁿ, bunda $n=1,0;- 1,0;- 2,0$ va x k. O'lchash asbobining aniqlik sinfi foizlarda hisoblangan eng katta keltirilgan hatolikka teng:

$$K_n = j_{\max} = \frac{\Delta X_{\max}}{N} \cdot 100\% = \frac{\Delta X_{\max}}{N_{\max} - N_{\min}} \cdot 100\% \quad (16)$$

O'lchash vositalarining hatoliklari statistik va dinamik hatoliklarga bo'linadi. O'lchash vositalarining statistik hatoligi Δ ni muntazam Δ_m va tasodifiy Δ_t hatoliklardek tashkil etuvchilar yig'indisi ko'rinishida tasvirlash mumkin:

$$\Delta = \Delta_m + \Delta_t \quad (17)$$

bunda Δ_m -o'zgarimas yoki sekin o'zgaradigan kattalik; Δ_t -o'rta qiymati nolga teng bo'lgan tasodifiy kattalik. Yuqoridagi munosabat o'lchov vositasi hatoligi modelini tavsiflaydi. Shuning uchun o'lchov vositasi aniq xossalarni tula va ob'ektiv tavsiflashda tasodifiy kattaliklar nazariyasi apparati-extimollar nazariyasidan foydalanish zarur.

Xulosa

1.Bevosita baholash uslubi–o'lchanayotgan kattalik qiymatini bevosita o'lchash asbobining daraja ko'rsatgichi bo'yicha aniqlanadi. Bu uslub o'lchanayotgan kattalik qiymatini asbobning ko'rsatayotgan yoki yozib olgan chiqish qiymatiga to'g'ri almashtirish bilan tavsiflanadi.

2.O'lchov bilan solishtirish yoki solishtirish uslubi – o'lchanayotgan kattalik qiymatini namunali o'lchov bilan solishtirishdan iborat.

3.Differentsial uslubda o'lchash natijasida asbob ko'rsatkichiga ta'sir qiluvchi o'lchanayotgan kattalik qiymati bilan ma'lum o'chov orasidagi farq aniqlanadi.

4.Nolaviy (kompensatsion) uslub – solishtirish asbobiga kattaliklar ta'sirining effekti nolga Etkazilish o'lchovi bilan solishtirishdan iborat.

Adabiyotlar

- [1]. Mohit B. Modeling, analysis, evaluation, selection and experimental investigation of parabolic trough solar collector system. — M. Sc. Thesis, Thapar University, 2012. — 107 p.
- [2]. Uzbekov M. O. Thermal balance of the solar air heater with a heat sink of metal shavings // International Journal of Advanced Research in Science, Engineering and Technology. Vol. 6, Issue 5, May 2019 – S. 9246-9254 (05.00.00 № 8. (23) Scientific Journal Impact Factor, IF:6,126) [2]. B.A.Abdukarimov., Yo.S.Abbosov., Sh.R.O'tbosarov Hydrodynamic Analysis of Air Solar Collectors // International Journal of Advanced Research in Science, Engineering and Technology Vol. 7, Issue 5, May 2020 y. — PP. 13545-13549.
- [3]. Abdukarimov B.A., Abbosov Yo.S., Mullayev I.I. Optimization of operating parameters of flat solar air heaters
- [4]. // Bulletin of science and education 2019.No 19 (73). Part 2. p.6-9.
- [5]. Abdukarimov B.A., O'tbosarov Sh.R. Relevance of use of solar energy and optimization of operating parameters of new solar heaters for effective use of solar energy // International Journal of Applied Research 2020; — PP. 16-20.
- [6]. Abbasov Y.S., Abdukarimov B.A. Mominov O.A., Xolikov A.A. Research of the hydraulic resistance coefficient of sunny air heaters with bent pipes during turbulent air flow // Journal of critical reviews Issn-2394-5125 vol 7, issue 15, 2020 y. — PP. 1671-1678.
- [7]. Abdukarimov B. A., Muminov O. A., Utbosarov Sh. R. Optimizatsiya rabochix parametrov ploskogo solnechnogo vozdušnogo obogrevatelya // Prioritetnye napravleniya innovatsionnoy deyatel'nosti v promyshlennosti. – 2020.
- [8]. – S. 8-11.
- [9]. Abdukarimov B.A., Abbosov Y. S. The issues of increasing the efficiency of conversion of primary energy resources in thermal energy in the workshops of the textile industry of the company" daewoo-textiles"(Fergana) //Scientific-technical journal. – 2019. – T. 22. – №. 1. – PP. 197-201.
- [10]. Abdukarimov B. A. i dr. Issledovanie povysheniya koeffitsienta poleznogo deystviya solnechnykh vozduxonagrevateley //Dostijeniya nauki i obrazovaniya. – 2019. №.
- [11]. 2. — S. 13-15.
- [12]. Abdukarimov B. A. i dr. Sposoby snijeniya aerodinamicheskogo soprotivleniya kaloriferov v sisteme vozdušnogo otopeniya tkaskix proizvodstv i voprosy rascheta ix teplovyykh karakteristik //Dostijeniya nauki i obrazovaniya. – 2019. – №. 2. – S. 43.
- [13]. Abdukarimov B.A., Mo'minov O.A., Shoyev MA. Calculation of the thermal performance of a flat solar air heater //Dostijeniya nauki i obrazovaniya. – 2019. – S. 9.
- [14]. Abdukarimov A.B., Abbosov Y.S. and Mullayev I.I. Optimization of operating parameters of flat solar air heaters // Vestnik nauki i obrazovaniya — 19-2 (73) (2019).
- [15]. Abdukarimov B. A., O'tbosarov S. R., Tursunaliyev M. M. Increasing Performance Efficiency by Investigating the Surface of the Solar Air Heater Collector. International Journal of Advanced Research in Science, Communication and Technology (IJARSCT) Volume 2, Issue 2, February 2021.— RR. 63-67.

SHARLARNI YUKLANISHI VA RUDA XUSUSIYATLARIGA QARAB SHAR
TEGIRMONLARINING ISHLASHINI BOSHQARISH

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Annotatsiya: Maqolada ma'dan uyumlarini mutanosib ravishda joylashtirish bilan rudalarni maydalashning ikkinchi bosqichida shar tegirmonlaridan foydalanish muhokama qilinadi. Mualliflar shar tegirmonlarining ish sharoitlarini nazorat qilishni optimal ishlash va yuqori yuk aylanmasining asosiy omillaridan biri sifatida ta'kidlaydilar. Sharlarga yukning tegirmon samaradorligiga ta'siri va rudaning uning o'lchamlari bo'yicha optimal taqsimlanishiga alohida e'tibor beriladi. Bundan tashqari, qattiqlik, zichlik va namlik kabi ruda xususiyatlarining ishlash va maydalash samaradorligiga ta'siri nuqtai nazaridan ahamiyati ko'rib chiqiladi. Mualliflar uning samaradorligini oshirish va energiya sarfini kamaytirish uchun maydalash jarayonini optimallashtirishning mumkin bo'lgan usullarini tahlil qiladilar.

Tayanch so'zlar: shar tegirmonlari, maydalash, ruda, minerallar, mutanosib joylashtirish, sharoitlarni boshqarish, sharli yuklama, optimal taqsimot, ruda xususiyatlari, unumdorlik, samaradorlik, energiya sarfi

Аннотация: В статье обсуждается применение шаровых мельниц во второй фазе дробления руды при добыче полезных ископаемых с пропорциональным размещением рудных куч. Авторы выделяют контроль условий работы шаровых мельниц как один из основных факторов оптимальной работы и высокого грузооборота. Особое внимание уделяется влиянию нагрузки на шары на эффективность мельницы и оптимальному распределению руды по её размерам. Кроме того, рассматривается важность свойств руды, таких как твердость, плотность и влажность, в контексте их влияния на производительность и эффективность дробления. Авторы анализируют возможные способы оптимизации процесса дробления с целью повышения его эффективности и снижения энергозатрат.

Ключевые слова: шаровые мельницы, дробление, руда, полезные ископаемые, пропорциональное размещение, контроль условий, нагрузка на шары, оптимальное распределение, свойства руды, производительность, эффективность, энергозатраты

Annotation: The article discusses the application of ball mills in the second phase of ore crushing during the extraction of minerals with proportional placement of ore heaps. The authors highlight the importance of controlling the operating conditions of ball mills for optimal performance and high throughput. Special attention is paid to the influence of ball load on mill efficiency and optimal ore distribution by size. Additionally, the significance of ore properties such as hardness, density, and moisture is examined in terms of their impact on crushing performance and efficiency. The authors analyze potential ways to optimize the crushing process to increase efficiency and reduce energy consumption.

Key words: ball mills, crushing, ore, minerals, proportional placement, control of conditions, ball load, optimal distribution, ore properties, performance, efficiency, energy consumption.

1. Kirish. Tegirmonning ish rejimi bo'yicha aylanish tezligi 4 ta turga bo'linadi. Sekin aylanish (kaskadli), tez aylanish (sharsharali), o'rtacha aylanish (aralash), juda tez aylanish (markaziy aylanish yoki kritik). Tegirmondan chiquvchi tayyor maxsulotni (maydalangan zarrachalar) donadorligini kamaytirish quyidagi asosiy omillarga bog'liq:

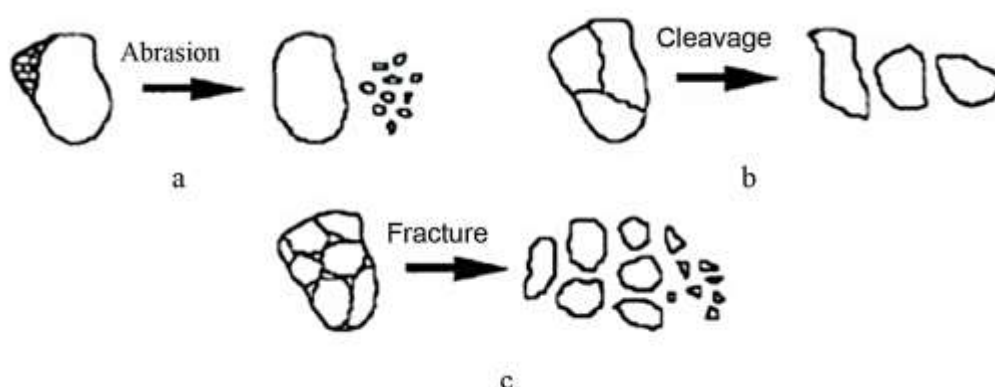
- tegirmondagi rudalarni xususiyatlari (zarralarning massasi, hajmi, qattiqligi, zichligi va granulometrik tarkibi);
- yanchish vositalarining xususiyatlari (massasi, zichligi, sharlarning o'lchamlari va taqsimoti);
- tegirmonning aylanish tezligi;
- nam yanchish vaqtida bo'tananing zichligi [5].

Ushbu jarayonining asosiy maqsadi yanchish unumdorlini oshirish va umuman butun jarayon uchun ishlab chiqarish xarajatlarini kamaytirishdir. Ushbu maqsadlarga erishish uchun turli

xil matematik modellar va boshqaruv usullari ishlab chiqiladi va amalda qo'llaniladi. Ushbu maqolada biz yanchish jarayonini modellashtirishning asosiy tamoyillari haqida qisqacha ma'lumot beramiz va jarayonni boshqarishning tegishli usulini amalga oshirishda ishlatiladigan bir nechta boshqaruv strategiyalarini tahlil qilamiz.

Barcha yanchish jarayonlarini modellashtirishning asosiy g'oyasi rudaning hajmi va tayyor mahsulot hajmi o'rtasidagi matematik munosabatlarni olishdir. Ruda donadorligi yanchish muhiti tomonidan energiya uzatilishi tufayli doimiy ravishda kamayib boradi, bu ularning bog'lanish kuchlarini kamaytiradi. Ruda o'lchamlarining qisqarishi quyidagi uchta asosiy parchalanish mexanizmining natijasidir.

1. Ishqalanish (Abrasion)
2. Bo'linish (Cleavage)
3. Sinish (Fracture)



1-Rasm. Shar tegirmoni ichidagi rudalarni qusoklanishi.

Amalda, uch xil mexanizm hech qachon alohida ishlamaydi va zarracha hajmini kamaytirish jarayonida ularning barchasi tegirmon turiga, ish sharoitlariga va maydalangan ruda turiga qarab mumkin bo'lgan ustunlik bilan ishlaydi [1].

2. Usul. Elektr energiyani solishtirma sarfi tegirmon elektr yuritmasi tomonidan iste'mol qilinadigan foydali quvvatning aylanma yukni hisobga olmagan holda yanchish siklining samaradorligiga nisbati. Ruda va siklning ma'lum hajmi bilan o'ziga xos quvvat sarfi ma'lum bir maxsulot tayyorlash uskunasi materialni maydalashni tavsiflovchi asosiy sanoat parametridir. Xuddi shu material uchun o'ziga xos energiya sarfi turli xil uskunalarining ish joylarida energiya uzatish samaradorligining sezilarli tebranishlari bilan bog'liq bo'lgan ruda tayyorlash moslamasining turiga bog'liq. Mahsulotning kerakli unumdorligi uchun o'ziga xos quvvat sarfi tegirmonning o'lchami va elektr yuritmasini foydali yanchish tizimini ta'minlaydi va u quydagicha ifodalanadi[2].

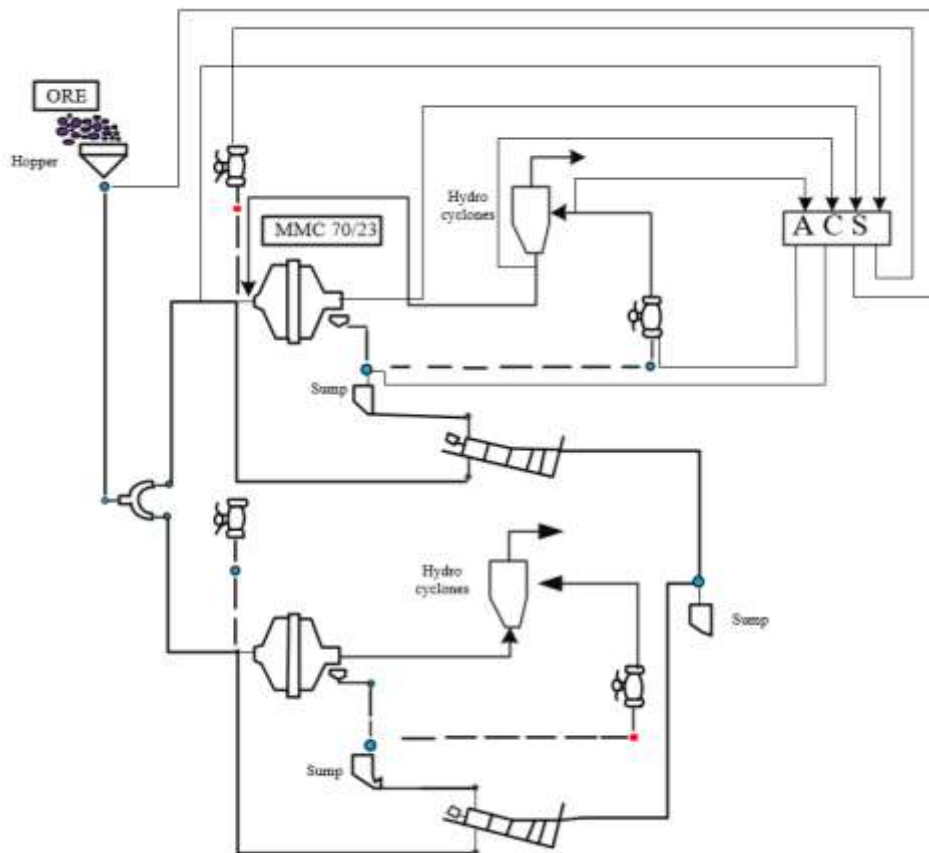
$$E = 10 \cdot W_i \cdot \left(\frac{1}{\sqrt{P_{80}}} - \frac{1}{\sqrt{F_{80}}} \right) \quad (1)$$

Bu yerda P_{80} va F_{80} – elak setkalarini o'lchami bo'lib, ular orqali tuproqning 80 % va boshlang'ich material mos ravishda mikron bilan ajratiladi; W_i – bu materialning ishchi indeksi, kVt/t; E – talab qilinadigan quvvat sarfi, kVt/t.

$$E_{tr} = 10 \left[CWI \left(\frac{1}{\sqrt{10000}} - \frac{1}{\sqrt{F_{80}}} \right) + \left[RWI \left(\frac{1}{\sqrt{2100}} - \frac{1}{\sqrt{10000}} \right) + BWI \left(\frac{1}{\sqrt{P_{80}}} - \frac{1}{\sqrt{2100}} \right) \right] \right] \quad (2)$$

E_{tr} tomonidan olingan qiymat rudani tayyorlash uchun uskunalaridan foydalanishning maksimal samaradorligini belgilaydi va sxemaga mos keladi, shu jumladan o'rta va kichik

bosqichlarda sharli yanchish rudani qayta ishlashning keng bosqichlarini qiyosiy tahlil qiladi va o'z-o'zini yanchish tegirmonida 5-15% energiya talab qiladi [3].



2-Rasm. Shar tegirmoni ishlash jarayonini ACS (Adaptable Control System) yordamida boshqarish tizimi.

2-rasmdan ko'rinib turibdiki kirish va chiqish signallar asosan tegirmon va gidrosiklonga bog'liq bo'layapti. Tegirmonga rudani kirishi va chiqishi (shu jumladan gidrosiklonga ham) da ro'y beradigan jarayonlarda yuzaga keladigan tizimning buzilishi oqibatida ba'zi bir nosozliklar paydo bo'ladi. Shularni bartaraf etish maqsadida quydagi boshqaruv tizimi orqali erishish mumkin. Bunda kirish signallari orqali quydagi ma'lumotlarni olishga erishishimiz mumkin:

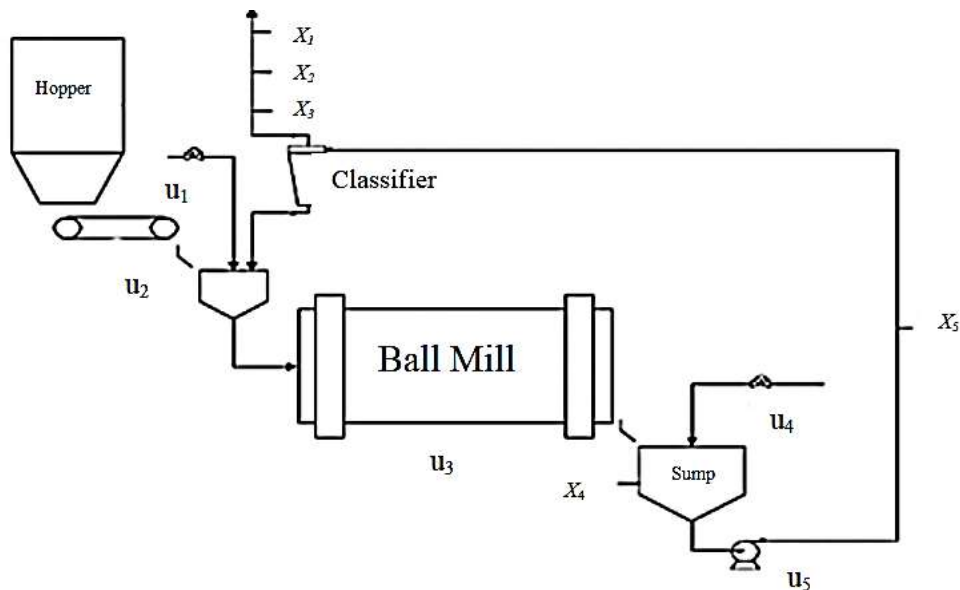
- Tegirmonni to'lib turish darajasi ultratovush datchigi tomonidan nazorati.
- M. M. Protodyakonov shkalasi bo'yicha ruda zarralari hajmi, qattiqligi va zichligi.

Bu 4 ta kirishda ruda miqdorini o'lchay oladigan va pulpa zichligini real vaqtda o'lchashni o'z ichiga oladigan tizim.

- Lentali konveyerdan keladigan yangi rudani tegirmonga kirish tezligi.
- Tegirmonga keladigan iste'mol suvini elektromagnit o'lchashdan.
- Gidrosiklonga kirgan pulpaning zichligini aniqlab turish.
- Klassifikatorga yetkazib beriladigan butananing tezligini elektromagnit oqim o'lchagich bilan aniqlash.

Texnologik jarayonni moslashuvchan boshqarish tizimi orqali, elektr motoriga tushadigan yuklamani hisobga olgan holda elektr energiya isrofini kamaytirishga erishiladi. Elektr motor tezligini yuklamaga qarab boshqarishimiz mumkin. Chastota va tiristorli o'zgartirgich qurilmalari yordamida elektr motor tezligini rostlaymiz.

Jarayonni boshqarish usullari. Yanchish sxemalarini boshqarish jarayonning chiziqli bo'lmagan va noaniq tabiati, matematik modeldagi noaniqliklar, sezilarli darajada farq qiladigan



3-rasmdagi jarayonning kirish o'zgaruvchilari quyidagilar: u_1 – tegirmon uchun kerak bo'ladigan suv sarfi, u_2 – ruda kelish tezligi, u_3 – tegirmonning kritik tezligining ulushi, u_4 – pulpa uchun suv sarfi va u_5 – tegirmonga kiruvchi pulpa sarfi. Ushbu o'zgaruvchan qiymatlar orqali chiqish parametrlarini boshqarish mumkin[3,5]:

x_1 – zarracha kattaligi belgilangan qiymatdan kam bo‘lgan mahsulotning massa ulushi, x_2 – mahsulotning qattiq zarralari konsentratsiyasi, x_3 – mahsulot sarfi, x_4 – mahsulotdagi suspenziya darajasi. x_5 – tegirmondagi qattiq zarrachalarning konsentratsiyasi. Texnologik jarayonning eng muhim buzilishlari rudaning qattiqligi va xom ashyo hajmining o‘zgarishi hisoblanadi. Jarayonning kirish-chiqish model vektorini matrisa usulida quydagicha yozish mumkin:

$$\begin{bmatrix} x_1(s) \\ \vdots \\ x_1(s) \end{bmatrix} = \begin{bmatrix} M_{11}(s) & \cdots & M_{15}(s) \\ \vdots & \ddots & \vdots \\ M_{15}(s) & \cdots & M_{55}(s) \end{bmatrix} \cdot \begin{bmatrix} u_1(s) \\ \vdots \\ u_1(s) \end{bmatrix} \quad (3)$$

Bu yerda $M_{ij}(s)$ i- kirish va j- chiqish signallaridan iborat bo'lgan uzatish funksiyasi bo'lib i, j = 1.....5. O'tkazish funksiyalari odatda kirishda boshlang'ich o'zgarishlarini qo'llash va chiqish xususiyatlarini o'lchash orqali eksperimental ravishda aniqlanadi. To'g'ri natijalarga erishish uchun odatda yetarlicha ko'p miqdordagi tajribalarni o'tkazish kerak. Bundan tashqari, yanchish davri va uskunasi konfiguratsiyasiga qarab, boshqaruv jarayonida turli xil kirish va chiqish signallaridan foydalanish mumkin[5,6].

Shar tegirmoni yanchish sxemasida texnologik jarayonni boshqarish quyidagi kamchiliklarga ega:

- ❖ jarayon chiziqli emas, juda ko‘p buzilishlar va modellashdirilmagan dinamikaga ega;
- ❖ jarayonning vaqt konstantalari keng diapazonda qiymatlarga ega va ba’zi kirish-chiqish juftliklarida sezilarli vaqt kechikishlari kuzatiladi;
- ❖ tizim modelida bir qator kirish signallariga mos ravishda chiqish signallari mavjud;
- ❖ jarayon parametrlari vaqt o‘tishi bilan o‘zgaradi;
- ❖ boshqariladigan o‘zgaruvchilarda texnologik cheklovlar mavjud

❖ o'lovlar ishonchsiz va shovqinli.

Nazoratning asosiy vazifasi chiqish o'zgaruvchilarining belgilangan qiymatlari bilan barqaror ishlashni ta'minlashdan iborat. Ushbu maqsadning bir qismi sifatida ruda hajmi belgilangan qiymatdan kichikroq bo'lgan tayyor maaxsulot hajmining barqaror taqsimlanishini ta'minlashdan iboratdir. Shu bilan bir qatorda, boshqaruv maqsadi ma'lum cheklovlarni hisobga olgan holda optimallashtirilishi kerak bo'lgan samaradorlik mezonini o'z ichiga olgan vazifa sifatida shakllantirilishi mumkin. Bu yanchish jarayonining ishlashini maksimal darajada oshirish yoki ishlab chiqarish xarajatlarini minimallashtirilishiga olib keladi [7,8].

3.Natijalar va mulohazalar.Shar tegirmonlari ishlash jarayonida shar bilan to'ldiriladi. Bu foizlarda $\square_{III}$, % ifodalanadi. Bu shar baraban tegirmonining mumkin bo'lgan maksimal unumdorligini belgilovchi o'lcham sinfiga muvofiq belgilanadi va quydagi ifoda yordamida aniqlanadi:

$$q_{0,071}^{\max} = f(\phi_u) \quad (4)$$

Tegirmonni shar bilan to'ldirishni hisobga oladigan boshqaruv tizimi tegirmonning elektr motori (P, kv) tomonidan iste'mol qilinadigan aktiv (foydali) quvvat va tegirmonlarning shar bilan to'ldirilishiga asoslanadi.

$$P = f(\phi_u) \quad (5)$$

Tegirmonga sharlarni yuklash jadvali 2023-yil fevral-aprel oylari uchun

1-jadval

Fevral		1	2	3	4	5	6	7	8	9	10	11	12
Sharlarni yuklash Ø 100	Tonna		4,8	2,4		4,8	2,4		4,8	2,4		4,8	2,4
	Idish		1	0,5		1	0,5		1	0,5		1	0,5
Sharlarni yuklash Ø 120	Tonna	4,8			2,4			2,4			2,4		
	Idish	1			0,5			0,5			0,5		
Fevral		13	14	15	16	17	18	19	20	21	22	23	24
Sharlarni yuklash Ø 100	Tonna		4,8	2,4		4,8	2,4		4,8	2,4		4,8	2,4
	Idish		1	0,5		1	0,5		1	0,5		1	0,5
Sharlarni yuklash Ø 120	Tonna	2,4			4,8			2,4			2,4		
	Idish	0,5			1			0,5			0,5		
Fevral		25	26	27	28							Jami	
Sharlarni yuklash Ø 100	Tonna		4,8	2,4								62,4 t	
	Idish		1	0,5								13	
Sharlarni yuklash Ø 120	Tonna	2,4			2,4							28,8 t	
	Idish	0,5			0,5							6	

2-jadval

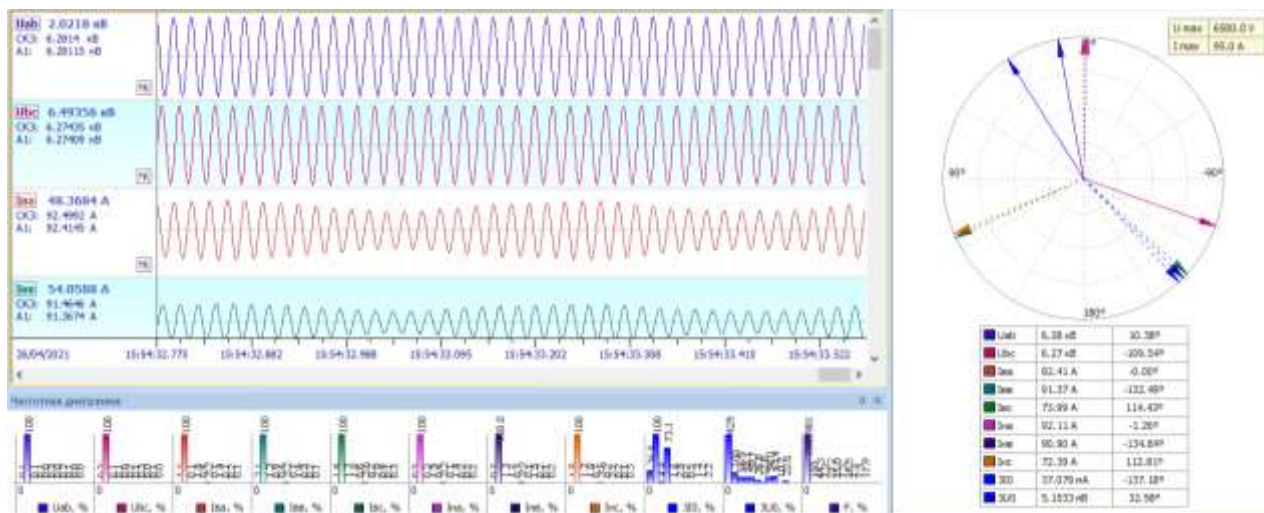
Mart		1	2	3	4	5	6	7	8	9	10	11	12
Sharlarni yuklash Ø 100	Tonna		4,8	2,4		4,8	2,4		4,8	2,4		4,8	2,4
	Idish		1	0,5		1	0,5		1	0,5		1	0,5
Sharlarni yuklash Ø 120	Tonna	4,8			2,4			2,4			2,4		
	Idish	1			0,5			0,5			0,5		
Mart		13	14	15	16	17	18	19	20	21	22	23	24
Sharlarni yuklash Ø 100	Tonna		4,8	2,4		4,8	2,4		4,8	2,4		4,8	2,4
	Idish		1	0,5		1	0,5		1	0,5		1	0,5

ЭНЕРГЕТИКА, ЭЛЕКТРОТЕХНИКА, ЭЛЕКТРОННЫЕ ПРИБОРЫ И ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ

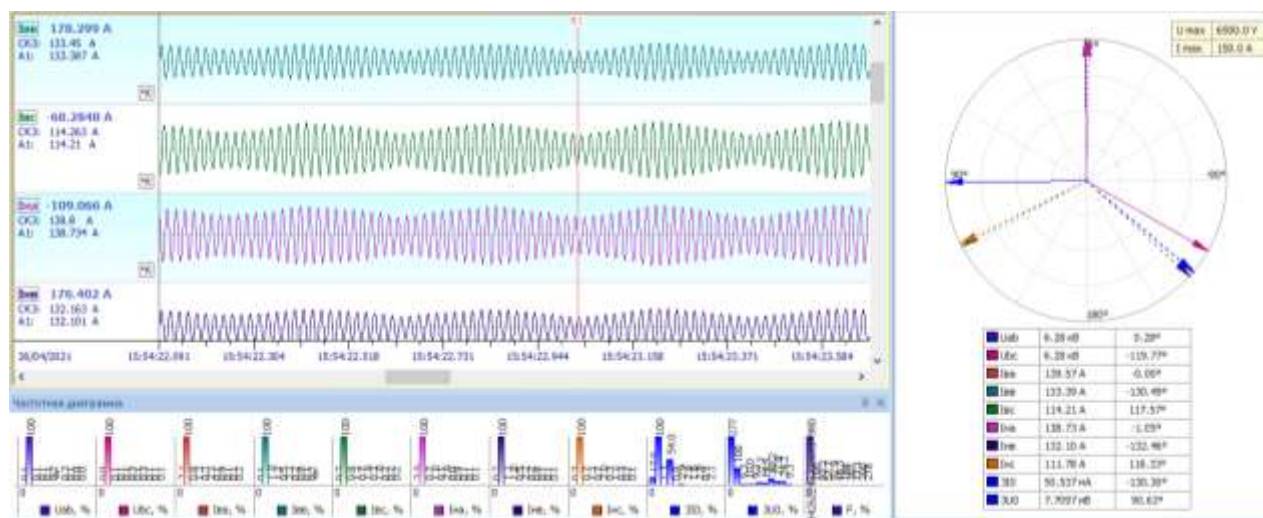
Sharlarni yuklash Ø 120	Tonna	2,4			4,8			2,4			2,4		
	Idish	0,5			1			0,5			0,5		
Mart		25	26	27	28	29	30	31					Jami
Sharlarni yuklash Ø 100	Tonna		4,8	2,4		4,8	2,4						72 t
	Idish		1	0,5		1	0,5						15
Sharlarni yuklash Ø 120	Tonna	2,4			2,4			4,8					33,6 t
	Idish	0,5			0,5			1					7

3-jadval

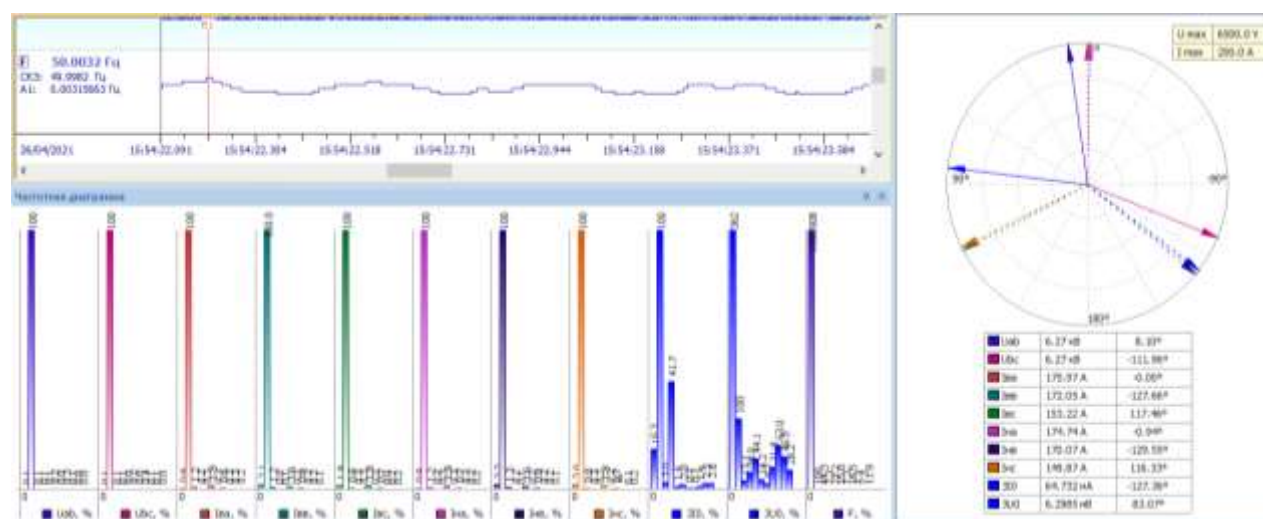
Aprel		1	2	3	4	5	6	7	8	9	10	11	12
Sharlarni yuklash Ø 100	Tonna		4,8			4,8			4,8			4,8	
	Idish		1			1			1			1	
Sharlarni yuklash Ø 120	Tonna				2,4			2,4		2,4			2,4
	Idish				0,5			0,5		0,5			0,5
Sharlarni yuklash Ø 68	Tonna	4,9					4,9				4,9		
	Idish	1					1				1		
Aprel		13	14	15	16	17	18	19	20	21	22	23	24
Sharlarni yuklash Ø 100	Tonna		4,8			4,8			4,8			4,8	
	Idish		1			1			1			1	
Sharlarni yuklash Ø 120	Tonna				2,4			2,4			2,4		
	Idish				0,5			0,5			0,5		
Sharlarni yuklash Ø 68	Tonna				4,9					4,9			
	Idish				1					1			
Aprel		25	26	27	28	29	30						Jami
Sharlarni yuklash Ø 100	Tonna		4,8			4,8							48 t
	Idish		1			1							10
Sharlarni yuklash Ø 120	Tonna	2,4			2,4								19,2 t
	Idish	0,5			0,5								4
Sharlarni yuklash Ø 68	Tonna			4,9									29,4 t
	Idish			1									6



4-Rasm. Shar tegirmonini ishga tushirish vaqtidagi kuchlanishlari



5-Rasm. Shar tegirmonini ishga tushirish vaqtidagi toklari



6-Rasm. Shar tegirmonini ishga tushirish vaqtidagi chastotasi.

Yanchish jarayonining mavjud matematik modellari massa yoki energiya balansi tenglamalari asosida ishlab chiqilgan bo'lib, ular maydalash vaqtiga yoki iste'mol qilinadigan o'ziga xos energiya nuqtai nazaridan maydalangan materialning zarracha hajmining pasayishini tavsiflaydi. Ikkala holatda ham modelning asosiy parametrlari, noma'lum bo'lgan tanlash va yanchish funksiyalari bo'lib, ularni aniqlash qo'shimcha eksperimental tadqiqotlarni talab qiladi. Jarayon boshqaruvida ko'rib chiqilgan tadqiqot natijalari va amaliy dasturlarda markazlashtirilmagan va ko'p o'zgaruvchan boshqaruv usullari ustunlik qiladi. Shunga qaramay, moslashuvchan, noaniq mantiqiy kabi ilg'or boshqaruv usullaridan foydalangan holda tizimlarni nazariy va simulyatsiya tadqiqotlari tobora ko'proq qiziqish uyg'otmoqda. Ushbu sohadagi keyingi tadqiqot faoliyatini muhim, hal qilinmagan muammolar shar tegirmonining energiya samaradorligi va jarayonni boshqarishni iqtisodiy baholash bilan bog'liq.

4.Xulosa. Sharli tegirmonlarning ishlashini nazorat qilishda ruda xususiyatlarini hisobga olish uchun turli usullardan foydalanish mumkin, masalan, monitoring moslashuvchan nazorat usullari. Moslashuvchan boshqaruv - bu tizimni tashqi va ichki omillarning o'zgarishiga, masalan, ruda xususiyatlarining o'zgarishiga, tegirmonning optimal ishlashi va sifatini ta'minlashga javob beradigan tizimlarni boshqarish usuli. U teskari aloqa tamoyiliga asoslanadi va boshqaruv tizimiga real vaqtda ruda xossalarning o'zgarishiga javob berish imkonini beradi. Misol uchun, agar tegirmonning ishlashi davomida rudaning xususiyatlari o'zgarsa, moslashuvchan boshqaruv tizimi

signallarni ishlab chiqarish va kerakli o'tkazuvchanlikka erishish uchun shar vazni va sinxron vosita qo'zg'alish tokiga ta'sir qilish orqali tegirmonning ish parametrlarini avtomatik ravishda o'zgartirishi mumkin.

Biz sharli tegirmonlar uchun moslashtirilgan boshqaruv tizimini taklif qilamiz, unda sharni yuklash (kerakli diametrlar bilan) va vosita qo'zg'atish toki, shovqin signallari va sinxron dvigatelning stator tokiga qarab tartibga solinadi. Shunday qilib, tizim ikkita kirish signali va ikkita chiqish bilan boshqariladigan parametrlardan iborat bo'ladi.

Adabiyotlar

- [1]. Vladimir M, Blagoy S, Stefan S. Grinding in Ball Mills: Modeling and Process Control // Cybernetics and information technologies Volume 12, No 2 Print ISSN: 1311-9702 Sofia 2012
- [2]. Bond, F. C. Crushing and Grinding Calculations. Part I. – British Chemical Engineering, Vol. 6, 1961, № 6, 378-385.
- [3]. Bond, F. C. Crushing and Grinding Calculations. Part II. – British Chemical Engineering, Vol. 6, 1961, № 8, 543-548.
- [4]. Mavlonov J. A., Mardonov D.Sh. “Rudani yanchuvchi tegirmonlarni elektr energiya samaradorligini oshirish usullari” // Konchilik xabarnomasi. Ilmiy texnik va ishlab chiqarish jurnali. – Navoiy, 2022. -№ 3. –st. 102-104 bet.
- [5]. Ишназаров О.Х. Мавлонов Ж.А. Мардонов Д.Ш. Кучкоров Ж.Н. Влияние на процесс измельчения в шаровых мельницах степени загрузки шарами // VII Международной научно-практической конференции «Энергетика и энергосбережение: теория и практика» г. Кемерово, 7-9 декабря 2022 года.
- [6]. Ishnazarov O.X., Mavlonov J. A., Mardonov D.Sh. “Sharli tegirmonlarni shar bilan yuklanishda elektr energiya samaradorligini oshirishning asosiy istiqbollari” // Konchilik xabarnomasi. Ilmiy texnik va ishlab chiqarish jurnali. – Navoiy, 2023. -№ 2. –st. 104-108 bet.
- [7]. Ishnazarov O.X. Mavlonov J.A. Basic Directions of Improvement and Improvement of Efficiency Ore Grinding // International Journal of Advanced Research in Science, Engineering and Technology Vol. 6, Issue 4, April 2019. India 269-271bet.
- [8]. Mavlonov J.A. Rudani maydalash jarayonining elektr energiya samaradorligini oshirish (Navoiy kon-metallurgiya kombinati misolida) // Dissertasiya. — Toshkent 2020 yil.
- [9]. Mavlonov Jonibek, Mardonov Davron, Eshmirzayev Mirzohid, and Togayev Islomjon Improvement of methods to ensure energy efficiency of ball mills functioning // III International Conference GeoTech-2023: Geotechnology, Mining and Rational Use of Natural Resources 16-17 June 2023 | Navoi, Uzbekistan.

УДК 612.311

ИЗУЧЕНИЕ УСТРОЙСТВА, КЛАССИФИКАЦИИ И ПРИНЦИПА ДЕЙСТВИЯ РЕАКТОРОВ

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(Получена 12.03.2024 г.)*

Аннотация: В данной статье освещен вопрос реакторов различных видов, где конкретно они нашли применение, а также в каких ситуациях они применяются. Рассмотрены основные виды реакторов и их конструкции. Кроме того, рассмотрены методы эффективного применения реакторов.

Ключевые слова: Реактор, короткое замыкание, электросети, динамические нагрузки, ударные токи.

Abstract: This article discusses the various types of reactors, where exactly they have been used, and in what situations they are used. The main types of reactors and their designs are discussed. In addition, the methods of effective use of reactors are discussed.

Keywords: Reactor, short-circuit, power grids, dynamic loads, shock currents.

Annotatsiya. Ushbu maqolada har xil turdagi reaktorlar, ular qayerda qo'llanilishi, shuningdek, qanday holatlarda qo'llanilishi masalasi ko'rib chiqiladi. Reaktorlarning asosiy turlari va ularning konstruktiviyalari ko'rib chiqiladi. Bundan tashqari, reaktorlardan samarali foydalanish usullari ko'rib chiqiladi.

Tayanch so'zlar: Reaktor, qisqa tutashuv, elektr tarmoqlari, dinamik yuklar, zarba oqimlari.

В настоящее время автоматические выключатели практически полностью исключают воздействие токов КЗ [1]. При этом они не могут оказать противодействия электродинамическим силам, которые возникают в первоначальный момент аварии [2]. Для уменьшения или же полной ликвидации воздействия данных сил используются инженерно-технические решения, базирующиеся на работе реакторов [3].

Реактор—устройство, которое осуществляет свою работу за счет сил, появляющихся входе каких-либо реакций, и создает ответное воздействие на протекание определенного процесса (химический, электрический, механический). Рассматривая вопрос энергетики, можно выделить наиболее распространенные виды. Наиболее широко применяются сухие реакторы в электросетях 6 и 10 кВ [4–6]. Их обычно выполняются в виде обмотки из изолированного провода, закрепленного на бетонных опорах. Они монтируются с вертикальным, горизонтальным или ступенчатым расположением фаз. В электросетях, имеющих большее напряжение, применяются реакторы, имеющие масляную изоляцию и каркас (стержневой или тороидальной формы) из диэлектрического материала и баком, выполненным из металла. Основные разделения реакторов по видам представлены в таблице 1.

Таблица 1

Основные разделения реакторов по видам

По исполнению	Одинарные и сдвоенные
По месту включения	Секционные и линейные
По характеристикам	С линейной и нелинейной характеристикой
Управление	Управляемые и не управляемые

Виды реакторов.

В высоковольтных электросетях реакторы работают по принципу контроля и ограничения токов коротких замыканий, появляющихся на установках системы в результате аварии. По назначению они подразделяются всего на два вида:

1. Уменьшающие величину токов КЗ—токоограничивающие;
2. Снижающие возникающую дугу—дугогасящие.

Оба вида устройств при нормальных режимах работы выносят малую погрешность в выходные характеристики сети, при этом она лежит в пределах нормы.

При нормальном режиме работы энергия расходуется на преодоление сопротивления цепи. При этом появляется рабочий ток, сбалансированный с номинальными мощностями, напряжением и полным сопротивлением электрической сети. В момент короткого замыкания шунтируется огромная мощность источника произвольным включением нагрузки с маленьким активным сопротивлением. Любое короткое замыкание разрушает равновесие в используемой сети. В данном случае источник напряжения переходит в режим аварии не мгновенно, этот период называется переходным [7–8]. В этом случае токи нагрузки меняют свою форму и величину. В переходном периоде полный ток КЗ представляет собой сложную форму, которую разделяют на две составляющие: вынужденную периодическую и свободную аperiodическую. График режима КЗ представлен на рисунке 1.

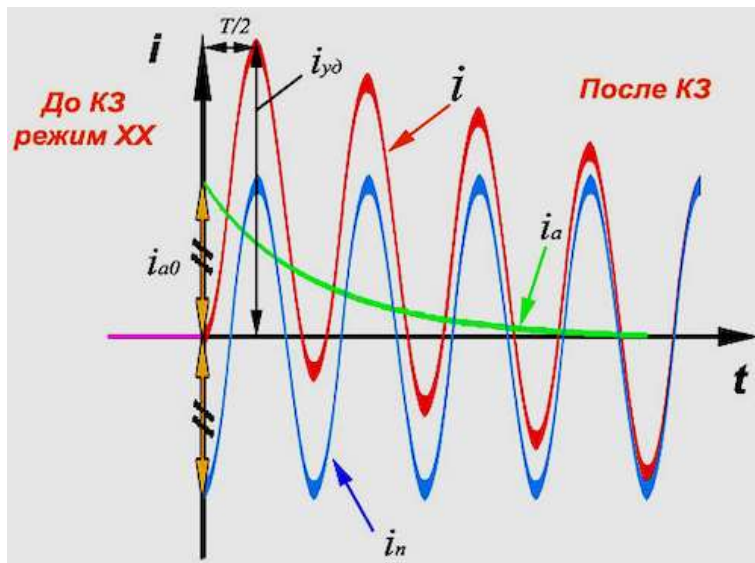


Рисунок 1. График режима КЗ.

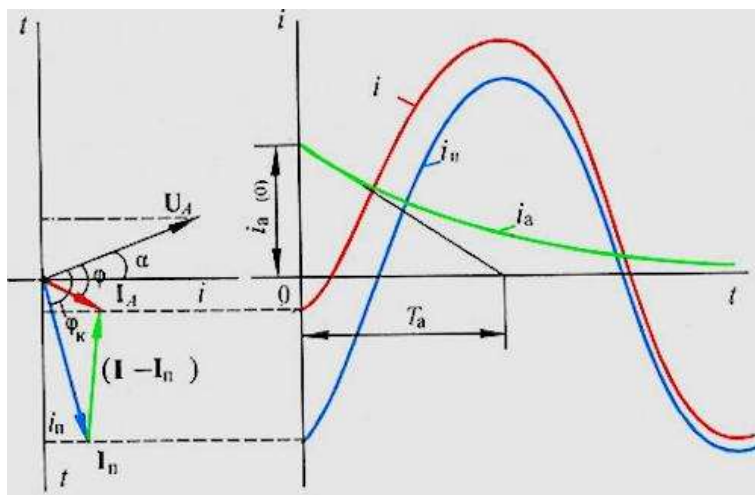


Рисунок 2. Форма аperiodической составляющей.

Первая часть повторяет форму питающего напряжения, а вторая возникает скачком и постепенно убывает по величине, формирование ее происходит за счет емкостной нагрузки нормального режима, который рассматривается как холостой ход для последующего короткого замыкания [9–10]. Две составляющие, складываясь, порождают ток, изменяющийся во времени сложной формы. Под ударным током понимают мгновенное максимальное значение аperiodической составляющей. Форма аperiodической составляющей представлена на рисунке 2.

Основной частью конструкции реактора является обмотка катушки, имеющая индуктивное сопротивление, включенное в разрыв основной цепи. Ее параметры подбирают так, чтобы падение напряжения было менее 4% от всей величины. Во время аварии в защитной схеме эта индуктивность гасит крупную часть высоковольтного напряжения и ограничивает

значение ударного тока. Рассчитать данный вид реакторов можно по максимальному току аварии:

$$I_{\text{н}} = \frac{2,54 * I_{\text{н}}}{X_{\text{р}}} 100\%$$

Конструкции токоограничивающих реакторов по внутреннему исполнению бывают бетонными, сухими, масляными, броневыми.

Рассмотрены основные виды реакторов. Освещены вопросы их конструкций, классификации, а также принцип действия. По изученному материалу можно сделать выводы о необходимости реакторов для энергетики и сетей электроснабжения. Без них аварии на подстанциях наносили бы колоссальный ущерб оборудованию и рабочему персоналу. В связи с этим применение реакторов в энергетике занимает очень важную позицию.

Дугогасящий реактор имеет большое индуктивное и незначительное активное сопротивление. Индуктивность ДГР может регулироваться путем изменения числа включенных витков, изменением величины воздушного зазора сердечника или его подмагничиванием.

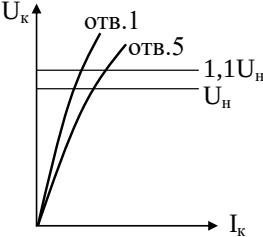
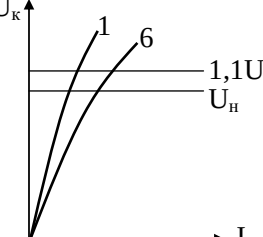
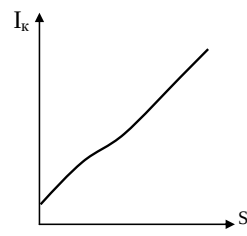
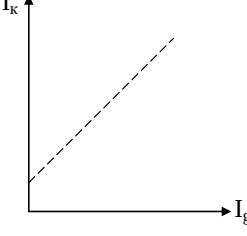
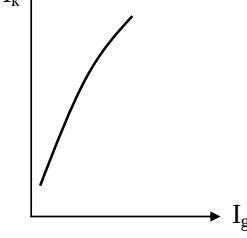
Катушка индуктивности как средство гашения заземляющих электрических дуг впервые была предложена В. Петерсеном в Германии в 1916 г. по результатам проведенных

им исследований процессов при однофазных замыканиях в электрических сетях [1].

Термин “катушка Петерсена” длительное время был у нас официальным названием ДГР и лишь в последнем стандарте на электрические реакторы (ГОСТ 18624–2003), он не рекомендуется к применению.

Таблица №1

Основные характеристики ДГР

Зависимость тока компенсации от фактора регулирования	Содержание в/Г в токе %	Отношение предельных токов	Магнитная индукция, Гс	Способ регулирования тока
	0	1/2	14000	Ручное переключение с отключением катушки от сети: переключатель пяти ответвлений на крышке
	1–1,5	1/2,5	16000	Ручное переключение с отключением катушки от сети: переключатель со штурвальным приводом для шесть или девяти ответвлений
	1–1,5	1/10 (1/20)	12000–14000	Плавная настройка электродвигателем без отключения от сети
	5–7	1/5–1/10	12000–14000	Настройка поперечным подмагничиванием без отключения от сети
	5–7	1/5–1/10	14000	Настройка продольным подмагничиванием без отключения от сети

Существует несколько групп ДГР принципиально мало отличающихся друг от друга: а) пофазно заземляющие реакторы; б) трехфазные ДГР; в) ДГР, включаемые в нейтраль сети. Пофазно заземляющие и трехфазные ДГР тока в практике эксплуатации, как правила не встречаются. Наибольшее распространение получили ДГР, включаемые в нейтраль сети.

Основные характеристики ДГР (табл. 1.1), подключаемых к нейтрали сети и различающихся по способам регулирования индуктивности, приведены в [2, 3, 4, 6].

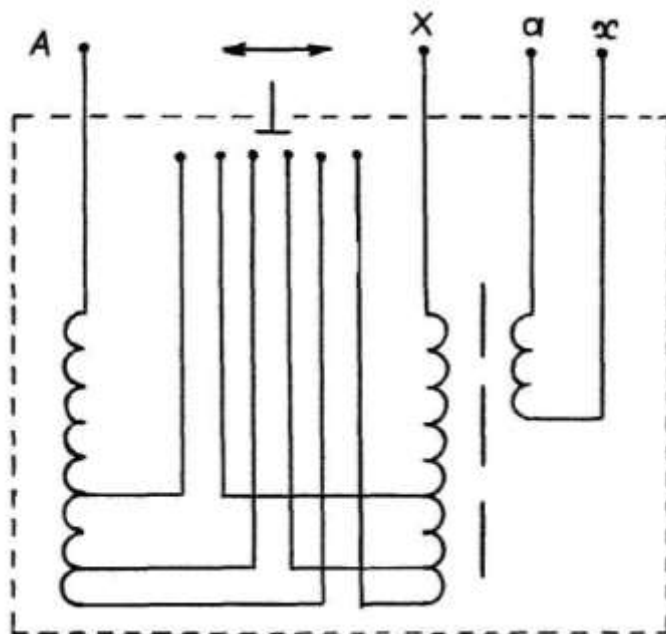


Рисунок 3. Принципиальная схема реактора ЗРОМ (РЗДСОМ).

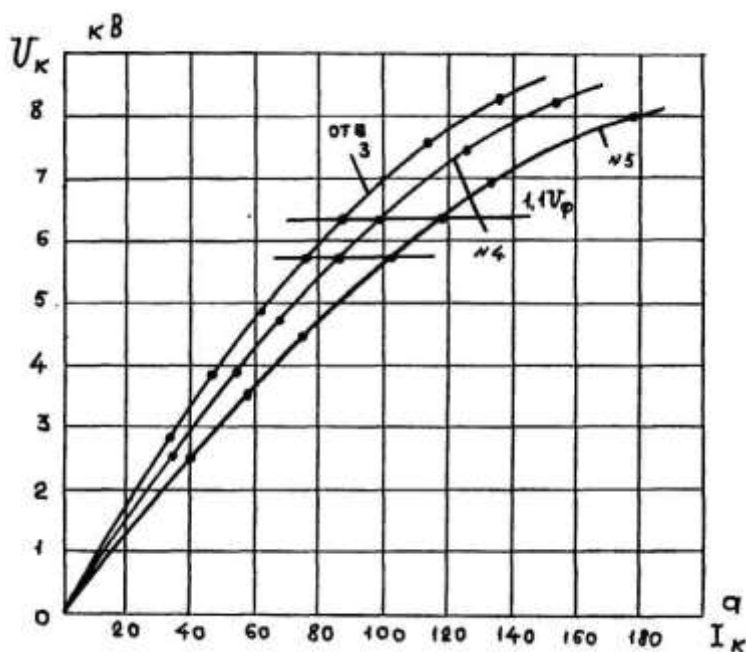


Рисунок 4. Характеристики $I_k = f(U_k)$ для ЗРОМ-600/10, для ответвлений 3,4,5.

Общими конструктивными элементами различных типов ДГР являются основная обмотка и магнитная система стрежневого или бронестержневого типа с зазорами. Наличие зазоров в магнитопроводе обеспечивает практическую линейность вольтамперной характеристики реактора при увеличении систем реакторов посвящен ряд работ [4].

Список литературы

- [1]. Petersen W., Erdschlusstromen in Hochspannungslagen, ETZ, 1916.
- [2]. Беляков Н.Н. Исследования перенапряжений при дуговых замыканиях на землю в сетях 6 и 10 кВ с изолированной нейтралью—Электричество, 1957, №5, с.31–37.
- [3]. Основы электроснабжения промышленных предприятий /А.А. Федоров, В.В.Каменева. Учебник для ВУЗов—Москва: Энергоатомиздат, 1984.—472с.
- [4]. Климова, Г.Н. Элементы энергосбережения в электроснабжении промышленных предприятий / А.В. Кабышев. Учебное пособие.—Томск: Изд-во Томского политехнического университета, 2008—185 с.
- [5]. Козлов, В.Л. Электроснабжение городов./В.Л. Козлов—Ленинград: Энергоатомиздат, Ленинградское отделение, 1988—264 с.
- [6]. Наладка устройств электроснабжения напряжением свыше 1000 вольт. / Г. Н. Дубинский Издание 2-е, переработанное и дополненное—М: СОЛОН-Пресс, 2015.—538 с.: ил.
- [7]. Киреева, Э.А. Электроснабжение и электрооборудование цехов промышленных предприятий : учебное пособие / Э.А. Киреева.—2-е изд., стер.—Москва : КНОРУС, 2018.—368 с.
- [8]. Сибикин, Ю.Д. Основы электроснабжения объектов : учебное пособие/Ю.Д. Сибикин—Москва. Берлин: Директ—Медиа, 2020.—329 с.
- [9]. Жобборов Т.К. Разработка устройства автоматического управления ДГР с применением микропроцессорной техники—Тезисы респ. науч. техн. конф. Ташкент, 1989, с.78–79.
- [10]. Гамазин С.И., Жобборов Т.К. Экономическая эффективность применения микроЭВМ для настройки ДГР в системах электроснабжения—Тезисы докл.респ.науч.техн.конф. Фрунзе, 1989, с.46–47.

ELECTROPHYSICAL PROPERTIES OF NITROGEN ATOMS IMPLANTED IN SILICON

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Abstract. Ion-electron synthesis is a method for the formation of implants of a new phase, implants arising during the formation of heterostructures, layers. The formation of a new phase during ion synthesis can occur as a result of the interaction of implanted atoms with target atoms or as a result of their interaction with each other. The use of ion-electron synthesis to create structures based on silicon has undoubted advantages over other methods, since this method is compatible with existing silicon technology.

Keywords. Regularities in the formation of the spatial distribution of nitrogen atoms, defect formation, investigation of silicon under high-temperature conditions, mechanism of nucleation and growth of the silicon nitride phase, thermionic synthesis of silicon, thin silicon upon implantation of large doses of hydrogen ions.

Аннотация: Ионно-электронный синтез — метод формирования имплантов новой фазы, имплантантов, возникающих при формировании гетероструктур, слоев. Образование новой фазы при ионном синтезе может происходить в результате взаимодействия имплантированных атомов с атомами мишени или в результате их взаимодействия друг с другом. Использование ионно-электронного синтеза для создания структур на основе кремния имеет несомненные преимущества перед другими методами, поскольку этот метод совместим с существующей кремниевой технологией.

Ключевые слова: Закономерности формирования пространственного распределения атомов азота, дефектообразование, исследование кремния в высокотемпературных условиях, механизм зарождения и роста фазы нитрида кремния, термоэмиссионный синтез кремния, тонкий кремний при имплантации больших доз ионы водорода.

Annotasiya: Ion-elektron sintezi - bu geterostrukturalar va qatlamlar hosil bo'lishida paydo bo'ladigan yangi bosqichdagi implantlarni, implantlarni shakllantirish usuli. Ion sintezi jarayonida yangi fazaning paydo bo'lishi implantatsiya qilingan atomlarning maqsadli atomlar bilan o'zaro ta'siri yoki ularning bir-biri bilan o'zaro ta'siri natijasida sodir bo'lishi mumkin. Kremniy asosidagi tuzilmalarni yaratish uchun ion-elektron sintezidan foydalanish boshqa usullarga nisbatan shubhasiz afzalliklarga ega, chunki bu usul mavjud kremniy texnologiyasiga mos keladi.

Kalit so'zlar: Azot atomlarining fazoda tarqalishining hosil bo'lish qonuniyatlari, nuqson hosil bo'lishi, yuqori harorat sharoitida kremniyni o'rganish, kremniy nitridi fazasining yadrolanishi va o'sishi mexanizmi, kremniyning termion sintezi, katta dozalarda implantatsiya qilinganida yupqa kremniy. vodorod ionlari.

Introduction.

The formation of a new phase in electron and ion synthesis can occur as a result of the interaction of implanted atoms with target atoms or their interaction with each other. The use of electrons under the influence of temperature to create structures based on silicon has clear advantages over other methods, since this method is compatible with existing silicon technology.

Sample preparation and research methods.

The method has ample opportunities for creating various types of systems. In this case, the properties of electronic bond structures are determined by the parameters of ion and electron transfer (type, dose, ion energy, ion flux density, target temperature during migration) and subsequent thermal effects (temperature, duration, pressure).

This method allows a wide range of control of the structural properties of the synthesized objects, their size (from a few nanometers to several micrometers) and their spatial distribution. Until the 1980s, research on the ion synthesis of semiconductor compounds was very sensitive and focused on new possibilities for ion implantation.

The new growth in interest in ion-electron synthesis was due to the problems of radiation resistance of very large integrated circuits. The solution to this problem was to use silicon layers as a substrate in insulator (SiO_2) rather than cast silicon. The research is mainly aimed at solving practical problems for the formation of dielectric and conductive layers with expanded silicon content. The solution to this problem can be achieved by introducing doses of ions of chemically active elements by ensuring the concentration of implanted atoms in silicon corresponding to the stoichiometric composition of the synthesized compound. Therefore, the researchers were mainly interested in the processes associated with the properties of the introduction of stoichiometric and super stoichiometric doses of oxygen, nitrogen and carbon ions into the silicon matrix. In particular, problems have been solved that allow to determine the spatial distribution of ion energy losses under the changing composition of the object under analysis in terms of layer depth, to take into account the effect of long-term surface scattering of silicon ions.

Results and discussion.

In the matrix of crystalline silicon, in amorphous dielectric matrices based on silicon and near Si/SiO_2 , the main physical processes that determine the mechanisms of nucleation and growth of a new phase in ion-electron synthesis have been established. To achieve this goal, the following problems need to be solved. Study of the regularities of the formation of the spatial distribution of nitrogen atoms, the formation of defects, the mechanism of nucleation and growth of the silicon nitride phase in silicon at high temperatures, the thermal effect of silicon on dielectric structures.

Establish the main patterns of growth of silicon and germanium nanocrystals in the main part of silicon oxide, nitride and oxynitride films. Establishment of the mechanism of nucleation of

the crystalline phase of Ge and InSb at the Si/SiO₂ interface. In the process of research, it is necessary to solve a number of technical and technological issues.

The main problem of semiconductor physics and technology is the development of the physical foundations for the ion-electronic synthesis of micro- and nanostructures based on silicon, which opens up new prospects for using silicon as a base material. The spatial distribution of nitrogen atoms, the processes of formation of secondary defects, and the initial stage of the nucleation of the silicon nitride phase in single-crystal silicon are studied in detail. The conditions for high-temperature ion implantation were met. The mechanism of nucleation of the Si₃N₄ phase of secondary structural defects in single-crystal silicon has been established. The nature of the difference between the theoretically predicted and experimentally observed spatial distribution of implanted nitrogen atoms and the synthesized phase of silicon nitride under the conditions of ion-electron synthesis is determined.

Based on their research, they are developed at the level of inventions and tested under the conditions of production of an ion-modified embedded dielectric silicon insulator structure. A method has been proposed and implemented for creating intermediate germanium Si/SiO₂ epitaxial layers, which makes it possible to create silicon-germanium dielectric structures.

The liquid-phase solubility of N in Si has a higher binding energy than the formation energy of this Si-SiO₂ bond. Oxygen atoms also have a much higher solubility in silicon. This means that under conditions of electron irradiation, when the low temperature reaches 500–700 °C and higher, the formation of Si/SiO₂ bonds can occur as the dose increases.

When the observed glass concentration is reached, the subsequent formation of Si/SiO₂ bonds in the mobile region stops, and dispersion of excess oxygen atoms with a high diffusion coefficient in SiO₂ from the diffusion zone also occurs in the glass. It is in the region of the edges of the maximum distribution of ions that new Si-SiO₂ bonds are formed. Unlike oxygen atoms, nitrogen atoms are slightly soluble in silicon (their equilibrium solubility is 3 times less than that of oxygen) and have a very low diffusion coefficient. The spatial distribution of nitrogen atoms in silicon during the deposition of high-temperature ions and the kinetics of nitrogen accumulation in silicon are studied from the point of view of its interaction with competing deposits in the crystalline matrix.

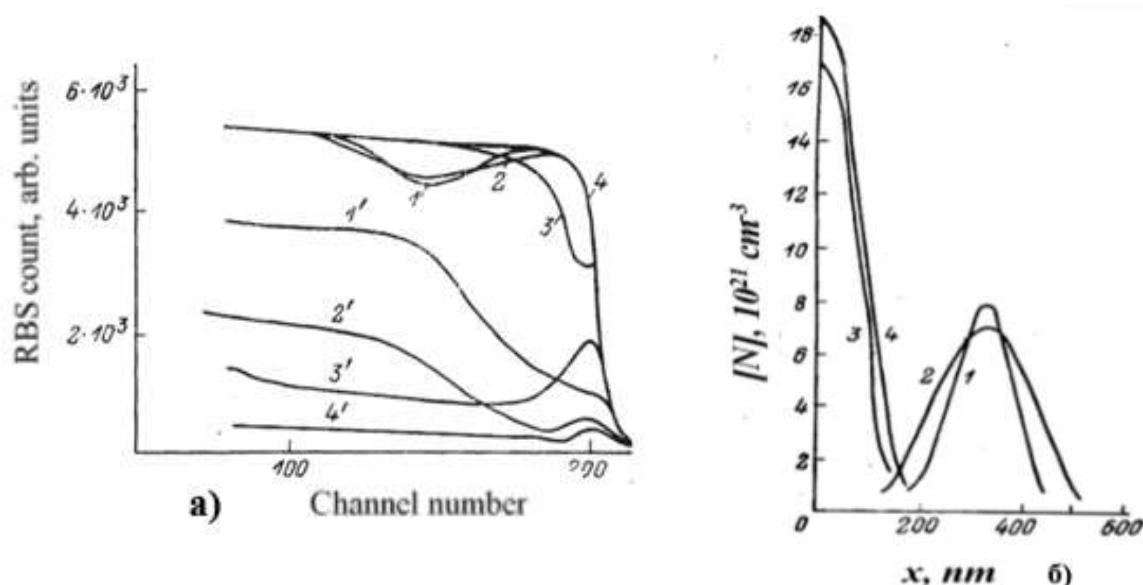


Figure 1.1 a) spectra of directional (1'-4') and non-directional (1-4') regression scattering. samples; T_i -°C during implantation with N⁺ ions at a dose of $1.5 \cdot 10^{17} \text{ cm}^{-2}$: 1, 1' - 700; 2, 2' - 900; 3, 3' - 1000; 4, 4' - not implanted. b) distribution of nitrogen atoms Silicon implanted with N⁺ ions at a dose of $1.5 \cdot 10^{17} \text{ cm}^{-2}$ at T_i -°C (according to the spectra of the redistribution pattern): 1 - 700; 2 - 900; 3 - 1000; 4 - 1100.

Nitrogen ions with an energy of 130-140 keV in doses of 5×10^{16} - 5×10^{17} sm^{-2} , introduced directly during bombardment with nitrogen (N) atoms, were introduced into a target made of single-crystal silicon KEF*-4.5 in the direction $\langle 100 \rangle$. Implantation samples $T_i = 700$ - 1100°C (T_i - implantation temperature) was heated by direct current to a temperature.

At $T_i = 900^\circ\text{C}$, a slight diffusion expansion of the distribution is observed. The spectra obtained under conditions of the most precise directivity of the probing light along the $\langle 100 \rangle$ channels show that after $T_i = 700$ - 900°C the upper silicon layer retains its crystallinity.

In this case, an increase in the implantation temperature in the specified T_i range is accompanied by a decrease in the exit velocity from the channel, which indicates an improvement in the crystal structure as a result of defective light. An increase in T_i to 1000°C stops the accumulation of nitrogen in the buried layer and causes it to flow out to the sample surface, where it accumulates in a layer about 200 nm thick. Calculations show that the integral concentration of nitrogen in the layer corresponds to the dose of introduced N^+ ions. An increase in T_i about 1100°C near C does not lead to a change in the nitrogen distribution. This means that nitrogen does not leave the sample and remains concentrated in the silicon layer near the thin surface. The nitrogen does not leave the sample and remains concentrated in the silicon layer near the thin surface. Interestingly, in the middle ionic range, the wastewater level continues to decrease and approaches its value in unimplanted silicon.

This indicates the recombination of defects resulting from the implantation of nitrogen ions and the structural perfection of the layer. The higher the efficiency of applying nitrogen to a thin layer, the lower the dissipation temperature. The second part of the implanted nitrogen diffuses to the crystal surface, where it accumulates in a narrow layer about 50 nm thick. With an increase in the holding temperature to 900°C , the nitrogen flow dominates over the sample surface during subsequent high-temperature melting, and it ceases to accumulate in the region of the average projection range of N^+ ions.

It is known that nitrogen in silicon in a highly saturated state (above 10^{15} - 10^{16} sm^{-3}) is present mainly in the form of pairs of nitrogen atoms, which weakly interact with the silicon lattice. However, the appearance of radiation defects in the Si matrix leads to an increase in the concentration of suspended silicon bonds.

This allows the formation of additional Si-N bonds in the silicon matrix of an increasing electron.

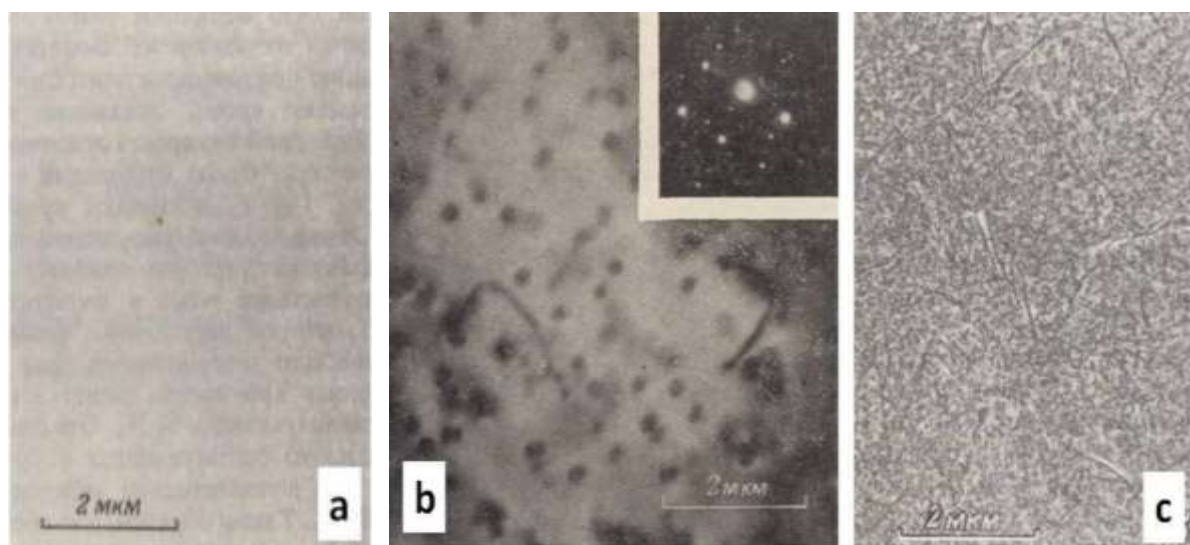


Figure 1.2 The electron has a microscopic image and the electron has an energy of 135 keV. Silicon samples implanted with N^+ ions microdiffraction; Doses 5×10^{16} sm^{-2} (a, b) and 8×10^{17} sm^{-2} (c) at a current density of 3-5 $\mu\text{A}/\text{sm}^2$. The temperature at the time of implantation was 600°C (a) and 900°C (b, c).

Excess concentrations of unsaturated Si bonds are present near dislocation rings, at interphase boundaries, and on the silicon surface. Post-implantation of silicon layers at high temperatures with high doses of N⁺ ions (higher than the silicon amorphization dose) can lead to nitrogen accumulation at the interface between the crystalline and amorphous regions. Under these conditions, the formation of expanded structural defects is suppressed, which ensures the formation of Si-N bonds in the region of maximum ionic elastic losses. The absence of precipitation in the main part of the crystal increases the role of sedimentation of nitrogen atoms on the actual surface of the crystal.

Indeed, the diffusion length of nitrogen atoms at the used flash point is comparable to the distance from Pp N to the real surface of the crystal. Due to the diffusion coefficient of nitrogen in silicon:

$$D = 0.87 \exp(-3.29/kT), \quad (1)$$

Here $k = 8.62 \cdot 10^{-5}$ eV/K, Boltzmann's constant, temperature T, then the diffusion length of the nitrogen atoms to use is such that flash times at 1150°C (3 hours) are about 530 nm. This value is almost twice the maximum distance. (PpN - nitrogen distribution on the silicon surface)

$$[ND] = (1 / L_D)^3, \quad (2)$$

where ND is the concentration of defects (deposit for nitrogen atoms), L_D is the distance between defects, and their maximum value corresponds to the diffusion length of atoms. Nitrogen (in this case - at a temperature of 900 °C). Calculations show that the N_D value can be at least $\sim 10^{16} \text{ sm}^{-3}$.

Conclusion

At all implantation and flash temperatures, nitrogen is not redistributed to a depth exceeding the average range of ions and does not evaporate in a vacuum. The critical temperature is enough to stop accumulation in the nitrogen-saturated layer. The sample is poured onto the surface at a temperature of 900 °C and above the critical temperature for the formation of secondary defects (for example, dislocation rings and dipoles) by nitrogen ions during the movement of an ion electron. The observed effects show that the appearance of secondary radiation defects in silicon creates conditions for the accumulation of nitrogen atoms in the layer.

References

- [1]. М.И. Гусева, Б.Г. Александрия. – Влияние плотности ионного тока на структуру и концентрацию изотопных мишеней, приготовленных в электромагнитном сепараторе. ЖТФ. 1961, т. 31, в. 7, с. 867-875.
- [2]. M. Watanabe, A. Tooi. – Formation of SiO₂ films by oxygen-ion bombardment. Japan J. Appl. Phys. 1966, v. 5, n. 12, pp. 737-738.
- [3]. W.J. Kleinfelder. – Properties of ion-implanted boron, nitrogen, and phosphorus in single crystal silicon. Technical Report No K701-1 on DARPA Contract SD-87, 1967.
- [4]. А.Е. Городецкий, Г.А. Качурин, Н.Б. Придачин, Л.С. Смирнов. – О возможности получения тонких слоев полупроводниковых соединений методом ионной бомбардировки. ФТП. 1968, т. 2, в. 1, с. 136-137.
- [5]. Kuchkarov, B. , Mamatkarimov, O. , Abdulkhayev, A. (2020). ICECAE IOP Conf. Series: Earth and Environmental Science 614 012027 “Influence of the ultrasonic irradiation on characteristic of the structures metal-glass-semiconductor”, Paper ID 116.
- [6]. Qo'chqarov, B. X. , Nishonov, A. , Qochqarov, X. O. , (2020). Scientific bulletin of Namangan State University, “The effect of tunneling current on the speed surface generation of charge carriers”, 1(7), 3-6.
- [7]. Vlasov, S. I., Nazirov, D. N., Kuchkarov, B. K., Bobokhujayev, K. U., (2014). Influence of all-round compression on formation of the mobile charge in lead-borosilicate glass structure. “Uzbekiston Fizika Zhurnali”, 3(16), 231-233.

SELECTION OF THE OPTIMAL LAW FOR REGULATING THE EXCITATION
OF SYNCHRONOUS MOTORS WITH LONGITUDINAL TRANSVERSE
EXCITATION UNDER VARIABLE LOAD

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Abstract. This article presents the results of theoretical and experimental studies carried out for the correct use of the mathematical apparatus and the results of experiments carried out on synchronous motors of uniaxial and longitudinal transverse excitation on a physical model to identify optimal laws for automatic control of excitation when operating with a variable load.

Key words: Variable load, uniaxial and longitudinal transverse excitation, vibration suppression, automatic regulation, derivative, “strong” magnetic field

Annotatsiya. Ushbu maqolada matematik apparatdan to'g'ri foydalanish bo'yicha olib borilgan nazariy va eksperimental tadqiqotlar natijalari va qo'zg'alishni avtomatik boshqarish uchun optimal qonuniyatlarni aniqlash uchun jismoniy model bo'yicha bir o'qli va uzunlamasina ko'ndalang qo'zg'alishning sinxron motorlarida o'tkazilgan tajribalar natijalari keltirilgan. o'zgaruvchan yuk bilan ishlash.

Kalit so'zlar: O'zgaruvchan yuk, bir o'qli va uzunlamasina ko'ndalang qo'zg'alish, tebranishlarni bostirish, avtomatik tartibga solish, lotin, “kuchli” magnit maydon

Аннотация. В настоящей статье приведены результаты теоретических и экспериментальных исследований проводимых для правильного использования математического аппарата и результатов проводимых экспериментов синхронных двигателей одноосного и продольно поперечного возбуждения на физическом модели для выявления оптимальных законов автоматического регулирования возбуждения при работе с переменной нагрузкой.

Ключевые слова. Переменная нагрузка, одноосного и продольно поперечного возбуждения, подавление колебаний, автоматическое регулирования, производным, «сильное», магнитное поле.

The significant advantage of synchronous motors with longitudinal transverse excitation (SM d-q) over synchronous motors (SM) with one excitation winding along the longitudinal axis can be most fully realized only with the proper selection of the laws of automatic control (ARC) of the current in the excitation windings along the longitudinal and transverse axes.

One of the main tasks solved by ARC SM d-q is to increase the reliable operation, energy, technical and economic performance of these engines under variable loads. Such indicators in transient modes caused by variable load include:

- Ensuring stable operation of a synchronous motor;
- Maximum suppression of rotor vibrations, which ensures a minimum of impacts on the mechanism and high quality of products;
- Minimum fluctuations in active power, and in the limit their complete suppression, which ensures the elimination of voltage fluctuations in phase;
- Minimum fluctuations in the stator current, which leads to a reduction in losses in the stator winding and its heating;
- Constancy of reactive power and motor voltage in amplitude.

It is not possible to ensure simultaneous fulfillment of the above requirements, especially in synchronous motors with uniaxial excitation, even with the use of proportional and “strong” excitation control according to the load angle and active power.

The problems of studying the laws of automatic control for the constancy of certain operating parameters in relation to steady-state modes of synchronous motors of uniaxial excitation are considered in /7.8/, and in relation to SD d-q in /1.2/. Some laws of ARC during transient

processes of SM d-q are considered theoretically in /9,4,10,11/, however, the issue of choosing the optimal law requires further study and experimental verification.

When choosing one or another ARC SM d-q law, it is necessary to proceed from the optimal operating conditions of both the engine itself and the load unit. However, choosing an optimality criterion is a complex technical and economic task, since the definition of this criterion is associated with a number of contradictories, sometimes incompatible requirements. For example, to stabilize the voltage, an in-phase change in the rotor run-out angle is necessary; to effectively dampen rotor oscillations, the excitation current must decrease before reaching the maximum rotor run-out angle, which leads to an increase in voltage fluctuations and a decrease in the dynamic stability of a synchronous motor.

To increase reliable operation under variable loads and the dynamic stability margin of SMs in transient modes, many regulators have now been developed that implement various control laws for the deviation of the rotor run-out angle, the stator current and its active and reactive components, voltage, and the first and second derivatives of these regime parameters. The introduction of derivatives into regulation only increases the speed of operation of automatic recirculation control systems without changing the nature of the magnetic field curve of the excitation winding. It is not possible to make the excitation system optimal in all respects and therefore a search for an optimal solution is necessary. The search for such a solution must be based on a clear physical representation of the complex interconnected electromagnetic and electromechanical processes occurring in SMs with longitudinal transverse excitation. Understanding the mechanism of these processes is also necessary for the correct use of the mathematical apparatus.

The ideal ARC law will be one in which the SM a periodically moves from one steady state (idle) to another (load) and back without changing, with constant reactive intensity and voltage both in amplitude and phase.

In a uniaxial excitation synchronous motor, under any control law, even with the use of “strong” control as a function of fluctuations in the load angle, stator voltage and current, this goal is unattainable. It is especially ineffective during load shedding, when the flux linkage of the longitudinal excitation winding creates a very small electromagnetic torque.

This article examines the laws of ARC of SM d-q, equipped with modern automatic regulators with thyristor exciters having a time constant from zero to 0.02 sec, and the ripple of the output signal controlling the thyristor rectifier does not exceed 1%. The shape of the rectified voltage pulse of the thyristor converter is assumed to be rectangular.

Calculations of the time constant of the transverse excitation winding of the studied SPSM d-q /1/ show that the number of turns of the transverse winding $W_{fd} = 4W_{fq}$, that is, it is significantly less than the number of turns of the longitudinal excitation winding for the tested SM d-q by 4 times less, therefore the time constant of the transverse winding is less than the time constant of the longitudinal windings, which ensures a rapid increase in the transverse excitation current i_{fq} and the electromagnetic torque M_{em} .

For intensive suppression of oscillations of the SM rotor of uniaxial excitation, the law based on the “maximum principle”, as is known, is optimal in terms of speed and increased reliability of operation and expansion of the limit of dynamic stability, as is known, is the use of alternating excitation /86 Petrov, 4/. However, along with the suppression of rotor oscillations, alternating excitation in the longitudinal axis causes unacceptable fluctuations in reactive power and other mode parameters.

Let us consider the mechanism of the initial stage of the transient process in the d-q SD under variable load. When the engine is idling, it can be assumed that the magnetic flux coincides with the longitudinal axis, because angle $\theta \approx 0$. When the load is applied, the rotor slows down - it moves against the stator field. In /4, 6/ it is indicated that at the initial stage the perturbed motion of the rotor has a “creeping” character, close to aperiodic. This is confirmed by many oscillograms. The speed of rotation of the rotor (sliding), in addition to the magnitude of the disturbing influence

(the magnitude of the applied or dropped load), is greatly influenced by the parameters of the initial mode and the inertia constant of the unit.

The task of optimal excitation control in the transient mode is to maintain a constant flux linkage and, ideally, not only in magnitude, but also in phase relative to the stator magnetic flux. Longitudinal control, both proportional and “strong”, with practically feasible forcing coefficients, can maintain a constant flux linkage module and only partially compensate for the phase (transverse armature reaction).

Ideally, to ensure constant instantaneous rotation speed of the rotor ($s=0$), these rotations should be in phase. Due to the time commensurability of electromagnetic processes in the excitation and mechanical windings, this requirement is achievable.

When the load is dropped, all the described processes occur in the reverse order; therefore, in this case, it is necessary to de-force the transverse excitation using a reversible thyristor exciter.

From the above, it follows that the most effective and easily implemented ARC law is the forcing and de-boosting of transverse excitation, therefore this law is discussed in this article.

The variable load on the shaft of powerful LEDs causes fluctuations in reactive power Q and voltage both in magnitude and in phase. When operating the SD with $\cos\varphi=1.0$, ($Q=0$).and regulating the excitation in the transverse axis to compensate for the transverse voltage phase remains unchanged. However, with the longitudinal component of the armature reaction, to compensate for the reactive power it is necessary to regulate the excitation control in this axis for a steady state

The active P and reactive Q components of the SM power d-q without taking into account the active resistance of the stator winding can be found from the relationships obtained on the basis of the vector diagram in Figure.1. /1,2/.

$$P = \frac{UE_{fg}}{x_d} \sin \theta + \frac{U^2}{2} \left(\frac{1}{x_g} - \frac{1}{x_d} \right) \sin 2\theta + \frac{UE_{fd}}{x_g} \cos \theta \quad (1)$$

$$Q = \frac{UE_{fq}}{x_d} \cos \theta + \frac{U^2}{2} \left(\frac{1}{x_q} - \frac{1}{x_d} \right) \cos 2\theta - \frac{U^2}{2} \left(\frac{1}{x_q} - \frac{1}{x_d} \right) - \frac{UE_{fd}}{x_q} \sin \theta \quad (2)$$

After simple transformations and joint solution of equations (1) and (2), we obtain

$$\left(\frac{E_{fq}}{X_d}\right)^2 + \left(\frac{E_{fd}}{X_q}\right)^2 = \left[\frac{Q}{U} - U\left(\frac{1}{X_q} - \frac{1}{X_d}\right)\cos\theta + \frac{U^2}{X_q}\right]^2 + \left[\frac{P}{U} - \frac{U}{2}\left(\frac{1}{X_q} - \frac{1}{X_d}\right)\sin 2\theta\right]^2 \quad (3)$$

For high torque utilization of the machine, it is advisable to regulate the transverse winding at a constant angle $\theta=0$. Under this condition (3) is simplified

$$\left(\frac{E_{fq}}{x_d}\right)^2 + \left(\frac{E_{fd}}{x_d}\right)^2 = \left(\frac{Q}{U} + \frac{U}{x_d}\right)^2 + \left(\frac{P}{U}\right)^2 \quad (4)$$

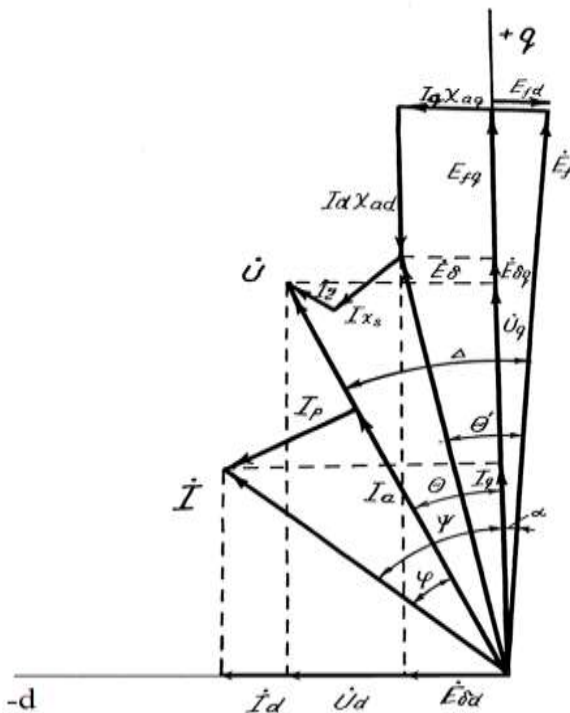


Figure. 1 Vector diagram of a synchronous motor with longitudinal transverse excitation.

Keeping in mind that $Q = UI_p$ and $P = UI_a$, equation (4) can be represented as

$$\left(\frac{E_{fq}}{x_d}\right) + \left(\frac{E_{fq}}{x_d}\right)^2 + \left(\frac{E_{fd}}{x_q}\right)^2 = \left(I_p + \frac{U}{x_d}\right)^2 + I_a^2 \quad (5)$$

Assigning the regulation of reactive power to the longitudinal excitation winding, from (4) we obtain

$$\left(\frac{E_{fq}}{x_d}\right)^2 = \left(I_p + \frac{U}{x_d}\right)^2 \quad \text{or} \quad U = E_{fq} - I_p x_d \quad (6)$$

From (6) E_{fq} is determined and, from the no-load characteristic, the corresponding excitation current i_{fd} , as well as the voltage on the excitation winding U_{fd} . Equation (6) also indicates the control parameter, which should be taken as the reactive component of the stator current.

In the experiment, active and reactive stator current sensors were used to automatically regulate the excitation current in the additional transverse winding of a synchronous motor with longitudinal transverse excitation.

The article shows that the most effective law of automatic excitation control is excitation forcing, which allows even under the most difficult conditions of variable load to suppress free fluctuations of operating parameters.

References

- [1]. Akhmatov M.G. Synchronous machines. Special course. M.: Higher School, 1984.-135 p.
- [2]. Akhmatov M.G., Kamolov N.K. Regulation of excitation of a synchronous motor with longitudinal-transverse excitation for constant voltage in the tires. //Izv. AN UzSSR.SNT. -1981.-No.6.-P.28-32
- [3]. Abramovich B.N., Krugly A.A. Excitation, regulation and stability of synchronous motors. -L., 1983.-128s
- [4]. Vazhnova A.I. Transient processes in alternating current machines. -L. Energy, 1980. -256 s
- [5]. Voldek A.I. About vector diagrams and inductive reactance of a synchronous machine. //Electromechanics. - 1962. -No. 3.-S. 329-337
- [6]. Gorev A.A. Transient processes of a synchronous machine. L: Gosenergoizdat, 1985.-50 p.
- [7]. Glebov I.A., Loginov S.I. Excitation and control systems for synchronous motors. -L.: Energy 1972.-112 s.
- [8]. Ivanov - Smolensky A.V. Electric cars. M.: Energy. -1980.-928 p.
- [9]. Kasparov E.A. Estimation of the effectiveness of ARV for reducing the oscillations of a synchronous machine during electrical resonance // Electricity. -1975.-No. 7. pp. 20-28
- [10]. Litkens I.V., Pogorelov L.M., StroeV V.A. Choice of control law for a synchronous machine using longitudinal transverse excitation. // Electricity. – 1977. -No. 8.-P.23-29.
- [11]. Petrov Yu.P. Using the “maximum principle” to find the optimal control law for synchronous machines. //Electricity. -1964.-No.10.-P.-37-38.
- [12]. Filts R.V., Lyabuk N.N., Dyachishchin B.V. Regime calculations of a salient-pole synchronous machine with longitudinal transverse excitation. //Technical Electrodynamics. - 1980.-No. 1. -WITH. 76-82.

DEVICE FOR OBTAINING ELECTROSTATIC FIELDS USING AFN-ELEMENT

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Аннотация: В статье описано солнечное устройство для генерации электростатических полей посредством миниатюрного энергонезависимого источника питания автономного типа в виде оптического луча. Устройство представляет собой

преобразование инфракрасного излучения в видимый свет. В статье приведена система уравнений для устройства функционального преобразования сигналов.

Ключевые слова: светодиод, фотоприемник, солнечный луч, электрический сигнал, оптоэлектрон, фотонапряжение, пленки, энергия, световод, емкость, солнечные устройства, полупроводники

Annotatsiya: Maqolada optik nurning avtonom turidagi miniatyura uchmaydigan quvvat manbai yordamida elektrostatik maydonlarni hosil qilish uchun quyosh qurilmasi tasvirlangan. Qurilma infraqizil nurlanishni ko'rinadigan nurga aylantirishdir. Funktsional signalni konvertatsiya qilish moslamasi uchun tenglamalar tizimi maqolada keltirilgan.

Kalit so'zlar: yorug'lik chiqaradigan diod, fotodetektor, quyosh nuri, elektr signali, optoelektron, fotovoltaj va plyonkalar, energiya, yorug'lik qo'llanmasi, sig'im, quyosh qurilmalari, yarimo'tkazgichlar

Abstract: The article describes a solar device for generating electrostatic fields by means of a miniature non-volatile power source of an autonomous type of an optical beam. The device is a transformation of infrared radiation into visible light. A system of equations for a functional signal conversion device is given in the article.

Key words: light-emitting diode, photodetector, sunbeam, electrical signal, optoelectron, photovoltage, AFN films, energy, light guide, capacitance, solar devices, semiconductors

As is known, electrostatic fields are widely used in many branches of science and technology. Various types of instruments and devices are used to create electrostatic fields. In these devices, traditional (HPP, TPP) energy sources are accepted as a source of electrical energy. In these sources of electrical energy, electrostatic fields are created at the expense of much higher energies. Today, thanks to advances in the field of optoelectronics and solar technology, it becomes possible to develop advanced methods for obtaining strong electrostatic fields due to low-amplitude solar radiation energy. The desire to reduce energy costs by opto-solar technology is accompanied by a radical decrease in the cost and size of devices, this circumstance opens the way to miniaturization of devices and devices.

Such developments stimulate numerous one of the most promising and rapidly developing branches of modern science and technology.[1] The development trend of which is due to the energy received from renewable sources. [2,3,4] Therefore, research and development in this area, which is one of the most urgent tasks of our time to improve the technology and technology of optoelectronic solar devices and devices.

In addition, thanks to the use of solar optoelectronics, new types of solar optoelectronic devices appear that have a number of important advantages, a more detailed discussion of which will be carried out in this and subsequent chapters of the dissertation. The elements of optoelectronic circuits are photo-emitters and photodetectors - devices that perform two main operations for the mutual conversion of electrical and optical signals. According to the functional feature, photodetectors are divided into two groups: a) directly generating electrical voltage when they are illuminated (photo generators or generator-type photodetectors) and b) changing the distribution of voltage from an external source in the circuit under the action of the roof (photodetectors). A photoemitter is a light source (IC), [5] as an IC it can serve as incandescent lamps, gas discharge lamps, electro luminophores, injection diodes (LEDs), lasers.

All of the above ICs are artificial ICs. The main parameters of artificial ICs are quantum yield, response time (sec), maximum photon flux (cm⁻², sec⁻¹), spectral line width (EE). Artificial ICs are mainly used in semiconductor microelectronics. In semiconductor solar technology, solar radiation is used as an IC. As noted above, the optocoupler of semiconductor solar technology is a solar optoelectronic device.

By the example of an optocoupler, it is easy to illustrate the richness of the possibilities of optoelectronics, due to the combination of two types of bonds. Optocoupler with a direct optical connection forms an amplifier of electrical signals Fig.1.

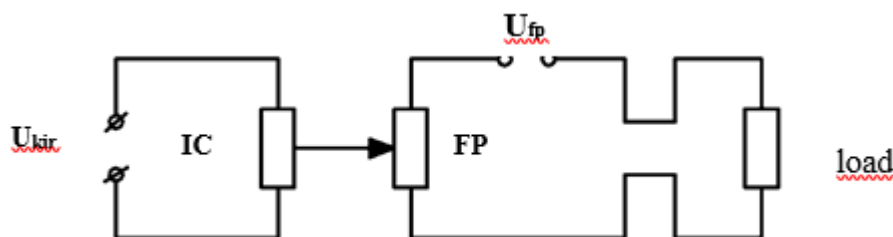


Fig. 1. Optocoupler with direct optical coupling.

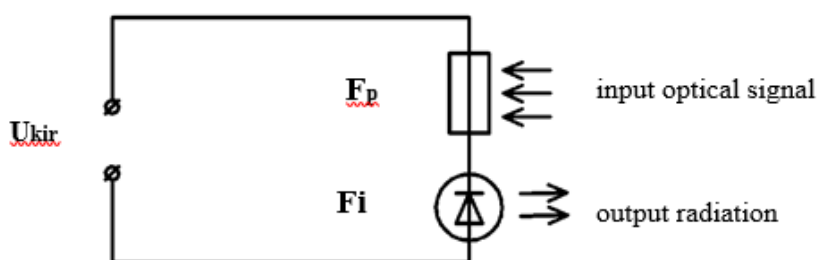


Fig.2. Light amplifier.

By creating an electrical direct line instead of an optical one, a connection between the components in the optocoupler, we obtain a light amplifier (fig.2).

In addition, it is possible to carry out spectral transformation, for example, the transformation of infrared radiation (IR) into visible light. Thus, with the help of an optocoupler with a direct optical connection, three operations can be carried out simultaneously: spectral conversion; amplification and stabilization of the luminous flux.

Properly designed generator-type photodetectors (FPGT) and made of highly active photoelectric material work with high efficiency, but losses are inevitable in it. If each incident photon produced one pair of "electron-hole" and these carriers all to one would reach the corresponding electrodes without losing their energies, the PGT would work with maximum efficiency.

However, in real conditions such a case is never observed. In reality, energy losses are unavoidable in the PGT. All energy losses in the PGT can be divided into two groups.

The first group of losses is formed from the following parts:

- 1) Part of the light flux incident on the surface of the photodetector (PC) F is reflected and, therefore, does not participate in the creation of current carriers;
- 2) The second part of the light flux Φ passes through the entire thickness of the semiconductor and does not participate in the photovoltaic process. Let's designate it through F_{pr} ;
- 3) The third part - let's denote it by F_n - is absorbed by the thickness of the semiconductor, but current carriers are not created. This type of radiation absorption is called photoelectrically inactive absorption.

So, the light loss F_{sv} are the sum: $F_{sv} = F_{otr} + F_{pr} + F_n$.

Let us now turn to the analysis of the energy losses arising as a result of the formation of pairs and the pressure of current carriers in the thickness of the phase transition. They also consist of several parts:

- 1) Part of the photo-active light flux absorbed by a semiconductor - it is equal to $\Phi - F_{sv}$, Creates electron-hole pairs. However, not all electrons and holes reach their electrodes. In the process of their movement, some of them necessarily re-combine. In this case, recombination is accompanied by the transfer of energy to the crystal lattice of the semiconductor;

2) The very movement of electrons and holes through the thickness of the semiconductor and through the contacts of the FP is also accompanied by a loss of energy;

3) In each FP there are shunt resistances. During the movement of photocarriers through the shunt resistance, both photoelectrons and photo holes leak;

4) During the movement of photocarriers, a collision of carriers with atoms of the lattice occurs, as a result, a transition of carriers from higher levels to lower levels occurs in the aisles of the same energy zone. This process is accompanied by energy losses.

According to the above analysis and in accordance with the requirements of the theory, in order to manufacture a highly efficient PHGT, it is necessary:

1) In the material from which the PGT is made, the lifetime of photocarriers should be maximum;

2) In the process of manufacturing PGT, it is necessary to find such technological methods that would ensure the formation of a p-n junction located at a distance less than the diffusion length from the upper electrode;

3) To create a highly efficient PHPT, the design of the device must meet the optimal parameters such as the depth of the pn junction, the width of the junction, the diffusion length, the surface recombination rate, and the size of the photoactive region where the electron-hole pair is generated. If the above requirements are met, the recombination of photocarriers decreases, and most of the electron-hole pairs will be able to reach the pn junction.

4) The energy of the photon $h\nu$ must be of the order of the forbidden width ΔE , since the photon with the energy of which $h\nu < \Delta E$ cannot create electron-hole pairs. The optimal band gap for solar radiation is approximately to lie near 1.5-1.6 eV.

If the PGT is used as a converter of solar radiation into electricity, then the PGT operates in the solar cell (SC) mode. For solar cells, the most probable and promising material, in addition to Si, is also thin films of chalcogenides and heterophotocells (HPE). Recently, solar energy has been widely used in world practice [2, 3]. In addition, PGT is used in optoelectronics to create various optoelectronic instruments and devices [1, 4, 5, 6]. In these devices, the FPGT operates in the AFS-element mode. As is known [1], AFS-elements is a current generator and, as a high voltage source, can only work on a highly intelligent load. Therefore, AFN-elements can be used to create strong electrostatic fields as a miniature non-volatile power source of an autonomous type of optoelectronics [7,9,10]. Any functional circuit of an optocoupler can be represented as a closed ring of signal transformations, consisting of five links. Such links are: LED, light guide, photodetector, photodetector circuit and functional signal conversion devices (output working device). Each link is characterized by its transfer function.

The transfer function of each FP is its photo-efficiency coefficient $\beta = \frac{\partial I_\Phi}{\partial B}$, If I_Φ and B will be measured in numbers, then the value of β will coincide with the quantum efficiency [1]. Under stationary conditions, the complete system of equations for an optocoupler with direct optical coupling consists of the equations of its components. A direct-coupled optocoupler operates as an electrical amplifier with an optical input, where the input is the light emitter circuit (sunlight, LED, etc.), and the output is the load in the FP circuit (Fig. 3).

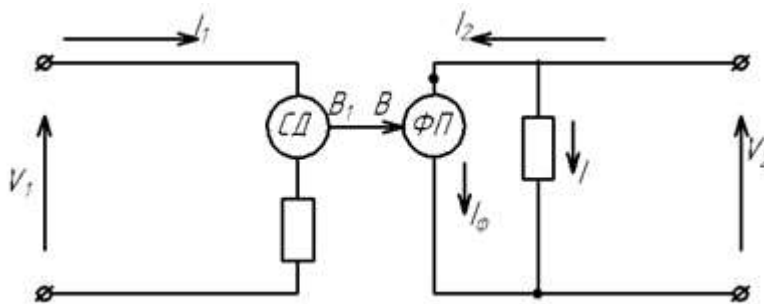


Fig.3. Scheme of an optocoupler with a direct optical connection.

For such an optocoupler, we can write the following system of equations,

$$I_1 = I_f(V_1), \quad I_2 = I_f + I(V_2)$$

$$B_1 = B_1(I_1), \quad B = B(B_1)$$

$$I_f = G(B(B_1[I_1(V_1)]))V_2$$

This system of equations makes it possible to analyze and calculate optoelectronic circuits with direct optical coupling. Moreover, various FPs differ from each other not only in functional properties, but in differential resistance.

If the FPHT operates in the SC mode, depending on the spectral region of solar radiation, a scheme (Fig. 4) is selected for the location of the p-p junction with respect to light. collection of media.

In the short-wavelength region of the spectrum, a structure (Fig-4) with a perpendicular arrangement of the p-n junction is used, since in this case an increase in the collection efficiency is observed, as a result, a significant photo-E.D.C can be obtained on a single illuminated surface of the solar cell.

In the proposed device, in the IC and FP circuits of the optoelectronic device, the role of electric power is performed by solar energy. In addition, unlike other similar optoelectronic devices, in this device, light is converted not into an electric current [8,9,10] but into an electric field. For the operation of many optoelectronic devices, it is necessary to create strong electric fields. Large electric fields are widely used in electronics, quantum electronics and various branches of micro and optoelectronics. With the use of this device, the reliability, autonomy and energy independence of optoelectronic devices is ensured. In addition, the possibility of microminiaturization of such optoelectronic devices opens up, in this way the non-contact remote controllability of optoelectronic devices improves and the sensitivity of such devices increases by several orders of magnitude.

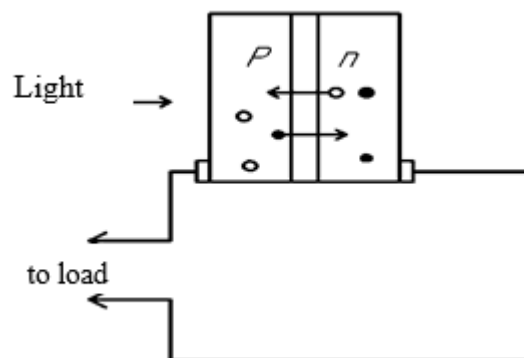


Fig.4. The arrangement of pn junctions in a semiconductor crystal is parallel to the incidence of solar radiation.

References

- [1] E. I. Adirovich, in Sat. Microelectronics, M, 1967 .1. page 75. Surg. Vuzov, ser. Radioelectronics, 11, No. 7 679 (1968).
- [2] Kasymakhunova A. M., Naimanboev R., Akhunov K. Kh., Tokhirov M. K., Khomidov A. K. - High-speed optoelectronic shutter, "Author's work No. EC-01-002677", 10, 2020.
- [3] Kasymakhunova A. M., Naimanboev R., Akhunov K. Kh., Khomidov A. K - Optoelectronic solar device for obtaining electric fields, "Author's work No. EC-01-002678", February 10, 2020.
- [4] Rakhimov N.R., Tozhiev R.Zh., Tilavoldiev O., Akhunov K.Kh. Optoelectronic colorimeter for monitoring the color differences of oil products //Uzbek Journal of Oil and Gas. - 2003. - No. 3. - With. 39.
- [5] Akhunov K. X. A FLOATING SOLAR DEALER WITH H-SHAPED METAL HEAT RECEIVER // Izvestiya of the Osh Technological University. - 2019. - No. 3. - With. 201-206.
- [6] Naimanboev R., Akhunov K. Kh. Optoelectronic method for determining the microparameters of generator-type photodetectors //Actual Science. - 2019 - No. 11. - With. 16-18.
- [7] Akhunov K. Kh., Khomidov A. K., Khomidov O. K. Floating solar distiller with a zigzag heat sink // Actual science. - 2018. - No. 10. -With. 22-25.
- [8] A.M. Kasimakhunova, R. Naimanbaev, K.K. Akhunov, A.K. Khomidov, Development and research of optoelectronic secondary energy transformer //PalArch's Journal of Archaeology of Egypt/Egyptology 17 (6), 3602-3608.
- [9] R. Naimanboev, K.Kh. Kambarali Faradey effect AFN-planks // Scientific Bulletin of Namangan State Universiti - 2019. - Volume 1, No. 10. -With. 8
- [10] R. Naimanboev and S. Irmatov, Semiconductor photodetector, Ed. Department. FerPI, Fargana, 2011, p.110.

**KONUSSIMON QUYOSH SUV KOLLEKTORLARINING GIDRODINAMIK NAZARIY
TAHLILI**

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Annotatsiya: Ushbu maqolada, quyosh energiyasidan issiqlik energiyasini olish uchun mo'ljallangan yangicha turda ishlab chiqilgan, konussimon quvurli quyosh suv kollektorining ishchi kamerasidagi issiqlik almashinuv jarayonlariga bevosita ta'sir ko'rsatuvchi omillar jumladan suvning harakat tartibi, quvurlardagi suv oqimi, isituvchi sirt konstruksiyalari, issiqlik almashinuv jarayonini jadallashtirish hamda bosim yo'qolishi kabi asosiy ko'rsatkichlarini hisoblash metodlari tahlil qilingan.

Tayanch so'zlar: Quyosh nuri, konvektiv issiqlik almashinuvi, absorber, suv oqimi, laminar, turbulent, issiqlik sig'im, bosim, chegaraviy qatlam.

Аннотация: В данной статье рассмотрены факторы, непосредственно влияющие на процессы теплообмена в рабочей камере конического трубчатого солнечного водокolleктора, предназначенного для получения тепловой энергии из солнечной энергии, в том числе поток воды в трубах, конструкции поверхностей нагрева, ускорение нагрева. обсуждаются обменные процессы и анализируются методы расчета таких основных показателей, как потеря давления.

Ключевые слова: солнечный свет, конвективный теплообмен, поглотитель, поток воды, ламинарный, турбулентный, теплоемкость, давление, пограничный слой.

Annotation: This article discusses the factors that directly affect the heat transfer processes in the working chamber of a conical tubular solar water collector designed to obtain thermal energy from solar energy, including the flow of water in the pipes, the design of heating surfaces, and heating acceleration. metabolic processes are discussed and methods for calculating such basic indicators as pressure loss are analyzed.

Key words: sunlight, convective heat transfer, absorber, water flow, laminar, turbulent, heat capacity, pressure, boundary layer.

Quyosh - bu toza energiyaning eng maqbul manbaidir. Dunyo miqyosida energiyaga talab doimiy ravishda o'sib bormoqda, bu esa muqobil energiya manbalaridan foydalanish salmog'ini oshirishga turtki beradi. Shu ma'noda, quyosh eng boy energiya manbaalaridan biridir va amalda tugab qolmaydi. Energiya samaradorligi va quyosh texnologiyalari binolar va sanoat obyektlarini har qanday energiya bilan ta'minlashda muhim element hisoblanadi. Radiatsiya shaklida olingan quyosh energiyasini to'g'ridan-to'g'ri yoki bilvosita energiyaga masalan, issiqlik va elektr energiyasi kabi boshqa shakllariga aylantirilishi mumkin.

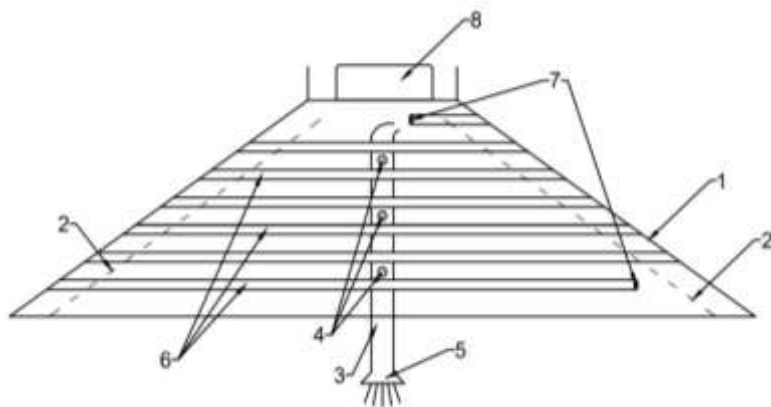
Quyosh nurini issiqlik energiyasiga aylantirishning eng oson usuli - bu konussimon quyosh suv isitgichlaridan foydalanish. Ushbu turdagi isitgichlar boshqa turdagi isitgichlarga nisbatan arzon hamda qurilmalarning strukturaviy tuzilishi soddaligi tufayli quyosh suv isitgichlar keng qo'llaniladi. Quyosh suv isitgichlari asosan maishiy xizmat ko'rsatish, qishloq xo'jaligi, fermerlar, bog'cha, oromgoh va issiq suv iste'molchilari uchun ishlatiladi. Suv isitish tizimida quyosh kollektori quyosh nurlari kelganida to'g'ridan-to'g'ri va tarqoq quyosh nurlarini issiqlik shaklida to'playdigan va issiqlik energiyasini kerakli muhitga yo'naltiradi. [1]

Adabiyotlarni o'rganishda natijasidan shuni ta'kidlash mumkinki, konvektiv issiqlik uzatish tezligi suv oqim ta'sirida bo'lgan issiqlik uzatish yuzalarini ko'paytirish yoki qizdirilgan yuzasidan konvektiv issiqlik o'tkazuvchanlik koefitsientini oshirish orqali oshirilishi mumkin. Issiqlik o'tkazuvchanligini oshirish va shunga mos ravishda konussimon quyosh suv isitgichlarni o'lchamlarini, uning massasini kamaytirish yoki oldingi o'lchovlarda uning issiqlik quvvatini oshirish va radiatsiya yutuvchi yuzadan suv oqimi orqali issiqlik samaradorligini oshirish uchun maqbul turbulent oqim rejimini tashkil etish kerak. Ushbu vazifa quvurlarni qo'llash orqali amalga

oshiriladi, quyosh nurini qabul qilgichining sirtini profilantiradi, nur qabul qilgich yuzasida quvurlar joylashtiriladi. [2]

Yangicha usulda ishlab chiqilgan konussimon shakldagi quvurli quyosh suv isitgichining statik holati: konussimon shakldagi quvurli quyosh suv isitgichining modeli ishlab chiqildi. Qurilmaning uzunligi $l=430$ mm, radiusi $R=1000$ mm, $r=200$ mm, balandligi $h=245$ mm ni tashkil etadi (1-rasm). Ushbu quyosh suv isitgich qurilmasi issiq suv chiqish quvuri (9) qurilmaning pastki asos radiusiga markaziga o'rnatilgan. Qizigan suv chiqish quvurining diametri $d=30$ mm ni tashkil etadi. Quyosh suv isitgichining ichki qismiga deflektor (6) o'rnatilgan. Absorber bilan deflektor oraliq masofa 30 mm. Quyosh suv isitgichi qurilmasining ishchi kamerasiga absorber $h_1=1$ mm qalinlikda qora rangga (3) bo'yalgan. Ushbu quyosh suv isitgichi ishchi kamerasini mis truba (8) bilan o'ralgan. Mis truba ishchi sirt yuzasiga spiralsimon tartibda o'rnatilgan. Har bir mis trubasining uzunligi konus kengligiga mos.

Quyosh suv isitgich qurilmasi suv kiruvchi quvur (4) absorber ichki qismigacha joylashgan. Har bir 40 mm oralig'ida suv chiquvchi teshiklar ochilgan. Quyosh suv isitgich qurilmasining suv kiruvchi quvuri suv chiquvchi quvuriga qarama-qarshi o'rnatilgan. Mis trubaga suv kirish uchun absorberga (1,2) quvurlar joylashtirilgan, ushbu suv kiruvchi mis trubalar diametri 12 mm ni tashkil etadi. Quyosh suv isitgich qurilmasining issiqlik o'tkazuvchanligi yaxshi, otsinkoviy listdan tashkil topgan korpus (7) qurilmaning ishchi kamerasidagi issiqlik yo'qotishlari bo'lmasligini ta'minlaydi.



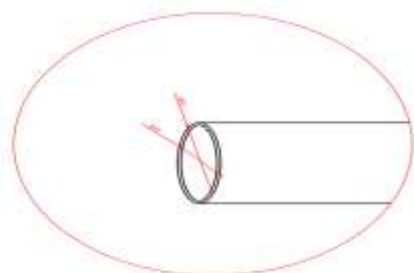
1-qoraytirilgan metal yuza(absorber),2-deflektor,3-suv chiqish kanali,4-issiqlik suv chiqish uchun yordamchi po'kak rezina shlang,5-ventil,6-suv kanallari,7-yordamchi kanal,8-qopqoq.

1-rasm. Quyosh suv isitgich qurilmasining prinsipial sxemasi

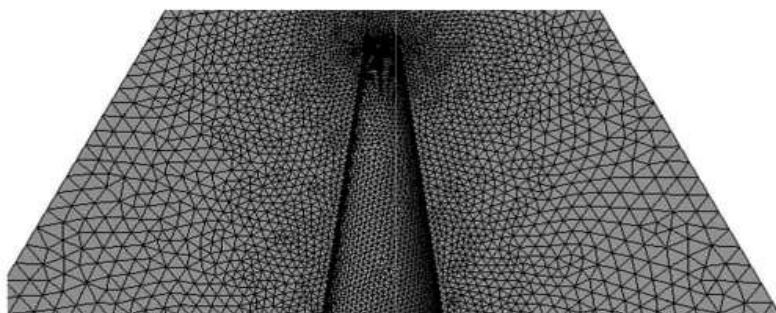
Konussimon quyosh suv isitgich qurilmalarining dinamik holati.

bo'lmaydi va konusning hamma qismi quyosh nuri bilan yoritiladi. Qurilmaning ishchi sirt yuzasiga quyosh nuri tushishi natijasida absorber (1) qiziydi hamda (3,5) ventil orqali issiq suv ishlatiladi. Quyosh suv isitgich qurilmasiga suv (4) suv kiruvchi kanal orqali qurilmaga suv to'ladi. Deflektor (2) va mis truba (6) oraliqlarida suv aylanish natijasida suvning isishini jadallashtiradi. Isigan suv tabiiy aylanish rejimi natijasida absorberning yuqori qismiga to'planib boradi.

Ushbu quyosh suv isitgich qurilmasining ishlash prinsipi quyida keltirib o'tilgan. Quyosh suv isitgich qurilmasi quyosh nurini yaxshi yutishi uchun kesik konus ko'rinishida tayyorlangan bo'lib, qurilmaning ishchi sirt yuzasi qora rangga bo'yalgan(1). Konusning yon tashkil etuvchi va asosi orasidagi burchak 35° katta bo'lmasligi kerak, chunki geografik kenglikdan kichik bo'lishi natijasida konusda soya qism



2-rasm. Suvga aylanma harakat beruvchi quvur sxemasi.



3-rasm. Konussimon quyosh suv isitgich qurilmasini geometrik yuzalarga ajratish.

Konussimon quyosh suv isitgichning absorber va korpusi orasidagi issiqlik izolyatsiya (7) qatlami qizigan absorberdan issiqlik yo'qotilishini oldini oladi va mavjud issiqlikni suvga uzatilishiga yordam beradi.

Oqim taxliliga ko'ra, uni kanal yuzasidagi chegaraviy qatlam va tashqi oqimga bo'lish mumkin. Chegaraviy qatlam oqimning yuviluvchi jism bilan dinamik va issiqlik almashinuv jarayonlarida asosiy rolni egallaydi. Energiyani yo'qotilishi xarakatdagi uzilish xodisalari va ular tufayli hosil bo'lgan uyurilmalar bilan aniqlanadi. [3]

Ko'rilgan tadqiqot ishidan kelib chiqib laminar chegaraviy qatlamni quyidagicha ifodalanadi [4]

$$\frac{\partial}{\partial x}(\rho V) + \frac{\partial}{\partial y}(\rho V) = 0 \quad (1)$$

$$\rho U \frac{\partial U}{\partial x} + \rho V \frac{\partial U}{\partial y} = -\frac{\partial p}{\partial x} + \mu \frac{\partial^2 U}{\partial x^2} \quad (2)$$

$$\rho U s_p \frac{\partial T}{\partial x} + \rho V s_p \frac{\partial T}{\partial y} = \lambda \frac{\partial^2 T}{\partial y^2} \quad (3)$$

$$U_\omega = 0, T = T_\omega (y = 0) \quad (4)$$

$$U = U_\infty, T = T_\infty (y = \infty) \quad (5)$$

Ushbu tenglamalardan quyidagi belgilar qabul qilingan : ρ —issiqlik tashuvchi (suv)ning zichligi ; U, V —Oqim tezligining bo'ylanma va ko'ndalang tashkil etuvchilar; U_ω, U_∞ - kanal devordagi va undan ma'lum bir masofadagi oqim xarorati; T —oqimning xarorati; T_ω, T_∞ -kanal devoridagi va undan masofadagi oqimning harorati; s_p —solishtirma issiqlik sig'imi; λ —issiqlik sig'imi. Bosim va ishqalanish gradiyenti issiqlik uzatilishiga tasirining inobatga olish uchun massaning siqilish qonuni tenglamasini qayta ifodlaymiz.

$$\rho U_\infty S = const \quad (6)$$

$$\rho \frac{\partial U_\infty}{\partial x} + U \frac{\partial S}{\partial y} = 0 \quad (7)$$

$$\frac{\partial U_\infty}{U_\infty \partial x} + \frac{\partial S}{S \partial x} \quad (8)$$

$$S = (a - \delta^*)b \quad (9)$$

Ushbu formulalardan a va b — quvurning balandligi va kengligi. Suv quvurining diffuzor-konfuzorga o'xshashligini inobatga olib va U orqali quvurni ochilishi burchagini belgilab quydagilarga ega bo'lamiz .[5]

$$\frac{x \partial U_\infty}{U_\infty \partial x} = \frac{x dS}{S dS} = \frac{x d(a-b^*)b}{(a-b^*)b dx} = \frac{x}{(a-b^*)} \left[\frac{da}{dx} - \frac{d\delta^*}{dx} \right] \quad (10)$$

$$a = a_0 + x \operatorname{tg} \gamma \quad (11)$$

$$\frac{x \partial U_\infty}{U_\infty \partial x} = \frac{x}{a-b^*} \left(\operatorname{tg} \gamma - \frac{d\delta^*}{dx} \right) \quad (12)$$

$$\frac{x \partial U_\infty}{U_\infty \partial x} = \frac{x}{\partial x(a-b^*)} = \frac{x \operatorname{tg} \gamma}{a-\delta^*} \quad (13)$$

Chegaraviy qatlamning siqib chiqarish qalinligi δ avtomodeli η o'zgarturuvchilari orqali ifodalanadi:

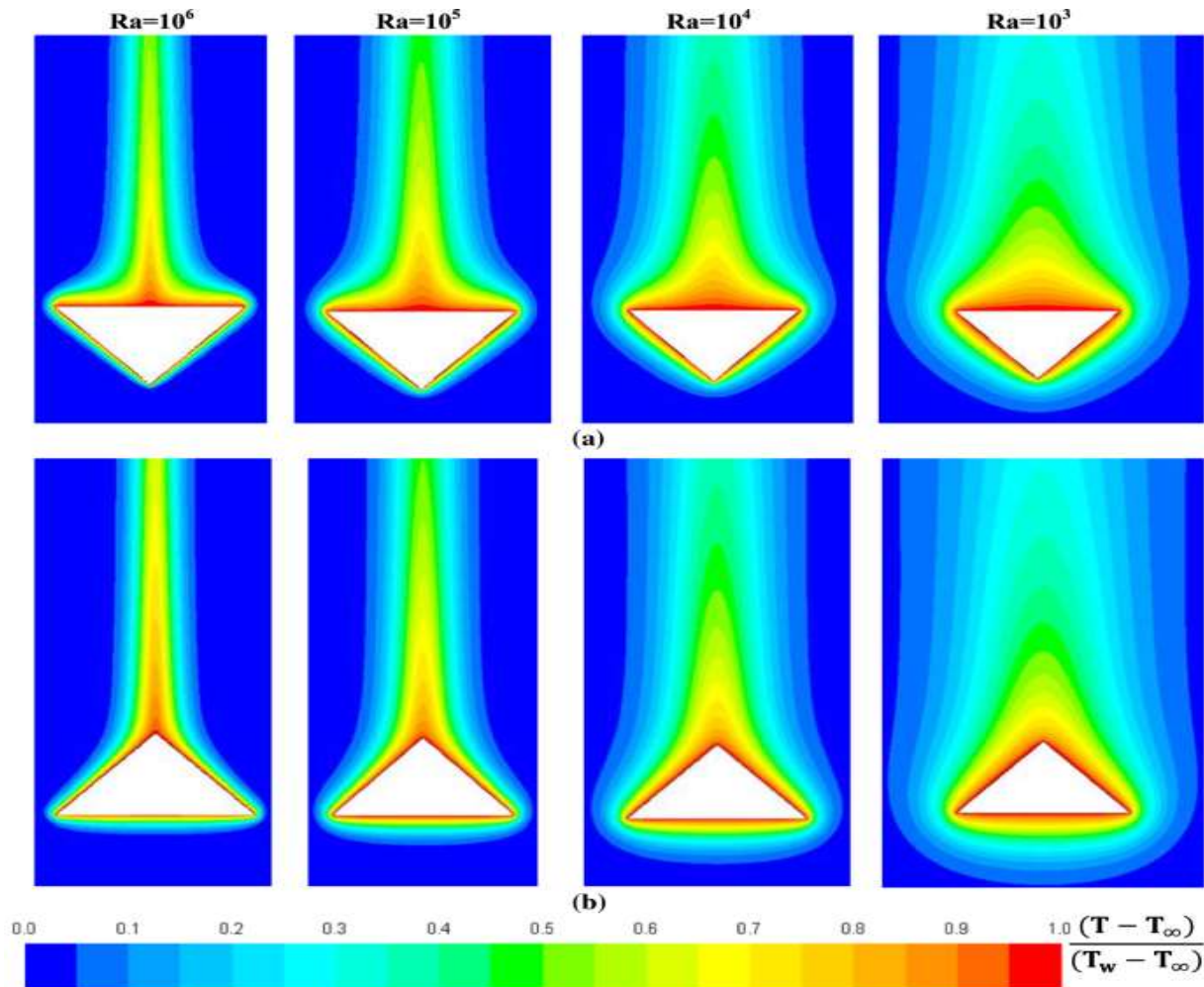
$$\delta^* = \eta \frac{x}{\sqrt{Re}} \quad (14)$$

$$\eta \frac{x \sqrt{Re}}{x} \int_0^y \left(1 - \frac{\rho U}{(\rho U)_\infty} \right) dy \quad (15)$$

$$d\delta^* = \eta \frac{1}{2} \frac{1}{\sqrt{Re}} \quad (16)$$

$$\frac{dP}{dx} = - \left(\frac{x \partial U_\infty}{U_\infty \partial x} \right) = \frac{x \eta \frac{1}{2} \frac{1}{\sqrt{Re}}}{a - \eta \frac{x}{\sqrt{Re}}} = \frac{x \operatorname{tg} \gamma}{(a-\eta) \frac{x}{\sqrt{Re}}} \frac{\frac{1}{2} \eta}{\frac{a \sqrt{Re}}{x} - \eta} \frac{\operatorname{tg} \gamma}{\frac{a \sqrt{Re}}{x} - \eta} \quad (17)$$

Issiqlik almashinuvi va quvurlardagi ishqalanish massalarini yechish uchun diffuzor-konfuzor quvurlardagi bosimga ham bog'liq holda bo'ladi.[6.7.8]



a) teskari oqimli konvektiv issiqlik almashinuvi; b) to'g'ri oqimli issiqlik oqimi
4-rasm. Konussimon yuzalar sirtida konvektiv issiqlik oqimi.

O'rganilgan tadqiqot ishlariga ko'ra qabul qiluvchi qurilmalarida issiqlik tashuvchisining uch turdagi xarakterga bo'lishi mumkin. Uzluksiz, uzilishdan oldingi va uzilishli. Oqim laminar va turbulent bo'lishi mumkin. Chegaraviy qatlam masalasini echish uchun quyidagi usuldan foydalanish mumkin. Quyidagi chetlanishlarni qabul qilamiz; Oqim barqaror va suv siqilmaydigan, oqimning ikki o'lchamli issiqlik almashinuvisiz berilgan erkin shaklli profildagi chegaraviy qatlam masalalarini tarkibiy yechish usullari tenglamasini yechishga asoslanadi.

$$\frac{d\delta^{**}}{dx} + \frac{dV_0}{dx} \frac{\delta^{**}}{V_0} (2 + H) = \frac{\tau_w}{\rho_0 V_0^2} \quad (18)$$

Bu erda δ^{**} - impulsning yo'qotilish qalinligi; δ^* - siqib chiqarish qalinligi; v_0 , ρ_0 - chegaraviy qatlamning tashqi chegarasidagi tezligi va zichligi; $N = \delta^* / \delta^{**}$; τ_w - devordagi ishqalanishi zo'riqishi. Chegaraviy qatlamning profil va tezlik aniq bo'lgan xolda siqib chiqarish qalinligi quyidagi ifodalar orqali aniqlanadi.

$$\delta^* \int_0^\delta \left(1 - \frac{\rho v}{(\rho_0 v_0)}\right) dy \quad (19)$$

- impulsning yo'qotilish qalinligi.

$$\delta^{**} \int_0^\delta \frac{\rho v}{(\rho_0 v_0)} \left(1 - \frac{v}{v_0}\right) dy \quad (20)$$

Impulsilar tenglamsiga uchta noaniq parametrlar bo'lganligi tufayli- δ^{**} , δ^* va τ_w , masalani taqriban echish usuliga ko'ra, bir noma'lumli tenglamaga bir parametrga bog'liq qator profillar va tezliklar orqali. Bunday parametr o'rnida shakl parametri deb ataluvchi φ miqdori taklif etilgan hamda buning natijasida turbulentlikni ichki masshtablari mavjudligi to'g'risidagi nazariy

asoslarga ko'ra chegaraviy qatlamlarni tarkibiy usullarni ishlab chiqishga imkon beradi. [9.10.11.12] Turbulent chegaraviy qatlamning yo'qoluvchi qovushqoqlik bilan hissoqlash usuli ham alohida ahamiyat kasb etadi.[13]

Ushbu usulda qovushqoqlik muxitiga o'lgamlar butun chegaraviy qatlamdagi o'lgamlarga nisbatan tezroq kamayib boradi.

Hulosa: Yangicha usulda ishlab chiqilgan konussimon shakldagi quvurli quyosh suv kollektorida olib borilgan eksperimental tadqiqot ishlarining natijalari asosida kollektorning suv quvurlarida suv oqimining matematik modelini ishlab chiqish talab etiladi.

Adabiyotlar

- [1]. Mohit B. Modeling, analysis, evaluation, selection and experimental investigation of parabolic trough solar collector system, M. Sc. Thesis, Thapar University, 2012. 107 p.
- [2]. Абдукаримов Б.А. , Акромов А.А. , Абдухалилова Ш.Б. Исследование повышения коэффициента полезного действия солнечных воздухонагревателей // Достижения науки и образования научно-методический журнал № 2 (43), 2019. 13-14 с.
- [3]. Харченко Н.В. Системный подход к разработке гелио-теплонасосных систем теплоснабжения. - Киев, 1987. — 158с. Деп. в Информэнерго 01.03.88. № 2639ЭН.
- [4]. Амерханов Р. А., Бутузов В. А., Гарькавый К. Ю. Вопросы теории и инновационных решений при использовании гелиоэнергетических систем// Энергоатомиздат Москва, 2009 г. 150-158 с
6. Вардияшвили А.Б., Теймурханов А.Т., Товарных Г.Н. Приближённый метод определения скорости движения теплоносителя в термосифонной установке // Гелиотехника. - 1991. - № 1. - С.57-61.
- [5]. Попель О.С., Фрид С.Е. Солнечные водонагреватели. Возможности использования в климатических условиях средней полосы России // Теплоэнергетика. - 2001. - №7. - С.44-47.
- [6]. Системы солнечного тепло- и хладоснабжения. Под ред. Сарнацкого Э.В. и Чистовича С.А. - М.: Стройиздат, 1990. - 217 с.
- [7]. Исследовать теплопоступления солнечной радиации и разработать рекомендации по выбору рациональных типов гелиоустановок для целей горячего водоснабжения и отопления в Приморском крае: Отчёт о НИР (заключит.) / Дальневост. НИИ по строительству. Руковод. работы В.П.Рудаков.- № ГР 01.83.0041142, инв. №0286. - 0-008090 - Владивосток, 1985. - 112 с.
- [8]. Андерсон Б. Солнечная энергия (Основы строительного проектирования). - М.: Стройиздат, 1982. - 372 с.
- [9]. Харченко Н.В. Критерии оценки энергетической эффективности гелио-теплонасосных систем теплоснабжения / Киев, инж.-стр. инст. Деп. в УкрНИИТИ 13.04.87. - Киев, 1987. - 160 с.
- [10]. Валов М.И., Зимин Е.Н., Поперечная Е.В., Лазаренко Т.В. Оптимизация режима гелиоустановок как средство повышения их эффективности / Сб. науч. тр. / Моск. энерг.инст. - М., 1986. - № 117. - С.49-55.
- [11]. Рабинович М.Д., Ферт А.Р., Ванжула С.К., Соколов Ю.В. Гидравлические характеристики солнечных коллекторов // Водоснабжение и санитарная техника. - 1988. - №12. - С.16-19.

ACHIEVING ENERGY EFFICIENCY BY ENABLING HYBRID AND GRID- CONNECTED SOLAR PLANTS TO OPERATE IN PARALLEL IN ISOLATED MODE

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Annotatsiya. Fotovoltaik (PV) panellar va akkumulyatorlarni saqlashni o'z ichiga olgan quyosh gibrid tizimi binolarni elektr energiyasi bilan ta'minlaydi. Uzluksiz ishlashni yaxshilash uchun tarmoqqa ulangan PV tizimini (batareyani) quyosh gibridini sozlash bilan birlashtirish alohida elektr energiyasini ishlab chiqarishni kuchaytirishi mumkin. Biroq, ko'plab gibridli / tarmoqdan tashqari invertorlar tarmoqdan tashqari rejimda batareyani boshqa energiya manbalaridan zaryad qilish qobiliyatiga ega emas. Buni hal qilish uchun aqlli o'lchash va quyosh nurlanishini sezish kombinatsiyasidan foydalangan holda quvvatni qisqartirish boshqaruvchisi taklif etiladi. Ushbu kontroller tarmoqqa ulangan invertning belgilangan

nuqtasini yuk iste'moli va PV quvvatidagi o'zgarishlarga mos ravishda avtomatik ravishda sozlaydi. Quyosh gibrid va tarmoqqa ulangan PV tizimlari o'rtasida orolga tushirish operatsiyalari samaradorligini baholash DIgSILENT PowerFactory dasturidan foydalangan holda vaqt oralig'ida quvvat oqimini tahlil qilishni o'z ichiga oladi. Natijalar shuni ko'rsatadiki, tarmoqqa ulangan PV tizimini quyosh gibrid tizimi bilan birlashtirish, faqat quyosh gibridini o'rnatishga tayanmasdan, batareyaning samaradorligini oshirishi va shu bilan tarmoq kuchlanishining yo'qolishi paytida binolarni uzluksiz elektr ta'minotini kengaytirishi mumkin.

Kalit so'zlar: Tarmoqqa ulangan inverter, gibrid inverter, ajratilagn rejim, quvvatni qisqartirish, quyosh gibrid tizimi

Abstract. The solar hybrid system, comprising photovoltaic (PV) panels and battery storage, offers electricity supply to buildings in both on-grid and off-grid scenarios. To enhance uninterrupted operation, integrating a grid-tied PV system (minus the battery) with the solar hybrid setup can boost power generation during islanding conditions. However, many hybrid on/off-grid inverters lack the ability to charge the battery from other energy sources in off-grid mode. To address this, a power curtailment controller, utilizing a combination of smart metering and solar irradiance sensing, is proposed. This controller automatically adjusts the grid-tied inverter's set-point to match changes in load consumption and PV power. Evaluating the performance of islanding operations between solar hybrid and grid-tied PV systems involves a time-sweep power flow analysis using DIgSILENT PowerFactory software. Results indicate that coupling the grid-tied PV system with the solar hybrid system, rather than relying solely on the solar hybrid setup, can enhance battery efficiency, thereby extending uninterrupted electricity supply to buildings during grid voltage loss.

Keywords: Grid-tied inverter, Hybrid inverter, Islanding operation, Power curtailment, Solar hybrid system

Аннотация. Солнечная гибридная система, состоящая из фотоэлектрических (PV) панелей и аккумуляторных батарей, обеспечивает электроснабжение зданий как в сетевом, так и в автономном режиме. Чтобы повысить бесперебойность работы, интеграция фотоэлектрической системы, подключенной к сети (без батарей), с солнечной гибридной установкой может увеличить выработку электроэнергии в условиях островного режима. Однако многие гибридные инверторы с питанием от сети не имеют возможности заряжать аккумулятор от других источников энергии в автономном режиме. Для решения этой проблемы предлагается контроллер ограничения мощности, использующий комбинацию интеллектуальных измерений и измерения солнечного излучения. Этот контроллер автоматически регулирует уставку сетевого инвертора в соответствии с изменениями потребления нагрузки и фотоэлектрической мощности. Оценка эффективности изолированных операций между солнечными гибридными и сетевыми фотоэлектрическими системами включает анализ потока мощности с временной разверткой с использованием программного обеспечения DIgSILENT PowerFactory. Результаты показывают, что соединение фотоэлектрической системы, подключенной к сети, с солнечной гибридной системой, вместо того, чтобы полагаться исключительно на солнечную гибридную установку, может повысить эффективность батареи, тем самым расширяя бесперебойное электроснабжение зданий во время потери напряжения в сети.

Ключевые слова: сетевой инвертор, гибридный инвертор, изолированный режим, ограничение мощности, солнечная гибридная система.

Introduction

Renewable energy sources like solar photovoltaic (PV) systems, particularly in the kW range, are well-suited for on-site generation in business and industrial buildings. Integrating PV systems offers benefits such as cost savings on electricity and improved power quality, including voltage profiles and reduced power losses. Additionally, a solar hybrid system, combining PV modules and battery storage, can serve as emergency generation akin to an uninterruptible power supply (UPS). Such a system ensures continuous electricity supply during grid voltage loss for specific loads like lifts, air conditioners, and lighting. In a large-scale solar hybrid system (MW range), the PV system and battery energy storage system each have their power converter unit and connect to the electricity system separately. Conversely, in a small-scale solar hybrid system (kW range), PV arrays and battery storage can integrate with the main grid via a solar hybrid on/off-grid inverter, such as the

hybrid PV inverter mentioned in reference [3]. During grid-connected operation, the system functions as a grid-following inverter, while during islanding operation, it acts as a grid-forming inverter to maintain satisfactory voltage and frequency levels. In the event of interruption during the day, the PV array and battery can supply most of the building's loads. However, at night, only the battery can provide power to essential loads due to the absence of supply from the PV array.

One of the challenges of islanding operation is to maintain a constant power balance between power generation and load consumption to prevent deviations in system frequency and voltage from nominal values. Additionally, many solar hybrid on/off-grid inverters on the market cannot absorb power from other energy sources when operating in off-grid mode. In buildings equipped with a mix of solar hybrid on/off-grid inverters and conventional grid-tied PV inverters, the grid-tied PV inverter is typically disconnected when islanding operation is detected. Consequently, the solar hybrid on/off-grid inverter becomes the sole device capable of supplying electricity to specific loads, thus preventing excess power injection from PV generation, especially during midday. However, this basic strategy has a drawback in terms of generation loss.

To mitigate surplus injection during off-grid operation, the grid-tied PV inverter can remain connected to the isolated system if the power curtailment controller is activated.

The grid-tied PV inverter typically operates as a grid-following type, wherein PV generation harnesses energy from the sun using a maximum power extraction algorithm. Additionally, the PV power can be regulated by reducing the injected power from the PV array below the maximum power point. Active power can be limited either when a predetermined power production set-point is reached or when either frequency or voltage exceeds specified values. Many modern grid-tied PV inverters already incorporate power limiting functionality within their product, such as the smart grid-tied inverter mentioned in reference [7].

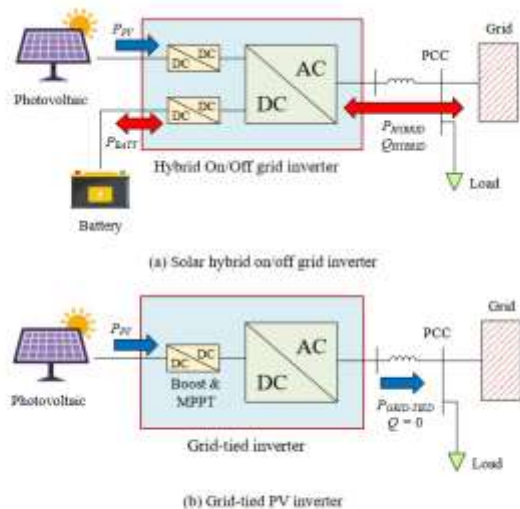


Fig. 1. The configurations of solar hybrid on/off grid inverter and grid-tied PV inverter.

Power curtailment finds application in various scenarios, such as zero energy exporting, where the PV system only generates enough power for local loads without injecting excess power into the distribution network; mitigating over-voltage and thermal violations; addressing grid congestion issues in power system planning; enhancing power quality and providing frequency control in microgrid systems with multiple energy sources; improving control in distributed power systems for multi-microgrid networks; and bolstering distribution system resilience.

This paper introduces a specific power curtailment controller designed to enable the grid-tied PV inverter to contribute to power generation during islanding operations,

alongside the solar hybrid on/off-grid inverter. To prevent excessive PV feeding, the output power of the grid-tied PV inverter is regulated using information from a smart meter and solar irradiance sensor. The objective of this study is to showcase the effectiveness of this power limiting controller in increasing power supply from the grid-tied PV inverter, potentially reducing the need for discharging power from the battery. Consequently, this strategy could aid in maintaining electricity supply continuity following a loss from the main grid.

2. GRID-TIED PV INVERTER AND SOLAR HYBRID ON-OFF GRID INVERTER

The configurations of the grid-tied PV inverter and the solar hybrid on/off-grid inverter are depicted in Figure 1. A PV panel-side DC/DC converter maximizes power capture from solar irradiance using the maximum power point tracking (MPPT) algorithm. In the case of the solar hybrid on/off-

grid inverter, it incorporates a battery-side DC/DC converter to regulate energy storage charging and discharging.

During grid-connected operation, the grid-side DC/AC inverter converts DC power from PV arrays/battery into AC power and synchronizes it with the distribution system through grid interface control. Besides supplying power to the network, the grid-side inverter of the solar hybrid system can also absorb power from the main grid for battery charging.

In the event of a grid voltage loss, the typical grid-tied PV inverter is designed to disconnect via anti-islanding protection mechanisms. However, the solar hybrid on/off-grid inverter remains connected and transitions from grid-following mode to grid-forming mode to establish voltage and frequency references during islanding operation.

Utilizing decentralized control principles [17], [18], droop control methods are implemented to regulate the active and reactive power of the solar hybrid on/off-grid inverter. These methods involve frequency-droop and voltage-droop characteristics, expressed as follows:

$$P = -\frac{(f - f_0)}{K_P} \text{ and } Q = -\frac{(V - V_0)}{K_Q} \quad (1)$$

In the provided equations, P and Q represent the active and reactive powers generated by the inverter, respectively, while K_P and K_Q denote the droop gains. The parameters f_0 and V_0 represent the reference frequency and voltage, respectively.

During off-grid operation of the solar hybrid on/off-grid inverter, the PV array initially supplies power to the load and then charges the battery. If there is surplus PV power remaining after fulfilling the load requirements, it will be directed towards charging the battery first, as illustrated in Figure 2 (a). However, it's important to note that the battery cannot be charged by other energy sources such as a diesel generator until the PV power becomes unavailable. On the contrary, if the PV power is insufficient to meet the load demand (refer to Figure 2 (b)), the battery will discharge power to supply the load. However, in a scenario where the battery power is depleted and the PV

power is insufficient to support the load, the load will be disconnected, resulting in an interruption in electricity supply and a potential outage event. Only PV power can replenish the battery charge, as depicted in Figure 2 (c). Once the battery reaches an acceptable charge level, the load can be reconnected, and the solar hybrid system resumes supplying power to the load.

The grid-tied inverter can be resynchronized with the isolated system once the solar hybrid on/off-grid inverter adequately supplies the load. However, it is crucial to ensure that the support provided by the other inverter does not lead to excess power injection into the system, which could cause abrupt changes in system voltage and frequency. Therefore, implementing active power curtailment control is essential to allow the grid-tied inverter to participate in islanding operations safely.

3. POWER CURTAILMENT CONTROLLER

The introduced power curtailment controller is designed to prevent the grid-tied PV inverter from exceeding its power output during islanding operation. This controller operates in real-time and relies on a combination of load consumption and PV output information from the solar hybrid on/off-grid inverter. Load consumption is measured using a high-

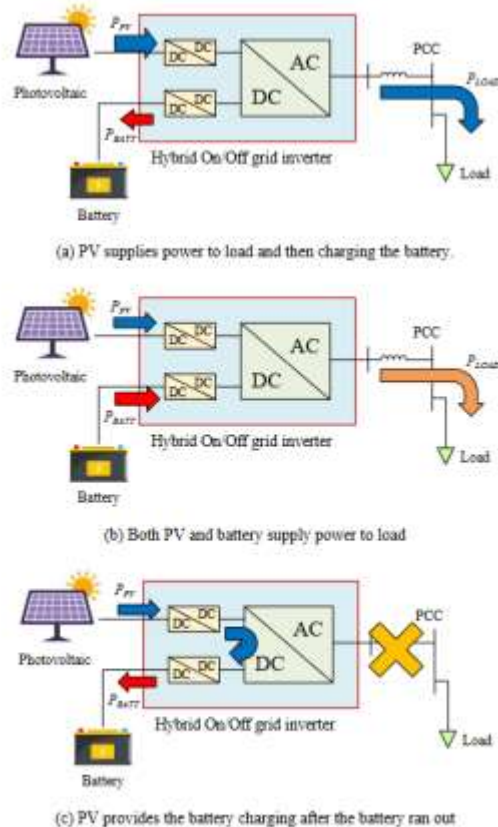


Fig. 2. The operation of solar hybrid on/off grid inverter in off-grid mode.

resolution power meter, while the PV output of the solar hybrid on/off-grid inverter is estimated based on solar irradiance measured by a pyranometer. Real-time data is transmitted to the power curtailment controller via a communication system, enabling it to determine the appropriate PV output for the grid-tied inverter, as illustrated in Figure 3.

In Figure 3, the PV power of the solar hybrid on/off-grid inverter ($P_{PV,hybrid}$) is calculated using the measured solar irradiance. This calculation is adapted from the PVWatts manual [19], neglecting the impact on cell temperature. The predicted PV output, predicted PVP, at time t , can be expressed as follows;

$$P_{PV}^{predict}(t) = \eta \frac{I_{tr}(t)}{1000} P_{dc0} \quad (2).$$

In equation (2), I_{tr} represents solar irradiance (W/m^2), and P_{dc0} is the nameplate DC rating of the PV array. η denotes the DC-to-AC derate factor. If the sizes of the PV arrays of the solar hybrid system and the grid-tied PV system are known, their PV outputs can be predicted using equation (2) and expressed in terms of predict hybrid predict $P_{Vhybrid}$ and predict grid tied predict $P_{Vgrid\ tied}$ respectively.

After the grid-tied inverter resynchronizes with the islanded electricity system, the PV power will only supply to the system when the load consumption, $LOAD_{PLOAD}$, is higher than predict hybrid predict $P_{Vhybrid}$. Therefore, the grid-tied inverter's PV power set-point, grid-tied PPV , grid-tied, is considered as:

In real-world operation, a small amount of power from the battery may be necessary to maintain power balance due to errors in prediction and some power losses, such as line losses, which are not accounted for in equations (2) to (5).

$$\Delta P(t) = P_{LOAD}(t) - P_{PV,hybrid}^{predict}(t) \quad (3)$$

If $P_{LOAD}(t) > P_{PV,hybrid}^{predict}(t)$, then

$$P_{PV,grid-tied}(t) = \begin{cases} \Delta P & \text{if } \Delta P < P_{PV,grid-tied}^{predict} \\ P_{PV,grid-tied}^{predict} & \text{else} \end{cases} \quad (4)$$

Otherwise,

$$P_{PV,grid-tied}(t) = 0 \quad (5)$$

The performance of the proposed power curtailment algorithm is evaluated through computer simulations in the DIgSILENT PowerFactory environment. The test system comprises a building equipped with a solar hybrid on/off-grid inverter and a grid-tied PV inverter. Measured data from Thailand is utilized to generate daily load and solar irradiance profiles. To demonstrate the potential of PV power curtailment, an islanding condition is created by disconnecting the building from the main grid during periods when aggregated PV generation exceeds load usage. The PV power outputs of the solar hybrid on/off-grid inverter and the grid-tied PV inverter, as well as the battery condition, are analyzed in two scenarios: 1) without including the grid-tied PV inverter in the islanding operation, and 2) with the grid-tied PV inverter, including power curtailment, in the islanding operation.

4. TEST SYSTEM

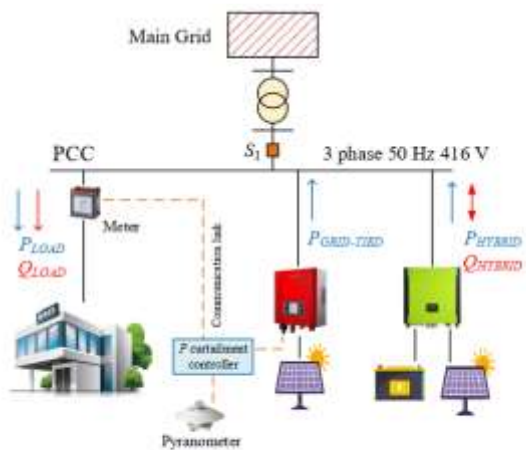


Fig. 3. The proposed active power curtailment controller.

The experimental building depicted in Figure 3 is connected to a three-phase 416 V, 50 Hz distribution network, serving as the test system for this study. Within this system, a 5 kW/5 kWh solar hybrid system and a 5 kW grid-tied PV system have been installed. Both systems utilize 5 kVA inverters, and the battery is of a gel type.

The daily load demand characteristic is illustrated in Figure 4, while the 24-hour solar irradiance and power generation of the 5 kW PV system, calculated using equation (2), are displayed in Figure 5.

During grid-connected operation, both the solar hybrid on/off-grid inverter and the grid-tied PV inverter operate at the maximum power point to supply as much PV power into the system as

possible, maintaining a constant power factor of 1.0. Reverse power flow, caused by PV generation exceeding load demand, is permitted in this test. In on-grid mode, the battery is maintained at 80% state of charge (SoC) at all times and can be charged either by PV power from the solar hybrid on/off inverter or by absorbing power from the grid.

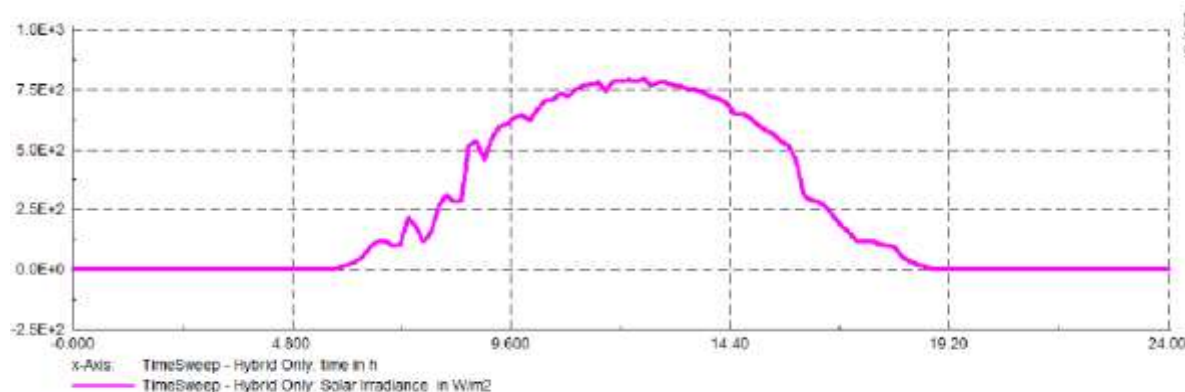
The main grid is disconnected by opening switch S1, assuming a loss of grid supply between 9:00 a.m. and 5:00 p.m. on the same day, resulting in 11 hours of islanding condition. During islanding operation, the solar hybrid on/off-grid inverter operates in grid-forming mode to regulate system frequency and voltage. To maintain power balance, the solar hybrid system adjusts to changes in active and reactive powers consumed by the load. PV array primarily generates power, and the battery supplies power only when the PV generation is insufficient.

In off-grid mode, the battery cannot be charged from other energy sources if the solar hybrid on/off-grid inverter is supplying electricity to the islanded system. The solar hybrid system supports electricity supply until the battery SoC drops below 20%, after which the solar hybrid on/off-grid inverter is disconnected from the system, resulting in no electricity supply to the load. The solar hybrid on/off-grid inverter resumes supplying electricity once the battery is charged by PV power until the SoC reaches 80%.

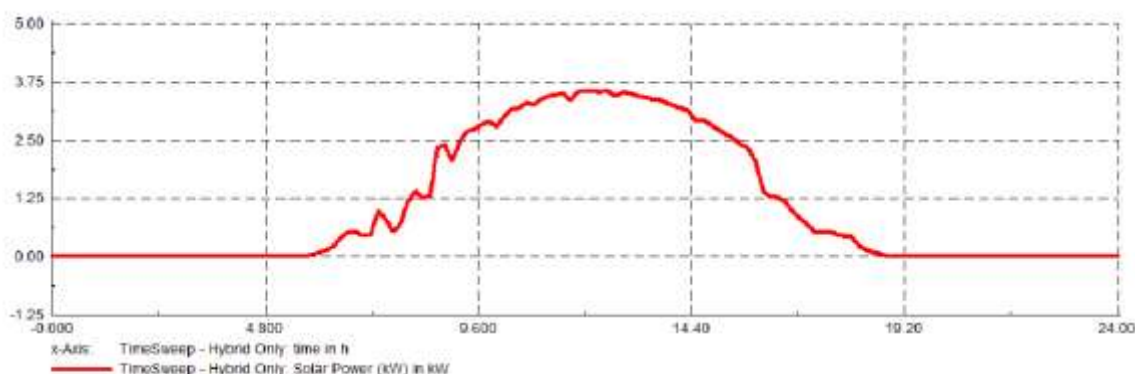
Upon reconnecting the main grid by closing switch S1, both the solar hybrid on/off-grid inverter and the grid-tied PV inverter return to grid-following mode, supplying PV power at the maximum power point. If the battery level is below 80%, it will be charged rapidly. To charge the gel-type battery within a reasonable time, it is recommended that the charging power be maintained between 15% and 25% of the battery capacity.



Fig. 4. Daily load profile.



(a) Solar irradiance (W/m²).



(b) Predicted PV power (5 kW capacity).

Fig. 5. Daily solar irradiance and predicted power generated by 5 kW PV system.

5. Simulation Results and Discussion

The performance of islanding operation is analyzed under two scenarios: one with the support of the grid-tied PV system and another without it, using 24-hour time-sweep load flow calculations in the DiGSILENT PowerFactory software, with simulations conducted at 1-minute time steps. Here are the results and discussions.

5.1 Case 1: Grid-Tied PV System Excluded from Islanding Operation

In this scenario, only the solar hybrid on/off-grid inverter supports electricity supply during the loss of grid voltage.

After islanding is detected at 9:00 a.m., the grid-tied PV system is disconnected, and the solar hybrid system smoothly supplies electricity power to the load. However, after 5 hours and 24 minutes, when the battery level drops below 20% at 2:30 p.m., the solar hybrid system is disconnected, resulting in an interruption of electricity supply.

During the period of battery charging by PV power until the SoC reaches 80%, there is a loss of electricity supply for about 1 hour. Once the solar hybrid system resumes supplying electricity at 3:30 p.m., the grid-tied PV system re-supplies power to the grid after reconnection at 5:00 p.m. Due to the SoC being below 80%, the battery is then charged at a rate of 1 kW (20% of battery capacity). Active power flows back through the solar hybrid on/off-grid inverter during the on-grid charging process.

5.2 Case 2: Grid-Tied PV System with Power Curtailment Control Included in Islanding Operation

The power curtailment controller, as described in Section 3, adjusts the output of the grid-tied PV system to maintain the balance between power generation and load consumption effectively.

With support from the grid-tied PV system, the battery provides a lower power supply compared to Case 1. It's also observed that the battery increases the discharging power significantly after 4:00 p.m., as PV generation drops dramatically due to low solar irradiance in the late afternoon.

Integration of the grid-tied PV inverter with the solar hybrid on/off-grid inverter for islanding operation enhances uninterrupted operation in the building. With a small amount of power supplied by the battery, islanding operation can provide continued electricity supply without interruption. Additionally, the battery's SoC is slightly reduced since only about 25% of its capacity is utilized during the loss of grid voltage.

The proposed power curtailment controller aims to automatically adjust the power set-point in the power limiting function present in many commercial grid-tied PV inverters. This adjustment balances PV generation with load demand during off-grid conditions. It's observed that utilizing load consumption and solar irradiance information for power limiting control, similar to the usage of P/f droop controller, can effectively prevent surplus PV feeding in isolated systems. Consequently, system frequency and voltage can be maintained within statutory limits. However, it's crucial for the controller, measuring instruments, and communication system to be sufficiently

fast to handle rapid variations in load demand and solar irradiation. Additionally, a safety margin should be considered, ensuring that the power output of the grid-connected PV inverter remains lower than the predicted value in equation (4) to prevent excess PV injection.

6. Conclusion

The study demonstrates that a specific power curtailment controller, combining smart meter and solar irradiance sensor, enables collaboration between the grid-tied PV inverter and the solar hybrid on/off-grid inverter in the event of a main grid loss. Simulation results indicate that the proposed active power controller effectively adjusts the output power of the grid-tied PV inverter to avoid exceeding PV generation during islanding operation. The adoption of a grid-connected PV inverter with suggested power limiting control can enhance PV generation while reducing reliance on the battery, particularly during daylight hours. Consequently, this approach can prolong uninterrupted operation of the building when energy from the main grid is unavailable.

ACKNOWLEDGEMENT

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References

- [1]. Sadeghian H. and Z. Wang. 2018. Decentralized demand side management with rooftop PV in residential distribution network. In 2018 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT), Washington, DC, pp. 1-5.
- [2]. Johnston D., 2013. Islanding Operation of Electrical Systems in Buildings. *Energy and Power Engineering* 5(4B): 198-201.
- [3]. MPP Solar Inc. , User Manual: MPI Hybrid 10 kW PV Inverter.
- [4]. Goqo Z. and I.E. Davidson. 2018. A Review of Grid Tied PV Generation on LV Distribution Networks. In 2018 IEEE PES/IAS PowerAfrica, pp. 907-912.
- [5]. Seuss J., Reno M.J., Lave M., Broderick R.J. and Grijalva S., 2016. Advanced inverter controls to dispatch distributed PV systems. In IEEE 43rd Photovoltaic Specialists Conference (PVSC), pp. 1387-1392.
- [6]. Oureilidis K.O., Bakirtzis E.A. and Demoulias C.S., 2016. Frequency-based control of islanded micro grid with renewable energy sources and energy storage. *Journal of Modern Power Systems and Clean Energy* 4(1): 54-62.
- [7]. GoodWe Technologies Co. Ltd. Smart DT (SDT) Series Solar Inverter. [Online serial], Retrieved September 1, 2021 from the World Wide Web: <https://en.goodwe.com/sdt-g2-series-three-phase-commercial-rooftop-solar-inverter>.
- [8]. Benabderazik A. Power limitation and zero export. Elum Energy. [Online serial], Retrieved May 14, 2021 from the World Wide Web: <https://elumenergy.com/en/2020/12/22/power-limitation-and-zero-export/>.
- [9]. Zhang Z., Mishra Y., Dou C., Yue D., Zhang B. and Tian Y.-C., 2020. Steady-state voltage regulation with reduced photovoltaic power curtailment. *IEEE Journal of Photovoltaics* 10(6): 1853-1863.
- [10]. Azzolini J.A., Reno M.J., Gurule N.S. and Horowitz K.A.W., 2021. Evaluating distributed PV curtailment using quasi-static time-series simulations. *IEEE Open Access Journal of Power and Energy* 8: 365-376.
- [11]. Bolgaryn R., Wang Z., Scheidler A., and Braun M., 2021. Active power curtailment in power system planning. *IEEE Open Access Journal of Power and Energy* 8: 399-408.
- [12]. Qi J. and T. Tsuji. 2017. Frequency control in micro grid based on inertial response of wind turbine and curtailment of photovoltaic generation. In 2017 IEEE Manchester Power Tech , pp. 1-6.
- [13]. Qi G., Chen A., and Chen J., 2017. Improved control strategy of interlinking converters with synchronous generator characteristic in islanded hybrid AC/DC microgrid. *CPSS Transactions on Power Electronics and Applications* 2(2): 149-158.
- [14]. Naderi Y., Sims R., Coffele F. and Xu L., 2020. Active power quality management in smart microgrids. In CIRED 2020 Berlin Workshop (CIRED 2020): 262-265.
- [15]. Dou X., Xu P., Hu Q., Sheng W., Quan X., Wu Z., and Xu B., 2018. A Distributed Voltage Control Strategy for Multi-Microgrid Active Distribution Networks Considering Economy and Response Speed. *IEEE Access*, vol. 6, pp. 31259-31268.

- [16]. Schneider K.P., Laval S., Hansen J., Melton R. B., Ponder L., Fox L., Hart J., Hambrick J., Buckner M., Baggu M., Prabakar K., Manjrekar M., Essakiappan S., Tolbert L. M. and Liu Y. and Dong J., Zhu L., Smallwood A., Jayantilal A., Irwin C. and Yuan G., 2019. A Distributed Power System Control Architecture for Improved Distribution System Resiliency. IEEE Access, vol. 7, pp. 9957-9970.
- [17]. De Araujo L.S., Alonso A.M.D.S., and Brandao D.I., 2020. Decentralized control of voltage- and current-controlled converters based on AC bus signaling for autonomous microgrids. IEEE Access, 8: 202075-202089.
- [18]. Hou X., Sun Y., Lu J., Zhang X., Koh L. H., Su M. and Guerrero J. M., 2018. Distributed Hierarchical Control of AC Microgrid Operating in Grid-Connected, Islanded and Their Transition Modes. IEEE Access, vol. 6, pp. 77388-77401.
- [19]. Dobos A.P., 2014. Technical report the PVWATTS version 5 manual. National Renewable Energy Laboratory (NREL) of U.S. p.1 – 123.
- [20]. Mastervolt. Charging batteries. [Online serial], Retrieved May 14, 2021 from the World WideWeb: [https://www.mastervolt.com/chargingbatteries/#:~:text=Charge%20current,to%20the%2015%](https://www.mastervolt.com/chargingbatteries/#:~:text=Charge%20current,to%20the%2015%20)

KUCHLANISHNI KONTAKTSIZ AVTOMATIK ROSTLOVCHI KUCH TRANSFORMATORIDA O‘TKAZILGAN EKSPERIMENT TADQIQOT NATIJALARINI TAHLIL QILISH

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(Qabul qilindi 12.04.2024 y.)

Аннотация. В статье рассмотрен экспериментальный образец силового трансформатора автоматического бесконтактного выпрямителя напряжения 2,5 кВА, разработанный в прототипе для использования в сетях электропередачи 6-10 кв., и результаты экспериментальных исследований, полученные на модели, разработанной с использованием пакета MATLAB-SIMULINK, анализируются. Полученные результаты сопоставлены и оценены с результатами эксперимента, полученными на лабораторной сборке LD DIDACTIC на трехфазном силовом трансформаторе в рабочем состоянии общей мощностью 350 кВА. Производительность силового трансформатора.

Ключевые слова: линии электропередачи, силовые трансформаторы, отклонение напряжения, энергоэффективность, показатели надежности, схемы подключения силовых трансформаторов, векторные диаграммы напряжения

Annotatsiya. Maqolada 6-10 kV kuchlanishli elektr uzatish tarmoqlarida foydalanish uchun prototip shaklida ishlab chiqilgan quvvati 2,5 kVA kuchlanishni avtomatik kontaktless rostlovchi kuch transformatorining tajriba namunasi hamda Matlab -simulink dasturi yordamida ishlab chiqilgan simulatsion modelida olingan eksperiment tadqiqot natijalari tahlil qilingan. Olingan natijalar umumiy quvvati 350 kVA lik ishchi holatdagi uch fazali kuch transformatorida LD DIDACTIC laboratoriya jamlanmasi orqali olingan eksperiment tadqiqot natijalariga solishtirilgan va baholangan. Olingan natijalar asosida kuch transformatorining ishlash samaradorligini baholash imkoniyati mavjud.

Tayanch iboralar: elektr uzatish liniyalari, kuch transformatorlari, kuchlanish og‘ishi, enegiya samaradorlik, ishonchlilik ko‘rsatgichlari, kuch transformatorining ulanish sxemalari, kuchlanishlarning vektor diagrammalari.

Abstract. In the article, the experimental sample of the 2.5 kVA automatic non-contact voltage rectifier power transformer developed in the form of a prototype for use in 6-10 kV power transmission networks and the experimental research results obtained in the simulation model developed using the MATLAB-Simulink program are analyzed. The obtained results were compared and evaluated with the results of the experiment obtained through the LD DIDACTIC laboratory assembly on a three-phase power transformer in working condition with a total capacity of 350 kVA. Based on the obtained results, it is possible to evaluate the performance of the power transformer.

Key words: power lines, power transformers, voltage deviation, energy efficiency, reliability indicators, power transformer connection diagrams, voltage vector diagrams.

Kirish. Dunyoda elektr energiyasi har bir soxaning ajralmas muhim qismi hisoblanib, unga bo'lgan talabning tobora ortib borishi, elektr iste'molchilarga uzluksiz va sifatli elektr energiyasi bilan ta'minlash alohida ahamiyat kasb etadi [1]. Elektr energiyasining sifati asosan chastotasi, kuchlanish og'ishi, kuchlanishning nosimmetriyasi va nosinusoidallik darajasi bilan aniqlanadi [2]. Agar, elektr energiyasining sifat ko'rsatkichlari xalqaro GOST 32144-2013 standartlari me'yoriy hujjatlarida belgilangan miqdordan o'zgarsa, elektr energiyasini yetkazib berishdagi texnik-iqtisodiy ko'rsatkichlarning yomonlashuviga olib keladi. Ushbu yetkazilgan zararni kamaytirish va elektr energiyasini iste'molchilarga yetkazib berishda texnik iqtisodiy jihatdan samaradorlikni oshirish maqsadida elektr energiyasining sifat ko'rsatkichlari optimal holatda bo'lishi talab etiladi [3].

Yangi avlod texnologiyalari va elektr iste'molchilari hisobiga elektr uzatish tarmoqlarda turli qarshiliklarga ega bo'lgan yuklamalarning o'rinishi energiya sistemasining turg'unligiga hamda elektr qurilmalarining ishlash ishonchliligi va samaradorligiga salbiy ta'sir o'tkazadi [4]. Uzoq masofali elektr uzatish liniyalaridagi quvvat yo'qotishlar va turli toifadagi qarshiliklarning elektr ta'minotiga ulanishi hamda kuch transformatoridan uzoqda joylashgan iste'molchilarda kuchlanish GOST talab etilgan chegaradan og'ishi holatlarini keltirib chiqaradi [5].

Kuchlanish og'ishini rostlashda bugun bir qancha usullar va qurilmalardan keng foydalanilmoqda. Misol uchun 6-10 kV kuchlanishdagi kuch transformatorlarda bugungi kunda foydalanilayotgan rostlash qurilmalarini ko'rib chiqaylik. Kuch transformatorlarida kuchlanishni rostlash elektr ta'minoti tizimida kuchlanishni barqarorlashtirishning eng keng tarqalgan usullaridan biridir [6]. Kuchlanishni rostlash mexanik yoki kontaktsiz qurilmalar yordamida kuch transformatorlarining birlamchi yoki ikkilamchi o'rashlari sonini o'zgartirishdan iborat [7]. Kuch transformatorlarida a) oddiy transformatorga rejimdan tashqari (ПБВ) yoki b) murakkab yuk (ПНН)dagi kuchlanishni sozlash moslamalari kiradi [8]. Ushbu turdagi rostlash qurilmalarida bir qancha kamchiliklar mavjud [9].

Ushbu maqolada 6-10 kV kuchlanishli kuch transformatorlarda kuchlanishni avtomatik kontaktsiz rostlash imkoniyati mavjud kuch transformatorlarda o'tkazilgan eksperiment tadqiqot natijalarini tahlil qilingan va uning energo-samaradorligi hamda ishonchliligi baholangan.

Ishning maqsadi: 6-10 kV kuchlanishli elektr tarmoqlari uchun mo'ljallangan kuchlanishni avtomatik kontaktsiz rostlovchi kuch transformatorida olingan eksperiment tadqiqot natijalarini tahlil qilish.

Materiallar va usullari: Yuqoridagi kalit so'zlar uchun Google academy, eLIBRARY, ELSEVER, ResearchGate va boshqa qidiruv tizimlarining resurslaridan foydalangan holda so'nggi 20 yil davomida bajarilgan ilmiy tadqiqot ishlari ko'rib chiqildi. Ushbu tahliliy tadqiqot uchun kuch transformatorida kuchlanish og'ishini rostlashning an'anaviy va zamonaviy usullari ularning afzallik va kamchiliklari bilan bog'liq bo'lgan maqolalardan foydalanilgan.

Eksperiment va olingan natijalarning tahlili.

Umumiy quvvati 2,5 kVA bo'lgan kuchlanishni kontaktsiz avtomatik rostlovchi uch fazali transformatorning Matlab-Simulink dasturida yig'ilgan modeli hamda tajriba namunasida olingan eksperiment tadqiqot natijalari bir biriga solishtirildi:

- Matlab simulink dasturiy ta'minoti orqali yig'ilgan umumiy quvvati 2.5 kVA bo'lgan uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatorining imitatsion modelida nazariy tadqiqotlar olib borildi.

- Bundan tashqari ilmiy tadqiqot ishining uchinchi bobida umumiy quvvati 350 W bo'lgan bir fazali va 2.5 kVA quvvatga ega uch fazali kuchlanishni kontaktsiz rostlovchi kuch transformatorlarining fizik modeli ishlab chiqildi.

ЭНЕРГЕТИКА, ЭЛЕКТРОТЕХНИКА, ЭЛЕКТРОННЫЕ ПРИБОРЫ И ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ

Eksperiment tadqiqotda LD DIDACTIC laboratoriya jamlanmasida yordamida uch fazali kuchlanishni avtomatik kontaktsiz rostlovchi transformatorning A fazasida yuqori kirish kuchlanishlari xalqaro GOST standartlarida belgilangan kuchlanishning nominal qiymatidan +10%, +5 %, 0, -5%, +10 % ga o'zgartirilgan holatga keltirildi. Transformatorni salt ishlash rejimida yuqori kuchlanishli tomonida kuchlanish og'ishi holatida eksperiment tadqiqot o'tkazildi (1-jadval).

1-jadval

Bir fazali kuchlanishni avtomatik kontaktsiz rostlovchi kuch transformatorining salt ishlash rejimida
chiquvchi kuchlanishlar miqdori

Yuqori chulg'amda kuchlanish og'ishi, δU_1 (%)	Kiruvchi kuchlanish U_1 (V)	Chiquvchi kuchlanish U_2 (V)	Quyi chulg'amda kuchlanish og'ishi, δU_2 (%)	Kuchlanishning faza burchagi φ_{UA} (°)
-10	198	218,5	-0,68	179,9
-5	209	219,6	-0,18	179,9
0	220	220,1	0,045	179,9
5	231	221,8	0,81	179,9
10	242	223,1	1,409	179,9

2-jadval

Ulanish sxemasi Δ/Y_0 bo'lgan uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatorida o'tkazilgan eksperiment tadqiqot natijalari

Taj. №	Transformatorlar	Yuqori chulg'amda kuchlanish og'ishi δU_1 %	Kiruvchi kuchlanish U (V)	Yuklamalar	Chiquvchi kuchlanish U (V)	Chiquvchi kuchlanish og'ishi δU_2 %	Faza burchagi φ (°)
1	T_A	-10	196,9	R=500 Om	217,6	-1,09	-179,4
	T_B		196,8	L=6 Gn	218,16	-2,2	59,8
	T_C		197	L=6 Gn C=16 μ F	217,3	-1,22	-61,6
2	T_A	-5	209,5	R=500 Om	218,9	-0,5	-179,3
	T_B		210,1	L=6 Gn	217,21	-1,27	60,8
	T_C		209,6	L=6 Gn C=16 μ F	218,1	-0,86	-59,4
3	T_A	0	220,4	R=500 Om	220,9	0	-179,3
	T_B		220,6	L=6 Gn	221,1	0,45	59,4
	T_C		219,8	L=6 Gn C=16 μ F	218,9	-0,5	-60,6
4	T_A	5	231,6	R=500 Om	221,6	0,72	-179,2
	T_B		231,5	L=6 Gn	220,1	0,045	60,8
	T_C		232	L=6 Gn C=16 μ F	220,1	0,045	-59,4
5	T_A	10	241	P=40 W	223,01	1,37	-179,5
	T_B		242,9	L=6 Gn	223,5	1,6	59,4
	T_C		243,01	L=6 Gn C=16 μ F	223,1	1,4	-60,6

Ekspluatatsiya jarayonidagi kuch transformatorlarda kuchlanishni kontaktsiz avtomatik rostlashni joriy etish maqsadida umumiy quvvati 2,5 kVA bo'lgan uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatori ishlab chiqildi. Ushbu uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatorlarga fazalar bo'yicha mos aktiv, induktiv, induktiv-sig'im xarakterdagi yuklamalar ulandi va transformatorning chiqish kuchlanishlari miqdori aniqlandi (2-jadval).

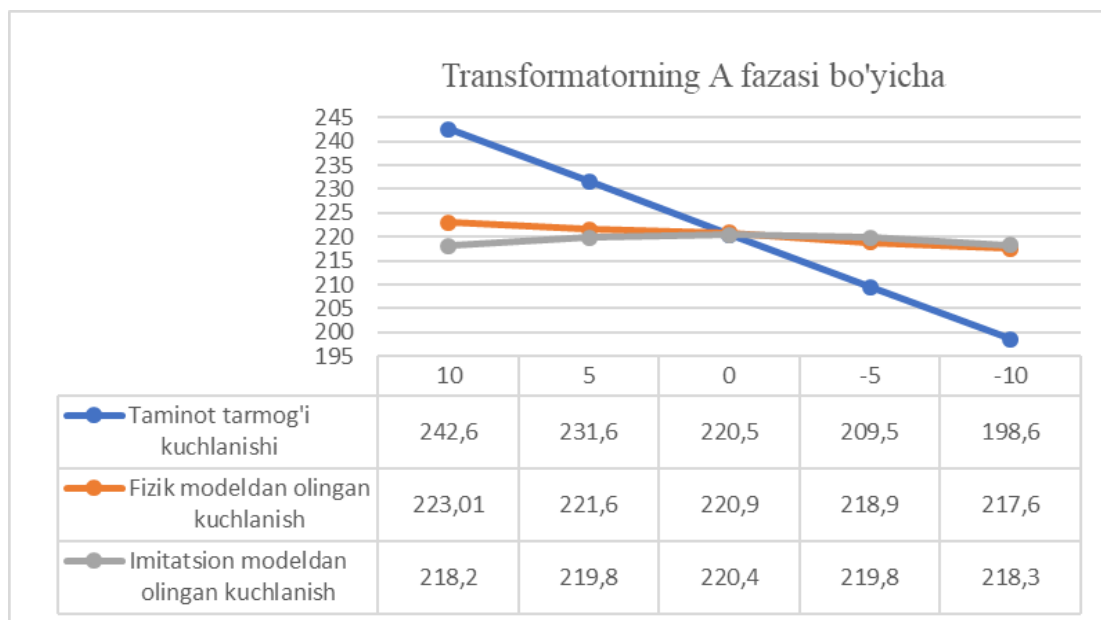
Transformatorning yuqori kirish qismidagi kuchlanish miqdorlari 198.6 V, 209.5 V, 220.5, 231.6 V va 242.6 V holatlari uchun aktiv, induktiv, induktiv-sig'im, aralash turdagi yuklamalarda hamda salt ishlash rejimida nazariy hamda eksperiment tadqiqotlar o'tkazildi. Kuchlanishni kontaktsiz rostlash usuli yordamida transformatorning chiqish kuchlanishlari qiymati har bir faza kesimida aniqlandi.

Yuqoridagi nazariy hamda amaliy tadqiqot natijalarini bir-biriga solishtirish asosida quyidagi holatlar aniqlandi:

1. Uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatori imitatsion modelining A fazasiga aktiv quvvati aktiv qarshiligi 500 Om bo'lgan yuklama ulanganda, transformatorning ikkilamchi chulg'amidagi kuchlanishning miqdori nazariy tadqiqot orqali aniqlandi.

To'la quvvati 2.5 kVA bo'lgan fizik modelning A fazasida aktiv qarshiligi 500 Om bo'lgan yuklama mavjud holatda uning ikkilamchi chiqish kuchlanishi miqdori eksperiment tadqiqot orqali aniqlandi. Nazariy va eksperimental tadqiqotlar bo'yicha aniqlangan chiqish kuchlanishlari qiymatlari o'zaro solishtirildi va ikkilamchi chulg'amda hosil bo'layotgan kuchlanishning nominalga nisbatan og'ish qiymatlari hisoblandi (1-rasm).

Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining A fazasida o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining farqi 0,78% ni tashkil etmoqda.



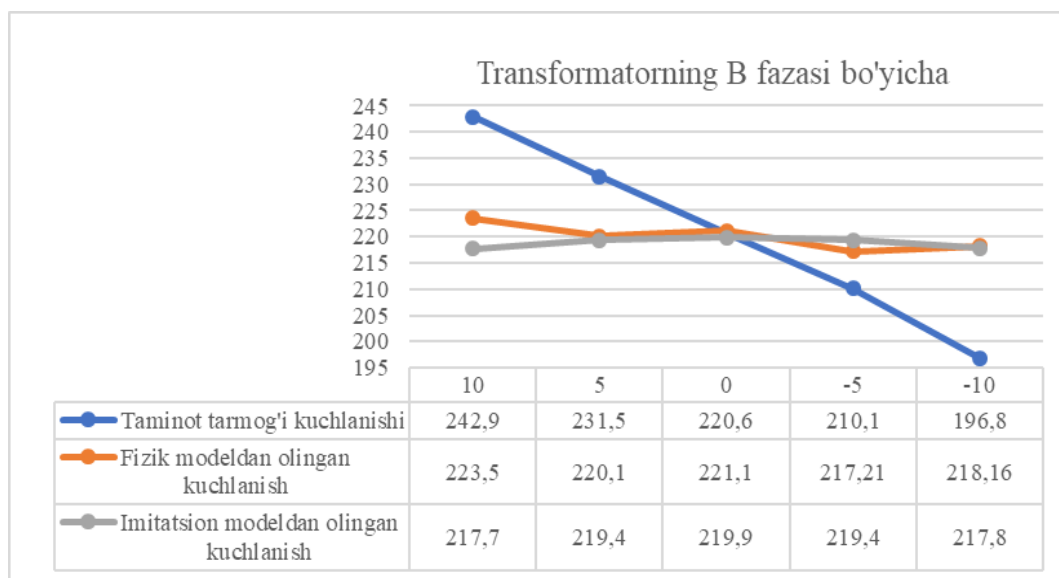
1-rasm. Uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatorining A fazasidagi nazariy va eksperimental tadqiqotlar natijalarni solishtirish grafigi.

2. Matlab simulink dasturi yordamida yaratilgan uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatori imitatsion modelining B fazasiga induktivligi $L=6$ Gn bo'lgan induktiv xarakterdagi yuklama ulanganda, transformatorning ikkilamchi chulg'amidagi kuchlanishning miqdori nazariy tadqiqot orqali aniqlandi.

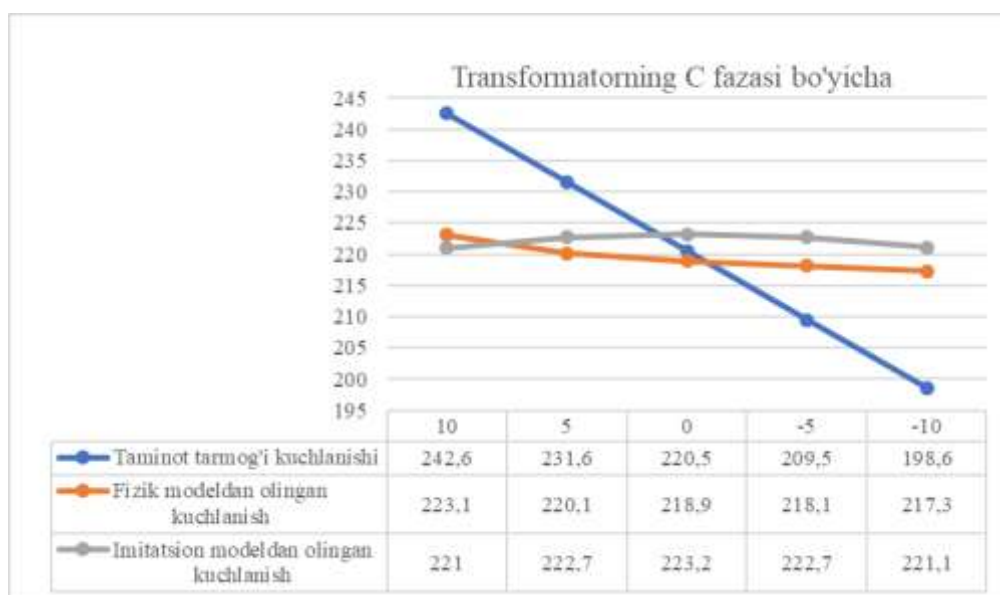
Fizik modelning B fazasida induktivligi $L=6$ Gn bo'lgan induktiv xarakterdagi yuklama mavjud holatda, uning ikkilamchi chiqish kuchlanishi miqdori eksperiment tadqiqot orqali aniqlandi hamda nazariy tadqiqot bo'yicha aniqlangan chiqish kuchlanish qiymatiga solishtirildi (2-rasm).

Kuch transformatorida kuchlanishni kontaktless avtomatik rostlash usuli orqali kuch transformatorining B fazasida o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining o'tacha nisbiy xatoligi 0,93 % ni tashkil qildi.

3. Imitatsion modelning C fazasiga induktivligi $L=6$ Gn hamda sig'imi $C=16$ mkF bo'lgan induktiv-sig'im xarakterli yuklama ulanganda, transformatorning ikkilamchi chulg'amidagi kuchlanishning miqdori nazariy tadqiqot orqali aniqlandi.



2-rasm. Uch fazali kuchlanishni kontaktless avtomatik rostlovchi kuch transformatorining B fazasidagi nazariy va eksperimental tadqiqotlar natijalarni solishtirish grafigi



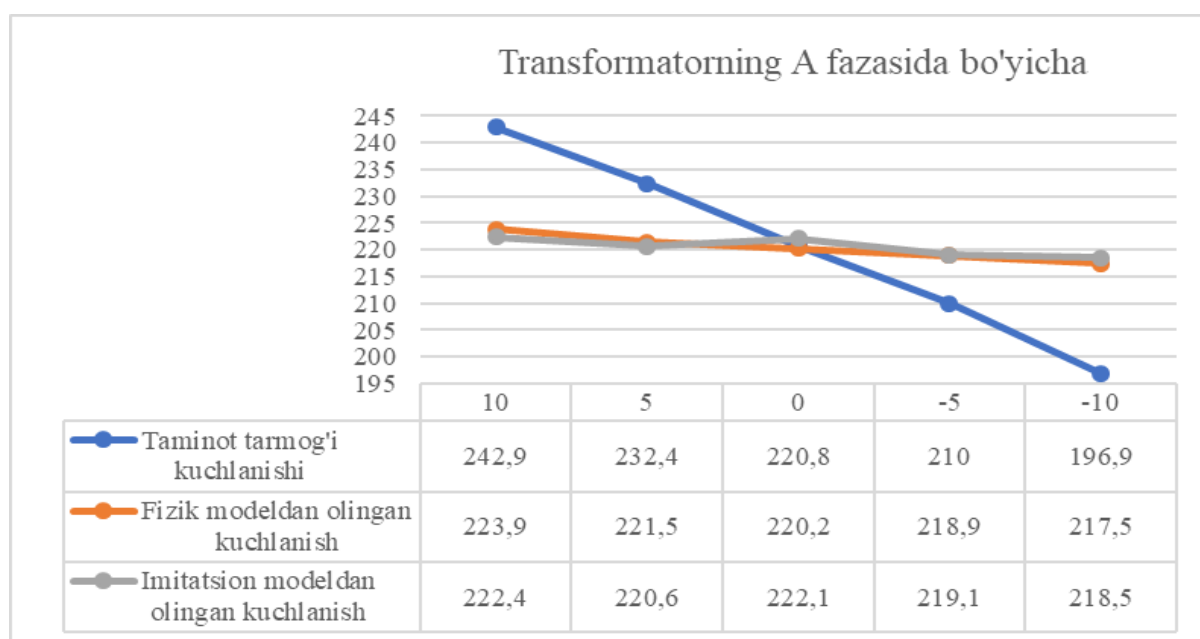
3-rasm. Uch fazali kuchlanishni kontaktless avtomatik rostlovchi kuch transformatorining C fazasidagi nazariy va eksperimental tadqiqotlar natijalarni solishtirish grafigi.

Fizik modelning B fazasida induktivligi $L=6$ Gn hamda sig'imi $C=16$ μ F bo'lgan yuklama mavjud holatda, uning ikkilamchi chiqish kuchlanishi miqdori eksperiment tadqiqot orqali aniqlandi hamda nazariy tadqiqot bo'yicha aniqlangan chiqish kuchlanish qiymatiga solishtirildi (3-rasm).

Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining C fazasida o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining o'tacha nisbiy xatoligi 1.6 % ni tashkil etdi.

4. Uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatori imitatsion modelining A fazasiga aktiv qarshiligi $R=500$ Om, induktivligi $L=6$ Gn va sig'imi $C=16$ mkF bo'lgan aralash qarshilikka ega yuklama ulanganda, transformatorning ikkilamchi chulg'amidagi kuchlanishning miqdori nazariy tadqiqot orqali aniqlandi.

Fizik modelning A fazasiga aktiv qarshiligi $R=500$ Om, induktivligi $L=6$ Gn va sig'imi $C=16$ mkF bo'lgan aralash qarshilikli yuklama mavjud holatda, uning ikkilamchi chiqish kuchlanishi miqdori eksperiment tadqiqot orqali aniqlandi hamda nazariy tadqiqot bo'yicha aniqlangan chiqish kuchlanish qiymatiga solishtirildi (4-rasm).

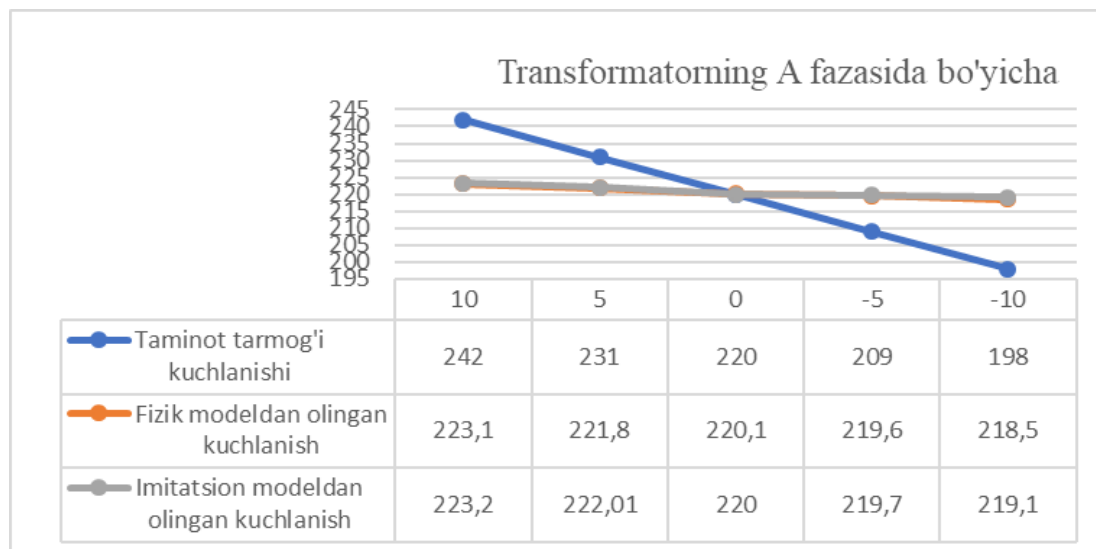


4-rasm. Uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatorining A fazasidagi nazariy va eksperimental tadqiqotlar natijalarni solishtirish grafigi (aralash qarshilikli yuklama ulanganda holat uchun).

Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining A fazasida aralash qarshilikli yuklama mavjud holatda o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining o'rtacha nisbiy xatoligi 0.43 % ni tashkil etishi hisoblandi.

5. Imitatsion modelning salt ishlash rejimi uchun, transformatorning ikkilamchi chulg'ami A fazasidagi kuchlanishning miqdori nazariy tadqiqot orqali aniqlandi.

Kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatorining fizik modelining salt ishlash rejimidagi A fazasidagi ikkilamchi chiqish kuchlanishi miqdori eksperiment tadqiqot orqali aniqlandi hamda nazariy tadqiqot bo'yicha aniqlangan chiqish kuchlanish qiymatiga solishtirildi (5-rasm).



5-rasm. Uch fazali kuchlanishni kontaktsiz avtomatik rostlovchi kuch transformatorining A fazasidagi nazariy va eksperimental tadqiqotlar natijalarni solishtirish grafigi (salt ishlash rejimida).

Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining salt ishlash rejimi uchun o'tkazilgan nazariy hamda amaliy tadqiqotlaridagi A faza kuchlanish qiymatlarining o'tacha nisbiy xatoligi 0.1 % ni tashkil etdi.

Xulosa.

O'tkazilgan eksperiment tadqiqot natijalaridan quyidagi xulosalarga kelish mumkin:

- Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining A fazasida o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining farqi 0,78% ni tashkil etdi.

- Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining B fazasida o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining o'tacha nisbiy xatoligi 0,93 % ni tashkil qildi.

- Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining C fazasida o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining o'tacha nisbiy xatoligi 1.6 % ni tashkil etdi.

- Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining A fazasida aralash qarshilikli yuklama mavjud holatda o'tkazilgan nazariy hamda amaliy tadqiqotlardagi kuchlanish qiymatlarining o'rtacha nisbiy xatoligi 0.43 % ni tashkil etishi hisoblandi.

- Kuch transformatorida kuchlanishni kontaktsiz avtomatik rostlash usuli orqali kuch transformatorining salt ishlash rejimi uchun o'tkazilgan nazariy hamda amaliy tadqiqotlaridagi A faza kuchlanish qiymatlarining o'tacha nisbiy xatoligi 0.1 % ni tashkil etdi.

- Umuman olganda, nazariy hamda eksperimental tadqiqotlarni solishtirish natijasida o'zaro o'rtacha nisbiy xatoligi 2% dan kam ekanligi aniqlandi.

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Adabiyotlar:

- [1]. De Oliveira Quevedo J. et al. Analysis and design of an electronic on-load tap changer distribution transformer for automatic voltage regulation //IEEE Transactions on Industrial Electronics. – 2016. – T. 64. – №. 1. – С. 883-894.
- [2]. Рудик П.С. Качество электрической энергии, способы повышения напряжения//Актуальные проблемы энергетики, 2021, С.230-235

- [3]. Yulin Zhao, Shoutian Dong, Qi Zhao, etc. Research on Automatic Regulating for Distribution Transformer by Solid-State Relays, 2010 Asia-Pacific Power and Energy Engineering Conference, pp.1–4, 2010.
- [4]. M.X. Qobilov, Z.Z. To'yichiyev. Elektr energiyasining sifat ko'rsatkichlari va kuchlanish og'ishi holatlarining tahlili// Scientific-technical journal of Fergana polytechnic institute.2023.-1 (27/1). -B.35-38.
- [5]. Zad B., Lobry J., Improvement of on-load tap changer performance in voltage regulation of MV distribution systems with DG units using D-STATCOM, Electricity Distribution (CIRED 2013), 22nd International Conference and Exhibition, Stockholm, Sweden, pp. (0496) 1-5 (2013).
- [6]. Robert M., Bertrand P., Pierre F., Dilipkumar Sh., Rajendra A., Transformer Design Principles (Second Edition), Taylor and Francis Group LLC (2010).
- [7]. M.X. Qobilov, Z.Z. To'yichiyev. Elektr uzatish tarmoqlarida kuchlanish og'ishining ekspluatatsiyadagi kuch transformatorlari ishrejimiga ta'siri// Ilm-fan va innovatsion rivojlanish.2024.-1 (1/7). -B.67-75.
- [8]. Кобиллов М.Х. и др. Исследование влияния отклонений напряжения в сетях электропередачи на режимы работы электрических устройств// VIII Международная научно-практическая конф. «Энергетика и энергосбережение: теория и практика»: Тез. док.-К.,2023. 428-434 б
- [9]. Kobilov M.X. and etc. The influence of voltage deviation in electrical networks to the reliability of power transformers with the voltage 6-10/0.4 kV// III-Международная научно-техническая конференция «Актуальные проблемы система электроснабжения» Тез. док.-Т.,2023. 36-39 б.

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**ИССИҚЛИК НАСОСИ ЁРДАМИДА ҚАТТИҚ МАИШИЙ ЧИҚИНДИ (ҚМЧ)
ПОЛИГОНЛАРИДА БИОГАЗНИ УТИЛИЗАЦИЯ ҚИЛИШ**

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Аннотация. Мақолада қаттиқ маиший чиқиндиларни йўқ қилиш учун полигонларнинг хавфсиз ишлаши муаммолари кўриб чиқилди. Қаттиқ маиший чиқиндиларни полигонларда сақлаш хавфи, хусусан, органик моддаларни биокимёвий йўқ қилиш пайтида ҳосил бўлган биогазнинг атмосферага назоратсиз эмиссияси билан боғлиқ. Биогазни қазиб олиш ва утилизация қилишнинг технологик жараёнини таъкил этиш бу муаммони ҳал қилади. Полигонларда биогаздан самарали фойдаланиш ва кейинчалик уни иситиш ва электр энергиясини ишлаб чиқариш учун ёқилги сифатида ишлатишнинг комплекс муаммолари кўриб чиқилди. Иссиқлик насосларидан фойдаланиш технологик схемасининг умумий энергия самарадорлигини ошириш имконини беради. Биогаз энергиясидан фойдаланиш технологиясининг энергия самарадорлигини оширишнинг муқобил усуллари ҳам кўриб чиқилди.

Калит сўзлар: биогаз, полигон, чиқиндилар, иссиқлик алмашув аппарати, иссиқлик насоси, қайта тикланадиган энергия манбаи, буглатувчи, компрессор, конденсатор.

Аннотация. В статье рассмотрены проблемы безопасной эксплуатации полигонов для захоронения твердых бытовых отходов. Опасность при хранении твердых бытовых отходов на полигонах связана, в частности, с неконтролируемой эмиссией в атмосферу биогаза, генерируемого при биохимической деструкции органического вещества. Организация технологического процесса добычи и утилизации биогаза позволит решить эту проблему. Рассматриваются комплексные проблемы эффективной утилизации биогаза на полигонах и использования его затем в качестве топлива для теплофикации и получения электрической энергии. Применение тепловых насосов позволяет повысить общую энергетическую эффективность технологической схемы. Также рассматриваются альтернативные способы повышения энергетической эффективности технологии утилизации энергии биогаза.

Ключевые слова: биогаз, полигон, отходы, теплообменный аппарат, тепловой насос, возобновляемый источник энергии, испаритель, компрессор, конденсатор.

Abstract. In article problems of safe operation of ranges for a burial place of a firm household waste are considered. Danger at storage of a firm household waste on ranges, in particular, is connected with the uncontrollable issue of biogas connected with biological decomposition of organic substance. Production process of extraction and biogas recycling on ranges will allow to solve this problem. Complex problems of effective recycling of biogas as fuel on ranges for the purpose of central heating and reception of electric energy are considered. Application of thermal pumps allows to raise the general power efficiency of the technological scheme. Alternative ways of increase of power efficiency of technology of recycling of energy of biogas are considered also.

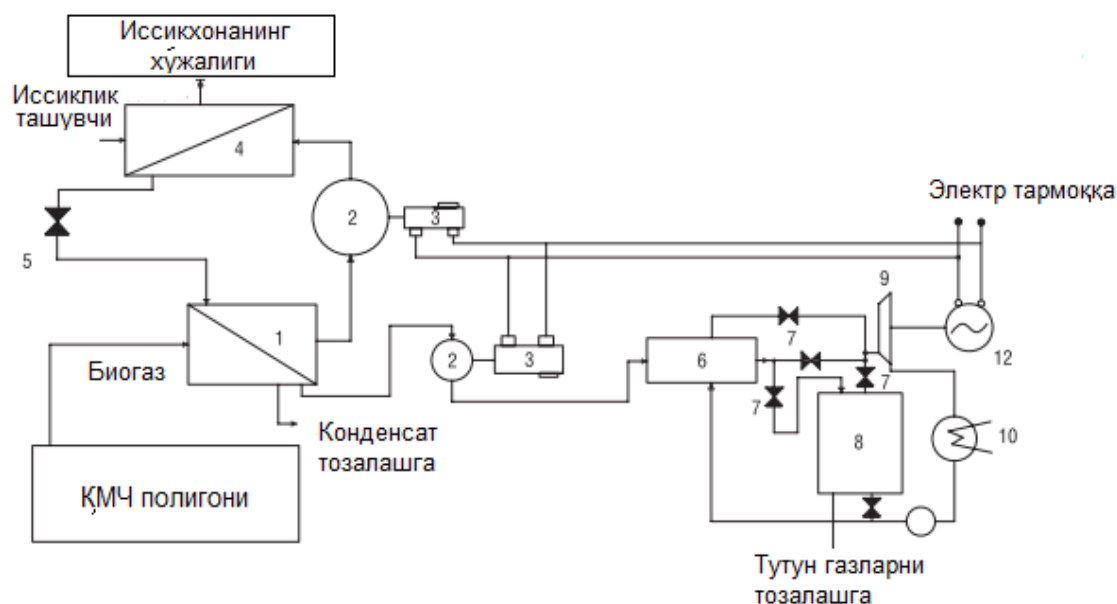
Key words: biogas, ground, wastes, heat-exchange, thermal pump, renewable energy source, evaporator, compressor, condenser.

Қаттиқ маиший чиқинди (ҚМЧ) ларни жойлаштириш учун полигонларда биогазнинг назоратсиз ишлаб чиқарилиши жиддий экологик муаммо ҳисобланади.

ҚМЧ таркибида атмосфера кислороди этарли даражада таъминланмаган полигонларнинг чуқур қатламларида анаэроб биоферментацияга дучор бўлган 30% га яқин органик чиқиндилар мавжуд [1]. Бир тонна ҚМЧ 200-300 м³ гача биогаз ишлаб чиқаришга қодир [4].

Биогаз-бу иссиқхона газлари аралашмаси: тахминан 30-40% карбонат ангидрид (CO₂) ва 60-70% метан (CH₄) [1].

Замонавий турар-жойларда қаттиқ маиший чиқиндиларнинг тўпланиши ҳажми жуда катта: Ўзбекистонда ҳар бир шаҳар аҳолисига йилига тахминан 600 кг [4]. Шундай қилиб, атиги бир йил ичида сайёрада тўпланган ҚМЧ массаси атмосферага бир неча юз миллиард куб метргача иссиқхона газларининг назоратсиз эмиссияси манбаи бўлиши мумкин [2]. Полигонларга кўплаб ҚМЧ дан биогаз 30 йил давомида органик моддаларнинг биокимёвий анаэроб парчаланиш жараёнида ҳосил бўлиши мумкин [2].



1-расм. Қайта тикланадиган энергия манбаи сифатида биогаз полигонидан фойдаланиш учун ўрнатиш схемаси: 1, 4 – иссиқлик алмашинувчилари; 2 – компрессор; 3 – электр мотор; 5 – газ клапан; 6 – ёниш камераси; 7 – клапан; 8 – иссиқлик алмаштиргич-регенератор; 9 – буғ турбинаси; 10 – конденсатор; 11 – насос; 12 – генератор.

Уфқлар остида жойлашган кўмилган ҚМЧ дан чиқиндихона юзасига кириб борадиган биогаз кўпинча полигонлардаги ёнғинларнинг сабаби ҳисобланади. Ушбу ёнғинлар атмосферанинг тутун газлари билан иккиламчи ифлосланиш манбалари бўлиб, улар кўпинча ўз таркибида жуда захарли таркибий қисмларни ўз ичига олади, улар чиқиндиларнинг бир қисми бўлган сунъий полимерларнинг ёниши ёки термал парчаланиш маҳсулотлари

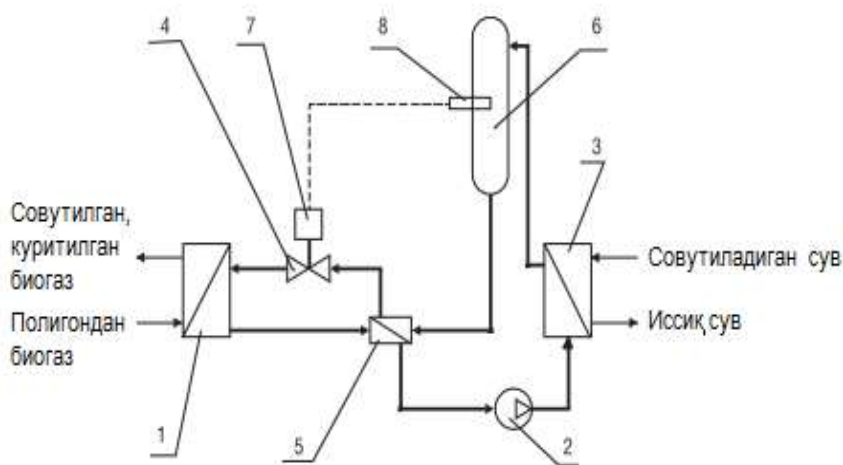
ҳисобланади. Бундан ташқари, ҳаво кислороди (O_2) ва биогазнинг метан (CH_4) аралашмалари (ҳаво билан аралашмадаги ҳажмнинг тахминан 15%) ёпиқ ҳажмларда портловчи ҳисобланади. Шундай қилиб, полигон газини ишлаб чиқариш ва утилизация қилишни ривожлантириш нафақат муқобил энергия манбаларини олиш йўналишида, балки табиий муҳитни муҳофаза қилиш нуктаи назаридан ҳам долзарбдир.

Мақолада органик моддалар бўлган ҚМЧ фракцияларидан махсус жиҳозланган полигонда ҳосил бўладиган биогаз энергиясидан анаэроб биоферментация жараёнларида комплекс фойдаланиш лойиҳаси кўриб чиқилади [1]. Олинган биогазни утилизация қилиш учун ўрнатиш схемаси 1-расмда кўрсатилган.

Полигон ҳосил бўлган биогазни қазиб олиш ва утилизация қилиш учун жиҳозланиши мумкин. Битта қудуқдан вақт бирлигида олинадиган биогазнинг ўртача миқдори $15 \text{ м}^3/\text{соат}$, маълум иссиқлик қувватини олиш учун зарур бўлган биогаз ҳажмларини олиш учун зарур бўлган қудуқлар сони эса 45 бирлик деб қабул қилинади [1].

Янгийўл шаҳрида режалаштирилган полигон қудуқларидан тўпланган биогазнинг ҳарорати $25-40^\circ\text{C}$, намлиги 20 г/м^3 гача. Бу усулда олинадиган биогаз ҳажми $645 \text{ м}^3/\text{соат}$ ни ташкил қилади [3]. Ишлаб чиқарилган биогаз чиқиндихона филтратларининг сингдирилган буғлари билан ифлосланган ва шунинг учун утилизация қилишдан олдин тозаланиши керак, масалан, буғларнинг конденсацияси билан совутиш орқали амалга оширилиши мумкин. Бундай ҳолда, биогазнинг умумий дренажи ҳам мавжуд.

Мақолада биогазни совутиш ва қуриштириш жараёнида олинган иссиқликдан фойдаланиш учун иссиқлик насосларидан фойдаланиш кўриб чиқилади [3]. Такдим этилган фойдаланиш схемасига мувофиқ (1-расм) биогаз иссиқлик насосли совутгич бўлган 1-иссиқлик алмаштиргичда совутилади.



2-расм. Буғ сиқиш иссиқлик насосининг технологик схемаси:
1 – буғлатгич; 2 – компрессор; 3 – конденсатор; 4 – ростлайдиган дроссел воситаси; 5 – рекуператив иссиқлик алмаштиргич; 6 – қабул қилувчи; 7 – бошқарув блоки; 8 – датчик.

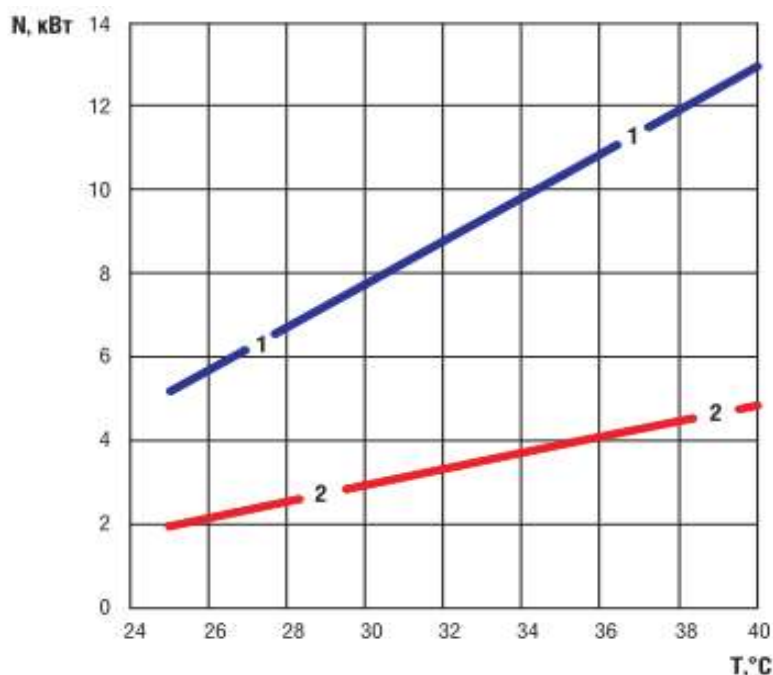
Бунда буғлар конденсацияланади ва биогаз қуриштирилади, шундан сўнг у қувур линияси тизими орқали ёниш камерасига 6, сўнгра буғ турбинасига 9, электр энергиясини ишлаб чиқариш ёки иссиқлик алмаштиргич-регенераторда 8, иссиқликни сақлаш учун берилади ва юқори юклаш режимида ишлатилади [5].

Оқава сув оқимлари, чиқинди газлар ва бошқалардан олинган паст потенциал иссиқлик энергиясини иссиқлик насослари ёрдамида ўзгартириш, ва ҳосил бўлган юқори потенциал иссиқликни иситиш мақсадида фойдаланиш, чиқиндилардан иссиқлик энергиясининг иккиламчи манбаларини жалб қилиш ва шу билан қазиб олинадиган ёқилғи сарфини камайитириш имконини беради.

2-расмда буғ сиқиш иссиқлик насосининг технологик схемаси келтирилган. Ушбу схемада комбинацияланган иссиқлик насосидан фойдаланиш бўйича тадқиқотларнинг баъзи натижалари келтирилган [4]. Мақолада ишлайдиган суюқликнинг тескари буғ сиқиш термодинамик циклида ишлайдиган иссиқлик насоси курилмасидан фойдаланиш кўриб чиқилади, у ўзининг ҳолатини ўзгартириб, ёпиқ контурда айланади: 1-буғлатгич – 5-рекуператив иссиқлик алмаштиргич – 2-компрессор – 3-конденсатор – 6-қабул қилувчи – 5-рекуператив иссиқлик алмаштиргич – 4-ростлайдиган дроссел воситаси – 1-буғлатгич.

Олинган иссиқлик энергиясини иситиш учун ишлатиш мумкин: иссиқ сув олиш; иситиш ва бошқалар.

Амалга оширилган ҳисоб-китобларнинг баъзи натижалари график кўринишида 3- ва 4-расмларда келтирилган бўлиб, улар полигондан келадиган биогаз ҳароратининг ошиши билан иссиқлик насоси циклининг иссиқлик чиқиши ва қувват сарфини мунтазам равишда оширишни кўрсатади.



3-расм. Иссиқлик насоси компрессорининг қўзғатувчи валидаги фойдали қувватнинг биогаз ҳароратига боғлиқлиги графиклари:

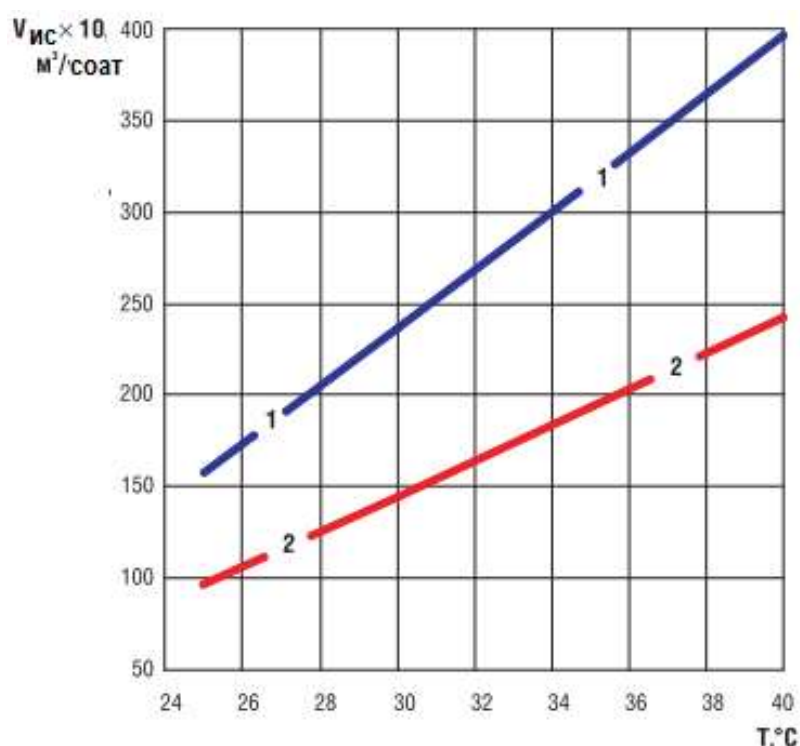
- 1-1- график конденсация ҳарорати $T_2=95^{\circ}\text{C}$ га тўғри келади;
- 2-2- график конденсация ҳарорати $T_2=65^{\circ}\text{C}$ га тўғри келади;

Конденсация ҳароратининг ошиши билан қувват ва иссиқлик ишлаб чиқаришнинг ўсиши янада кучаяди. Шуни таъкидлаш керакки, 65°C дан 95°C гача бўлган ишчи суюқликнинг конденсацияланиш ҳароратидаги техник параметрлар кўрсатилган эгри чизиқлар орасидаги майдонда тақдим этилган графикларга киритилган қийматлар оралиғида. Ушбу конденсация ҳарорати олинган иссиқ сувнинг қуйидаги ҳароратига мос келади: 60°C ва 90°C .

Иш параметрларини ўзгартириш соҳасидаги иссиқлик насосининг иситиш қуввати 5 кВт дан 21 кВт гача ўзгариб туради. Олинган иссиқ сув миқдори 100 л/соат дан 400 л/соат гача. Машинанинг оғирлиги ва ўлчамлари параметрларини аниқлайдиган иссиқлик насоси компрессорининг волуметрик ишлаши иш параметрлари $20\text{ м}^3/\text{соат}$ дан $100\text{ м}^3/\text{соат}$ оралиғида. Компрессорнинг ҳаракатлантирувчи кучи 2 кВт дан 13 кВт оралиғида жойлашган [4].

Лойиҳалаштирилган полигон учун иссиқлик насосини ўрнатишнинг ҳисобланган техник параметрлари стандарт кичик буғ совутгич машиналарининг параметрларига мос

келади, бу эса лойиҳани техник амалга оширишда оммавий ишлаб чиқарилган ускуналарни танлашга имкон беради. Амалга оширилган моделлаштириш натижалари, шунингдек, юқори самарадорлик кўрсаткичларига эга бўлган энергия комбинацияланган цикли энергия ишлаб чиқариш қурилмасида биогазнинг иссиқлик қийматидан фойдаланиш лойиҳасини амалга ошириш шарти билан ўрганилаётган режимлар оралиғида энергия тежайдиган иссиқлик насосларини иситишни амалга ошириш имкониятини асослайди. Кўриб чиқиладиган схеманинг энергия самарадорлигини оширишнинг баъзи йўналишлари қизиқиш уйғотиши мумкин, масалан, компрессор тўғридан-тўғри газ ички ёниш двигатели ёки газ турбинали двигател ёрдамида бошқариш мумкин. Шунингдек муқобил энергия ривожланишининг замонавий ёндашувларига тўлиқ мос келадиган муқобил қайта тикланадиган энергия манбаларидан, масалан, шамол электр стансияларидан фойдаланишнинг юқори самарасини қайд этиш мумкин [5].



4-рассм. Иссиқ сув учун иссиқлик насосининг ишлашининг биогаз ҳароратига боғлиқлик графиклари:

- 1-1- график конденсация ҳарорати $T_2=95^{\circ}\text{C}$ га тўғри келади;
- 2-2- график конденсация ҳарорати $T_2=65^{\circ}\text{C}$ га тўғри келади;

Кўриб чиқиладиган иссиқлик энергиясини қўллашга муқобил бўлган чиқинди газидан фойдаланишнинг қизиқарли йўналиши, шунингдек, унинг автомобил ёқилғиси сифатида ишлатилиши ҳамдир, бу эса қазиб олинadиган ёқилғилар истеъмолини тизимли равишда камайтириш дастурларини амалга оширишда муҳим аҳамиятга эга. Эффект уни энергия жиҳатидан эквивалент ҳажмдаги муқобил ёқилғи билан алмаштириш орқали эришилади. Чиқинди газидан ички ёнув двигателлари учун ёқилғи сифатида фойдаланиш масаласи техник-иқтисодий асослашни талаб қилиши мумкин, чунки ҳосил бўлган биогазни керакли сифатга эришиш учун қўшимча тозалаш ва тайёрлашдан ўтиши керак. Масалан, биогазни намлик ва карбонат ангидрид каби сифатини пасайтирадиган аралашмалардан тозалаш керак, кейин уни сиқиш ёки суюлтириш керак. Бунга жалб қилинган техник ва иқтисодий ресурсларни утилизация қилишнинг бошқа усуллари харажатлари билан солиштириш керак.

Хулосалар

1. Полигон газларини назорат остида ишлаб чиқариш ва утилизация қилиш замонавий

каттиқ майишй чиқиндилар полигонларининг ишлашида экологик хавфни камайтиришнинг ягона йўли.

2.Полигонда электр ва иссиқлик энергияси ишлаб чиқариш учун биогаздан фойдаланиш самарадорлиги тасдиқланди.

3.Иситиш учун иссиқлик насос қурилмаларини ишлатишда кўриб чиқиладиган технологиянинг энергия самарадорлигини ошириш шартлари аниқланди.

4.Чиқиндилардан ёки иккиламчи иссиқлик энергиясининг паст потенциал манбаларидан олинadиган муқобил энергия манбаларидан фойдаланиш қазиб олинadиган органик ёқилғиларни истеъмол қилишни камайтиришга имкон беради, бу эса антропоген экологик юқларнинг динамикасига ижобий таъсир кўрсатиши керак.

5.Биогаз транспорт учун муқобил мотор ёқилғиси сифатида ҳам ишлатилиши мумкин.

Адабиётлар

- [1]. 1.Лозовецкий В.В., Дугин Г.С., Малышев Е.В. Методы использования биогаза (в качестве возобновляемого источника энергии), являющегося продуктом полигонного захоронения отходов. Журнал «Проблемы безопасности и чрезвычайных ситуаций». М.: ВИНТИ. 2010. № 1. С. 85-95.
- [2]. 2.Филиппов Г.А. Состояние и проблемы развития атомной энергетики. Доклад на международной научной конференции «Глобальные проблемы современной энергетики». – Москва, 2006. С. 33-37.
- [3]. 3.Теплофизические основы получения искусственного холода. Справочник из серии справочников «Холодильная техника» под ред. Быкова А.В., Гоголина А.А. и др. М.: Изд-во: «Пищевая промышленность», 1980. 231 с.
- [4]. 4.Анарбаев А.И, Қорақулов А.Н. Биогаз қурилмасининг энергия самарадорлигини оширишнинг мумкин бўлган йўллари. “Инновацион технологиялар” илмий-техник журнал. 2023 йил 1-сон.
- [5]. 5.Никитин А.Т. Проблемы создания альтернативной энергетики. Доклад на международной научной конференции «Глобальные проблемы современной энергетики». Москва, 2006. С. 117-124.

UO‘K 372.8

ATOM VA ATOM YADROSI TO‘G‘RISIDA UMUMIY TUSHUNCHALAR, RADIOAKTIV NUKLIDLAR MAVZUSINI O‘QITISHDA AQL XARITASI TEXNOLOGIYASINI QO‘LLASHNING SAMARADORLIGI

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Annotatsiya. Ushbu maqolada atom va atom yadrosi to‘g‘risida umumiy tushunchalar, radioaktiv nuklidlar mavzusini o‘qitishda aqliy xujm texnologiyasini qo‘llashning samaradorligi ko‘rsatilgan. Ma‘ruza mashg‘ulotida aql xaritasi texnologiyasini AKT vositalari bilan integratsiyalashgan ta‘limni amalga oshirish bo‘yicha takliflar berilgan hamda pedagogik tahlil qilingan.

Kalit so‘zlar: aqliy xujm, texnologiya, MindMeister, model, atom va atom yadrosi.

Аннотация. В данной статье показана эффективность новой технологии мозговой штурм в обучении общим понятиям об атоме и атомном ядре, радиоактивных нуклидах. В ходе лекционной сессии были сделаны предложения по реализации интегрированного обучения технологии интеллектуальных карт с инструментами ИКТ и проведен педагогический анализ.

Ключевые слова: мозговой штурм, технология, MindMeister, модель, атом и атомное ядро.

Annotation. This article shows the effectiveness of the new brainstorming technology in teaching general concepts about the atom and atomic nucleus, radioactive nuclides. During the lecture session, proposals were made for the implementation of integrated training in mind map technology with ICT tools and a pedagogical analysis was carried out.

Key words: brainstorming, technology, MindMeister, model, atom and atomic nucleus.

KIRISH

Axborotlar olamidagi jamiyatda yashaydigan va ishlaydigan qolaversa zamonaviy oliy ta'lim muassasalarida ta'lim beradigan hamda ta'lim oladigan insonlar o'zlarining shaxsiy fazilatlariga ega bo'lishi kerak, xususan: - o'zgaruvchan hayotiy vaziyatlarga moslashuvchan tarzda moslasha olish, zarur bilimlarni mustaqil ravishda olish, turli muammolarni hal qilishda nazariy bilimlarni amaliyotda qo'llash kabilar. Ularga quyidagilar kiradi:

- ✓ tanqidiy fikr yuritish, yangi g'oyalarni yuzaga keltira olish;
- ✓ axborotlar bilan malakali ishlay olish;
- ✓ xushmuomala bo'lish, turli ijtimoiy guruhlarda muloqot qilish, ziddiyatli vaziyatlarning oldini olish;
- ✓ o'z odob-axloqi, aql-zakovati, ma'naviy saviyasini rivojlantirish ustida mustaqil ishlash.

Ana shunday vazifalardan xal qilishda aql xaritasi (интеллект-карта) metodi qo'l keladi. Aql xaritasi bu-tushunchalar va g'oyalarni tushunishni osonlashtirishga yoki ularni yodlashni osonlashtirishga qaratilgan markazdan tashqariga qarab, ierarxik ma'noda tashkil etilgan tasvirlar va so'zlar to'plamidir[1]. Aql xaritasida aqliy hujumni yaratish uchun keng qo'llaniladigan usuldir, bu erda har bir inson o'z hissasini qo'shadigan ma'lumotlar yangi ma'lumotlar yoki ilgari hisobga olinmagan g'oyalarni yaratishga yo'l ochishi mumkin 1-rasm.



1-rasm. Aql xaritasi texnologiyasining strukturasi.

Aql xaritasi texnologiyasini 1974 yilda ingliz psixologi Toni Buzan tomonidan keng tarqalgan bo'lib, markaziy g'oyadan kelib chiqadigan aks ettirishni yaratish uchun ijodkorlik va sintez kuchidan foydalanish maqsad qilingan. Ushbu aks ettirishlar ma'lum bir shaklda guruhlangan tasvirlar yoki kichik iboralarni o'z ichiga olgan sxemada aks ettirilishi kerak edi. Biroq axborot bilan ishlashning bu usulini eramizning III asrida yunon neoplaton faylasufi Porfiriy Aristotelning "Kategoriyalar" asari sharhida grafik daraxt diagrammasida ham uchratish mumkin.

TADQIQOT METODOLOGIYASI

Aql xaritasi usuli juda yaxshi o'rganilgan va uning o'qitishdagi samaradorligi tadqiqotlar va ko'plab

foydalanuvchilarning tajribasi bilan tasdiqlangan. Ular quyidagilar:

1. O'quv jarayoni mazmunli bo'lishiga yordam beradi.

Ma'noli o'rganish (ingliz tilida - meaningful learning) odatda zerikishga qarshi. Odatiy o'rganishdan farqli o'laroq, mazmunli o'rganish, mavzuni chuqur tushunishni, ob'ektlar va hodisalar o'rtasidagi aloqalarni topish qobiliyatini, shuningdek, yangi ma'lumotlarni mavjud bilimlar bilan bog'lash qobiliyatini o'z ichiga oladi.

G'oyalar o'rtasidagi bog'liqlikni aks ettiruvchi aql xaritasini yaratish ushbu kontseptsiyaga juda mos keladi. London King's kolleji olimlarining aytishicha, eslatma yozish kabi an'anaviy usullar, o'rganilayotgan mavzular o'rtasidagi bog'lanishning vizual tarzda namoyon bo'lishi oliy ta'lim muassasalarida o'qitish samaradorligini oshirishi va mazmunli bo'lishini ta'kidlaydilar.

2. Axborot yaxshiroq esda qoladi.

Melburn universiteti tadqiqotchisi Martin Devisning aytishicha, diagrammalar xotirani mustahkamlaydi, chunki inson miyasi qattiq matndagi ma'lumotlardan ko'ra qismlarga bo'lingan ma'lumotlarni qayta ishlashni osonlashtiradi.

Barts instituti va London tibbiyot va stomatologiya maktabi olimlari tomonidan olib borilgan tadqiqot shuni tasdiqlaydiki, aql xaritalaridan foydalangan tibbiyot talabalari nazorat guruhidagi talabalarga qaraganda bir haftadan so'ng o'rganilgan materialni 10% ko'proq takrorlay olishdi.

3. Murakkab tushunchalarni tushunishga yordam beradi.

Mental xaritalar yordamida katta hajmli mavzuni vizual ravishda kichik bo'limlarga va mikro-mavzularga, katta hajmdagi loyihani esa aniq vazifalarga bo'lish mumkin.

Chak Frey, aql xaritasini qo'llash vositalari va usullari haqida bo'lgan The Mind Mapping Software blogi yaratuvchisi har ikki yilda o'z auditoriyasi o'rtasida so'rovnomaga o'tkazadi. "Siz aqliy xaritalardan foydalanishning eng muhim foydasi nima deb hisoblaysiz?" degan savolga, ko'pchilik aql xaritalari murakkab loyiha yoki muammoni tushunishga yordam beradi, deb javob beradi.

MUHOAKAMA VA NATIJALAR

Bog'lanish diagrammalarini doska, planshet yoki qog'ozga chizish mumkin, biroq metodni amalga oshirish uchun standart A4 varag'i biroz qiyinchilik tug'dirishi mumkin. Ya'ni qog'oz versiyasida xatolarni tuzatish va biror narsani o'zgartirish oson emas. Yaxshisi, stikerlardan foydalanish, sxemaning turli darajalarida g'oyalarni tasavvur qilish uchun rang-barang barglarga yozish yetarli. Agarda to'g'ridan-to'g'ri devorda yoki doska bilan aql xaritasini yaratayotgan bo'lsak marker yoki yopishqoq xatcho'plar ulanishlarni ko'rsatish uchun foydanish maqsadga muvoviq bo'ladi.

Men tajriba-sinov ishlarini olib brogan Islom Karimov nomidagi Toshkent Davlat Texnika Universiteti "Muhandislik texnologiyalari" fakulteti "Biotibbiyot muhandisligi" kafedrasida biotibbiyot muhandisligi yo'nalishi talabalarida Aql xaritasi texnologiyasi quyidagicha qo'llanildi. Mashg'ulot mavzusi "Atom va atom yadrosi to'g'risida umumiy tushunchalar. Radioaktiv nuklidlar". Dasr mashg'uloti quyidagicha modellashtirildi.

Auditoriyalarimiz zamonaviy AKT vositalari internet bilan ta'minlanganligi bois metodni avtomatik yasash mumkin bo'lgan saytlardan foydalandim. Aql xaritalarini yaratish uchun qulay vositalar va tayyor shablonlarni taklif qiluvchi ko'plab raqamli xizmatlar mavjud. Bular quyidagilar:

- [MindMeister](#),
- [Miro](#),
- [XMind](#),
- [MindMup](#),
- [Mind42](#) va boshqalar

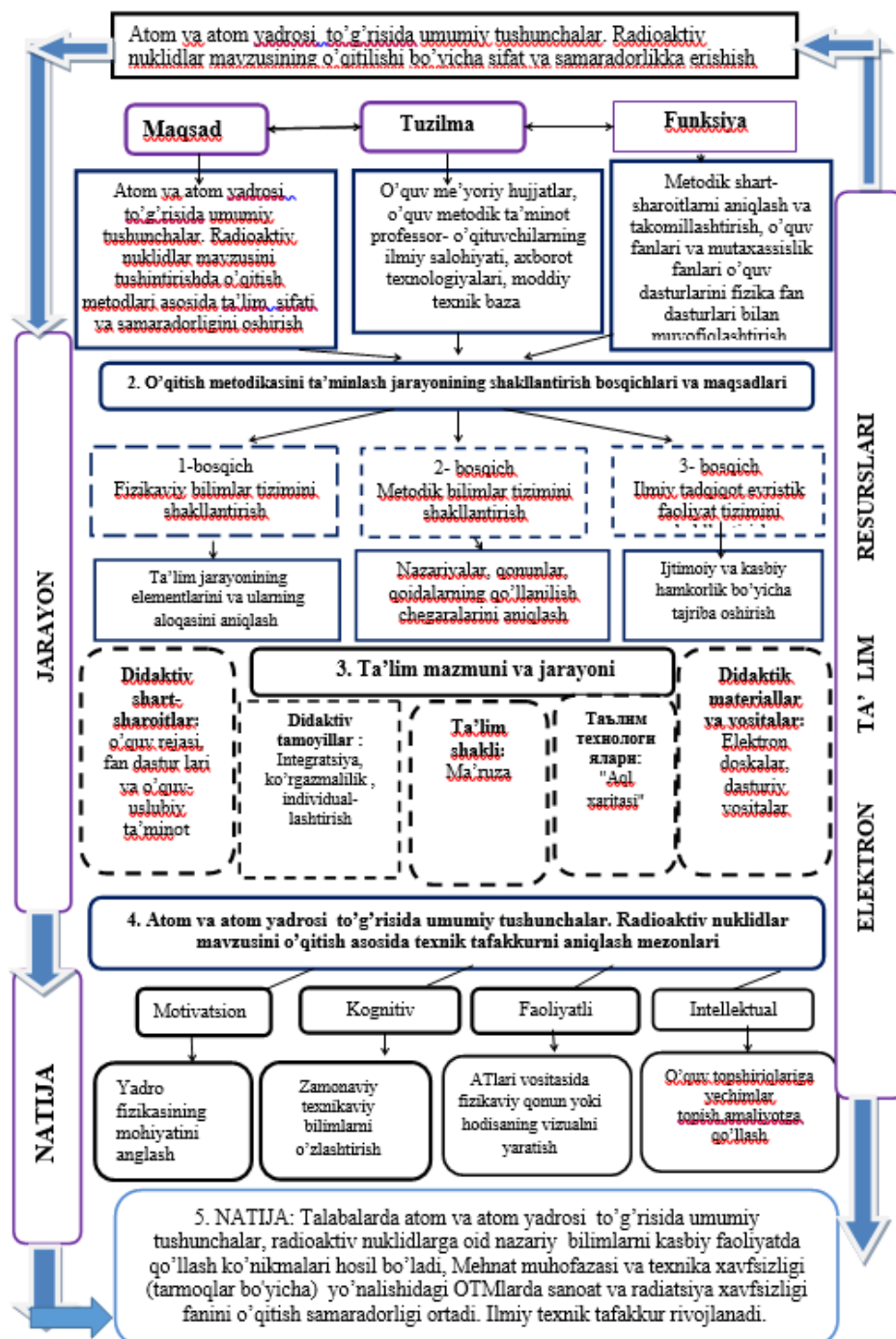
Ushbu xizmatlarning afzalligi shundaki, aniq va tez tuzatishlar kiritish, shuningdek, eslatmalar, izohlar, rasmlar, qo'shimcha materiallarga havolalar qo'shishingiz mumkin. Qolaversa bunday xizmatlardan standart funktsiyalar to'plami bilan bepul foydalanish mumkin - yoki bepul sinov muddati taklif etiladi.

Asosiy g'oya, mavzu, muammo, vazifa yoki loyiha nomi doimo markazda. Uni yorqin rang bilan ajratib ko'rsatish va uni katta hajmda yozish kerak.¹

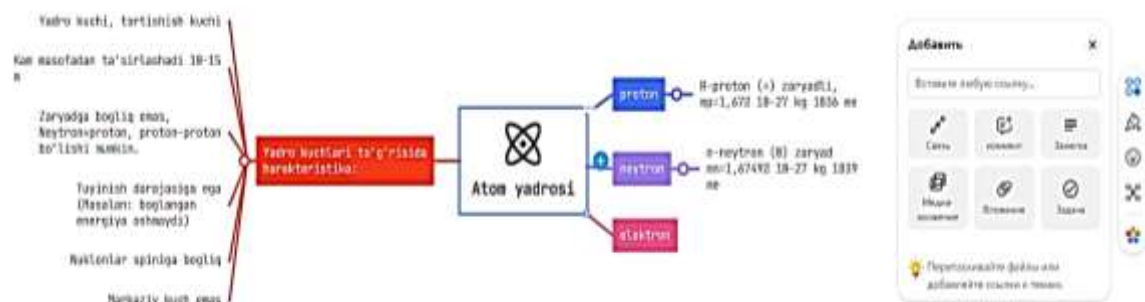


Keyin birinchi darajaga o'tamiz - asosiy toifalar, kichik bo'limlar, bosqichlar yoki markaziy g'oyaga tegishli bo'limlar. Ularga 1-2 so'zdan iborat qisqa nomlar berish yaxshiroq. Rasmlarni ularning mazmuni bilan bog'liq bo'lgan birinchi darajali toifalarga qo'shish mumkin.

¹ Screenshot: sayt [MindMeister](#)



2- rasm. Texnika OTMlarda Atom va atom yadrosi to'g'risida umumiy tushunchalar, radioaktiv nuklidlar mavzusini o'qitish modeli.



Ikkinchi darajada biz ushbu toifalarning mazmunini ochib beramiz, tegishli tushunchalarni qo'shamiz. Mening mavzuyim Atom yadrosi bo'lganligi uchun, atom yadrosi to'g'risida dastlabki ma'lumotlardan boshladim.

Uchinchi darajada va undan keyingi bosqichlarda biz aniq g'oyalarga, tafsilotlarga o'tamiz. Ierarxiyani tasavvur qilish uchun turli darajalar uchun turli ranglardan foydalaning yoki markazdan uzoqlashganda shrift hajmini kamaytish mumkin. Biroq, to'rtinchi darajani qo'shish tavsiya etilmaydi, aks holda xaritani idrok etish noqulay bo'ladi.

Aql xaritasi texnologiyasidan foydalanishning afzalliklari:

- ✓ Talabalarni aqliy xaritalar bilan tanishtirish va ulardan ma'lumot to'plash va tartibga solishda yordam beradi (masalan, hisobotlar, insholar, kurs ishlarini tayyorlashda). Bundan tashqari, aql xaritalari ma'ruza paytida eslatma olish va kitoblardan muhim fikrlarni ajratib ko'rsatish usuli sifatida samarali.
- ✓ Aql xaritalari nafaqat dars mashg'ulotida yoki o'quv rejasini yaratishda, ular yordamida siz mavzular va vazifalar ro'yxatini, o'quv materiallari va yordamchi vositalar ro'yxatini qulay tarzda tuzish mumkin.
- ✓ Jamoaviy guruhlariga bo'lingan holda dars mashg'ulot paytida, aqliy xaritalar miya hujumi, markaziy vazifa yoki muammo atrofida ishtirokchilarning fikrlarini yozish uchun ishlatilishi ham mumkin.
- ✓ Ushbu texnologiyani barcha fanlarga qo'llash mumkin.

XULOSA

Pedagog tug'ma ijodkor bo'lmashligi mumkin, lekin yuqorida keltirilgan axbotor texnologiya vositalaridan foydalanish natijasida ma'lum muddat ichida, ijodkorlik sifatlariga ega bo'la oladi. Hozirgi jadal rivojlanib borayotgan axborot texnologiyalari asrida, har tomonlama yetuk, intellektual salohiyatli, ijodkor-qobiliyatli insonni tarbiyalash uchun pedagogtarbiyachi o'z kasbiy faoliyatiga, albatta, kreativ yondashishi shartdir. Kreativlik esa ijodkorlik, nostandart fikrlash, muammoli vaziyatlarda tezkor oqilona yechim, o'z ustida tinimsiz ishlash, rivojlangan yuksak tasavvur, ijodiy qobiliyat, ijodiy tafakkur va o'z-o'zini ijodiy shakllantirish demakdir. Bu sifatlariga ega bo'lish uchun pedagog-tarbiyachidan o'z ustida tinimsiz ishlash talab etiladi. Pedagogik jarayonda ijodkorlikni rivojlantirish uchun shaxs salohiyatini oshirishga, ijodiy faolligini oshirishga yordam beradigan o'qitish metodlari va texnologiyalaridan foydalanish zarur. Aql xaritasi texnologiyasi mavzuni qiziqarli yoritishga, talabalar ongida yaxshi saqlanib qolishga yordam beradi.

Ushbu texnologiya Islom Karimov nomidagi Toshkent Davlat Texnika Universiteti "Muhandislik texnologiyalari" fakulteti "Biotibbiyot muhandisligi" kafedrasida biotibbiyot muhandisligi yo'nalishi talabalarida dars mashg'ulotida qo'llanildi. Tajriba guruhi nazorat guruhiga nisbatan 25 % yuqori natijaga erishildi.

Ushbu maqola №AM-PZ-2019062031 "Yadro energetikasi", "Yadro tibbiyoti va texnologiyalari", "Radiatsion tibbiyoti va texnologiyalari" fanlari bo'yicha bakalavr va magistrlar uchun multimedial darsliklarini yaratish nomli innovatsion loyiha doirasida yozib tayyorlangan materiallarning pedagogik tahlili asosida yozilgan bo'lib, darsliklar mualliflariga minnatdorchilik bildiramiz.

Adabiyotlar:

- [1]. Абраменко О.В. Интеллект карты как средство визуализации в обучении русской грамматике иностранных студентов начального этапа обучения / О.В. Абраменко, С.Э. Надха // Наука и Школа, 2017 №6.
- [2]. Асауленко, Е.В. Тестирование знаний учащихся на основе машинного анализа ментальных карт / Е.В. Асауленко // Вестник КГПУ им. В.П. Астафьева. 2023. № 4 (26). [sayt] URL: <http://cyberleninka.ru/article/n/testimonies-znaniy-uchaschihsya-na-osnove-mashinnogo-analizamentalnyh-kart> (дата обращения: 10.10.2019).
- [3]. Баум, В.В. Система зачётных единиц (кредитов) как один из инструментов признания квалификаций: учеб. пособие. / В.В. Баум, В.Н. Чистохвалов, В.М. Филиппов. М.: RUDN, 2018.

- [4]. Безрукова В.С. Основы духовной культуры (энциклопедический словарь педагога). / В.С. Безрукова. Екатеринбург, 2000.
- [5]. Бершадская, Е.А. Технология обучения взрослых на основе метода интеллект-карт / Е.А. Бершадская // Педагогический опыт: теория, методика, практика, 2015. Т.2. №3(4).
- [6]. Бершадский, М.Э. Теоретико-практические аспекты работы с картами интеллект-понятий / М.Э. Бершадский // Народное образование, 2020. №6.
- [7]. Бершадский, М.Э. Представление знаний учащихся в виде фреймов на основе метода интеллект-карт / М.Э. Бершадский, Е.А. Бершадская // Профильная школа, 2019. Т.3. №5.
- [8]. Беспалко, В.П. Слагаемые педагогической технологии. / В.П.Беспалко М.: Педагогика, 2019. 192 с. Текст: непосредственный.
- [9]. Болонский процесс и его значение для России. Интеграция высшего образования в Европе. / Ред.-сост. С. Медведев, К. Пурсиайнен. М.: РЕТсЕП, 2015.
- [10]. Бюзен, Т. Научите себя думать. / Т. Бюзен / Пер. с. англ. Ю.И. Герасимчик. Минск: Поппури, 2014. 224 с. Текст: непосредственный.
- [11]. Бюзен, Т. Супермышление. 4 изд./ Т. Бюзен, Б. Бюзен Мн.: Попурри, 2017.

ORGANIZATION OF HIGH SCHOOL STUDENTS' INTEREST IN WORKING WITH
LITERARY TEXT IN ENGLISH LESSONS

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This article reflects on the importance of the use of artistic text in English lessons in graduating senior students of secondary schools and the results of research in this direction.

Key words:, select text, text, literary text, , translate text, reading, adolescence, monologue, cognitive interest.

В данной статье размышляется о важности использования художественного текста на уроках английского языка у выпускников старших классов общеобразовательных школ и результатах исследований в этом направлении.

Ключевые слова: выделенный текст, текст, художественный текст, перевод текста, чтение, подростковый возраст, монолог, познавательный интерес.

Ushbu maqolada umumta'lim maktablarining yuqori sinf o'quvchilari uchun ingliz tili darslarida badiiy matndan foydalanishning ahamiyati va bu yo'nalishda olib borilgan tadqiqotlar natijalari aks ettirilgan.

Kalit so'zlar: matnni tanlash, matn, badiiy matn, , matnni tarjima qilish, o'qish, o'smirlik, monolog, kognitiv qiziqish.

Introduction

Students in grades 10 and 11 psychologically belong to adolescence, which is literally the "third world", between childhood and adulthood. The peculiarities of the psyche of youth are determined by their status and intermediate position in society.

In high school, children are ready to perform all kinds of adult mental activities because the development of their cognitive processes reaches such a level. The cognitive processes of schoolchildren acquire qualities that make them perfect and flexible, and the development of the means of cognition is ahead of the personal development of children.

With the transition from junior to middle school and then high school, the position of children in the system of business and personal relationships with other people changes. More and more time is occupied by serious matters, less and less time is allocated for rest and entertainment.

In adolescence, the process of cognitive development is actively underway. At this time, it occurs mainly in forms that are hardly noticeable both to the child himself and to an external observer.

The mental activity of high school students is more active and independent. They are characterized by a tendency to generalize, a search for general principles and laws behind particular facts. At this age, the development of theoretical thought is observed. Teenagers are already able to think logically, they are preoccupied with theoretical reasoning and introspection. They can freely reflect on moral, political, and other topics that are virtually inaccessible intellectually to primary or secondary school age. High school students have the ability to draw general conclusions on the basis of particular premises and, on the contrary, to proceed to particular conclusions on the basis of particular premises, that is, the ability to induct and deduction. An important intellectual acquisition of this age is the ability to operate with hypotheses.

This stage of training is characterized by: improving the skills of using vocabulary enrichment techniques, expanding the potential vocabulary and linguistic knowledge. At the forefront is the use of a foreign language as a means of obtaining new information that would help to look at the familiar world in a different way, present the facts known to them in a different way, expand their awareness in various fields of knowledge, and introduce them to new areas of their application. In this regard, reading becomes the leading type of speech activity, and the leading type of work is the extraction of information from the text and its subsequent processing.

High school students are faced with the task of social and personal self-determination, which involves clear orientations and determination of their place and role in the adult world. This is associated with the differentiation of mental abilities and interests, without which it is extremely difficult to choose a profession, develop a worldview and life position.

By high school age, many scientific concepts and their use in the process of solving various problems are mastered. This means that they have formed theoretical or verbal-logical thinking. At the same time, there is an intellectualization of all other cognitive processes.

Materials and methods

In adolescence, important processes related to the restructuring of memory take place. Logical memory begins to develop actively and soon reaches such a level that the child moves on to the predominant use of this type of memory, as well as voluntary and mediated memory. As a reaction to the more frequent practical use of logical memory in life, the development of mechanical memory is slowed down. As a result of the introduction of new subjects at school, the amount of information that a teenager must memorize, including mechanically, significantly increases. He has memory problems, and complaints of poor memory are much more common at this age than in younger students. Along with this, there is an interest in adolescents in ways to improve memorization.

As we age, the relationship between memory and thinking also changes. In early childhood, memory is one of the basic mental functions, and all other mental processes depend on it. The thinking of a child of this age is largely determined by his memory: "to think is to remember." At primary school age, thinking shows a high correlation with memory and develops in direct dependence on it. A crucial shift in the relationship between memory and other mental functions occurs during adolescence. Studies of the memory of children of this age have shown that for an adolescent, remembering means thinking. His process of memorization is reduced to thinking, to the establishment of logical relations within the memorized material, and recollection consists in the reconstruction of the material according to these relations.

In adolescence and early adolescence, reading, monologue and written speech are actively developed. From grades 10 to 11, reading develops from the ability to read correctly, fluently and expressively to the ability to recite by heart. Monologue speech is transformed in a different way: from the ability to retell a short work or a passage of text to the ability to independently express thoughts and argue them. Written language improves in the direction from the ability to write to independent composition on a given or arbitrary topic.

As for the study of a foreign language, during this stage of training, students improve the knowledge, skills and abilities acquired by them during the previous period. Foreign language oral speech as a form of direct communication naturally synthesizes the features of dialogic and monologue speech, so the program puts forward requirements for the process of speaking as a whole, and not for its forms separately. All types of reading are being further developed. Writing continues to be used as a means of preparing oral statements and information processing of the text.

A characteristic feature of adolescence is the readiness for many different types of education, both in practical terms (labor skills, skills) and in theoretical terms (the ability to think, reason, use concepts).

Adolescence is characterized by increased intellectual activity, stimulated not only by the natural age-related curiosity of teenagers, but also by the desire to develop, show others their abilities, get high praise from them, and put themselves in the best light. That is why teenagers tend to take on the most difficult tasks in public, they often show a highly developed intellect and outstanding abilities. They do not perceive simple tasks and therefore there is a characteristic emotionally negative affective reaction to these tasks. They are not attracted to such tasks and refuse to perform them for reasons of lack of prestige. At the heart of the increased intellectual and labor activity of adolescents is the natural interest and increased curiosity of this age.

High school students may also be overly rationalistic. At the same time, they consider it necessary and correct to study only what they believe will be useful in life for their future

profession, and they do not always correctly assess the role of humanitarian subjects in the development of their spiritual world.

To maintain the proper level of cognitive interest in the subject at this stage of language education, there is differentiation of learning, its profile orientation, a personal approach to students, which requires, first of all, a respectful attitude to the student as a person with his needs, opportunities and aspirations.

At this stage, a foreign language should act as an effective tool that satisfies, develops and deepens the interests of schoolchildren in their chosen field of knowledge, in particular, as a means of obtaining meaningful and important information for their future profession. This goal is met by a variety of options for profile-oriented foreign language teaching in grades 10-11 (with humanities, physics and mathematics, and other areas) with special programs. If the conditions for such training are not available, then a program containing training can be used, reflecting everything that should be in the language course in any variant of its profile orientation. In high school, successful education largely depends on the high-quality organization of students' work, the availability of manuals that meet their interests and the requirements of modern methods.

Thus, the distinguishing aspects of high school students are:

1. The process of cognitive development;
2. Active and independent thinking;
3. Social and personal self-determination;
4. Formation of theoretical or verbal-logical

Thinking;

5. Improvement of self-control of activities;

6. Memory restructuring (development of logical and voluntary memory);

7. The process of memorization is reduced to thinking, to the establishment of logical relations within the memorized material, and recollection consists in reconstructing the material according to these relations;

8. Interest in worldview issues.

The interests of high school students are becoming even more selective and stable. There is a tendency for interest in the subject to grow into an interest in science. High school students are trying to comprehend the surrounding reality philosophically, and are seriously fascinated by worldview issues. The problem of the formation of cognitive interest in learning is of particular significance. According to Mirolyubova, in the nature of every child there are moral and mental capabilities that allowed the scientist to discard the old methods of influence, means of intimidation, constant control and suppression of the student's personality, to put forward the thesis about the ease, pleasantness and thoroughness of learning.

Let's define the very concept of cognitive interest. Cognitive interest is a deeply personal formation that is not reducible to individual properties and manifestations. Its psychological nature consists of an indissoluble complex of processes that are vital for the personality. The awakening of cognitive interest is only the initial stage of the great work of cultivating a deep, sustained interest in knowledge and the need for self-education. Interest in the broad sense of the word is the orientation of a person to learn everything new, to master skills, to acquire various skills. Interest in knowledge or cognitive interest is a person's orientation towards mastering knowledge in a particular subject area. The teacher fosters interest in his subject.

From curiosity to interest, from interest to persistent cognitive activity, from them to the awakening of scientific curiosity and an increasingly stable orientation of the individual to the study of the subject – this is the way of the origin and development of interest in knowledge, associated with the mobilization of will, energy, and diligence.

Cognitive interest has an impact on the personality of a student in many ways. It is possible to combine all three features of interest as an end, a means, and an end in a system of teaching.

From the point of view of interest education in terms of the development of general cognitive orientation, activity and curiosity as a personality trait, this problem can be considered as a goal of learning or its motive.

Interest is used as a means of learning with the help of an element of amusement introduced at different stages of the lesson, attention to the topic being studied. In this case, objectively attractive properties of objects, phenomena, events, and processes (spectacular experience, unexpected comparisons, paradoxical phenomena, an impressive word) are popular.

Cognitive interest at a higher level of its development, being quite strong and stable, occupies a dominant position in the circle of other motives, becoming a personality trait that is called curiosity and inquisitiveness. At this stage, cognitive interest appears as a result of learning.

Results

According to the nature of the manifestation of cognitive interest in the process of studying the subject, there are three levels of development of cognitive interest:

- 1) Low level;
- 2) Intermediate level;
- 3) High level.

In students with a low level of cognitive interest, activity in the classroom is reduced, abstraction appears, preference is given to tasks of a different nature, with stereotyped actions. Students with an average level of cognitive interest also prefer the exploratory nature of activity, but there is not always a tendency to perform creative tasks, their independent activity is not often manifested and depends on external stimuli and factors. Students with a high level of interest are distinguished by independence, active participation in the lesson, and preference for educational activities of a more complex level.

Criteria for Learners: Characterizing Thinking-Activity

1) questions that testify to orientation in knowledge, to the mental activity of the student, to the desire to penetrate and understand the content of the educational subject;

2) the desire of students to become a part of the consideration and discussion of important educational issues, in supplementing and correcting the answers of their classmates, of their own free will, and not on demand. The willingness of students to give a detailed answer to the teacher's question is considered a sign of the student's cognitive interest;

3) focusing on the subject of interest;

4) how the task is accepted - with readiness for action or indifference, and how the task is performed – independently or according to a model (or even just copying a ready-made solution from the blackboard), and how focused or absent-minded the student is in the process, and how he behaves in the process of his activity - enthusiastic or absent-minded. And, finally, what is the actual result of the task (depth, thoroughness, originality or primitiveness in the approach to the solution).

Emotional manifestations of students act as indicators of cognitive interest, easily recorded in the process of observation:

1) verbal exclamations ("That's great!") in an exchange of opinions with a neighbor at the desk;

2) the silence that has followed, indicating the agitation of the students;

3) the adequacy of students' reactions in response to what is happening in the classroom during the lesson: laughter in response to humor and funny situations corresponding to the content of the situation.

Indicators that determine the picture of the stability and strength of cognitive interest are the selective orientation of the reading circle of students and voluntary participation in various forms and types of extracurricular work (subject circle, evenings), and the performance of individual tasks and the nature of free pastime.

There are various methods of stimulating students' cognitive interest in the educational process and different approaches to their classification. In the learning process, there are three types of stimulation of students' cognitive interests:

The novelty of the content is an important stimulating component that stimulates cognitive interest and evokes an orienting response in students. The most significant states of a person that accompany the process of his orientation are the states of *surprise*, *bewilderment*, and *surprise*.

Novelty is the stimulus of the external environment that excites these states, which bring positive emotions to the student, if possible. Novelty is a large number of new facts, information, theories, which most students did not even know before.

Updating the knowledge that has already been acquired. In order to arouse interest in a subject, it must be partly new and partly familiar to the learner. They deal with many elements of new knowledge that learning gives them, acquiring this knowledge in the lessons of other disciplines. New knowledge acquires a special meaning for the learner when comparing old and newly acquired knowledge. Hence the impossibility of using the novelty of the content as a regular stimulus for the development of cognitive interest. At school, many things are studied that have become habitual, have lost their "freshness" due to frequent repetition. The renewal of knowledge, a new aspect of the consideration of what is already known, the opportunity to see in the former, already formed and habitual knowledge new facets, new turns, new sides that puzzle and give the impression of strangeness - this is an important stimulus for cognitive interest.

An important stimulus of cognitive interest related to the content of education is the historical aspect of school knowledge (historicism), the communication of information from the history of science, the history of scientific discoveries, on the one hand, cognitive interest is based on less known, sometimes completely new material, mastering which students become even more aware of what the lesson is giving them. On the other hand, the historical approach to the study of academic subjects to some extent brings the process of learning closer to scientific knowledge. To find out what the corresponding knowledge was like at its origins, how it developed, to get in touch with scientific research, to feel and experience its difficulties and joys – this means to come closer to the realization of one's own cognitive process, which, if not discovering, but assimilating scientific propositions, is nevertheless associated with the search for truth. Historical information is always less known to students and is perceived by them as unexpectedly new and attractive. Acquaintance with the history of science and its discoveries contributes to the awareness of the enormous difficulties of scientific research, raises the prestige of science in the eyes of students, and forms respect for established scientific facts and concepts.

Historical information broadens the horizons of students, helps them understand how much effort it takes scientists to invent something, and prepares students for the perception of new material. For example, the study of the topic "History of Great Britain" can begin with the story of Julius Caesar, white cliffs and foggy Albion.

Not everything in the educational material can be interesting for students. And then there is another, significant source of stimulation of cognitive interest – the *process of activity itself*. That is why the influence of various forms of organization and nature of the course of educational activity of schoolchildren gives rise to a peculiar aspect of the formation of their cognitive interest, which differs from the aspect of stimulation arising from the content of education.

Various forms of independent work of students make it possible to put the student in a favorable light, in the position of a person who operates with knowledge, applying maximum mental and volitional forces to solve the assigned tasks. Independent activity, which is successful, can cause positive experiences in students, multiplying the activity of thought processes and helping to realize the need to overcome large and small difficulties.

Problem-based learning, rather than the teaching of ready-made, memorized facts and conclusions, invariably contributes to the unflagging interest of learners. Such a teaching forces us to search for the truth and find it together. In problem-based learning, a question is brought up for general discussion – a problem that sometimes contains an element of contradictions, sometimes of surprises. The problem situation created in the lesson gives rise to questions in the students. And it is in the appearance of questions that the inner impulse (the need for cognition of a given phenomenon) finds its expression, which is significant for strengthening cognitive interest. Problem-based learning is characterized by a clash of different points of view that need to be analyzed in order to further occupy one's own position. In this way, problem-based learning stimulates an active search for evidence, arguments to prove and to defend one's own point of view.

This stimulus serves to overcome difficulties, to engage in intensive thinking, to exert the mind, and to exploratory activity.

In order to develop cognitive interest, it is necessary to complicate cognitive tasks. The material is transformed in the direction of complexity, so that the student gradually but steadily comes to overcome more and more complex stages of it.

Entertaining is a technique that contributes to the creation of a positive attitude to learning and readiness for active thinking activity in all students. It is imperative for the teacher to correctly understand amusement as a factor influencing mental processes, to clearly understand the purpose of using entertaining for use in the lesson with other didactic means. Only in this case will this method be able to help scientific truths to come closer to students for better understanding, and contribute to the successful course of cognitive processes.

The third type of stimulation of cognitive interest in learning is determined by the relationships that accompany the learning process.

The relationship between the teacher and the students always finds its manifestation in the lesson in the emotional and active tone of the students, which either manifests and strengthens the cognitive interest, or extinguishes it. This emotional tone depends on many factors.

The emotionality of the teacher plays an important role in creating an emotional tone for the cognitive activity of students.

Pedagogical optimism also strongly influences the cognitive interest of students. Faith in the student, in his cognitive powers and capabilities is a powerful stimulus for his interest in learning.

Mutual support in the learning process of the teacher and students requires continuous communication between the teacher and the wards, an active response of the students to all the initiatives and efforts of the teacher.

Competition can also be seen as a stimulus of cognitive interest related to the relationships between students.

Conclusion

Encouragement should also be singled out among the stimuli of cognitive interest. Playing a significant role, it is in demand in different classes and depends to a greater extent on the personality of the teacher and the nature of his relationship with the students. Positive evaluations, supported by arguments, and positive judgments from the teacher and classmates carry positive emotions that increase the energy of students.

One of the most important aspects is the psychological comfort of students during the lesson. Firstly, the task of preventing fatigue of students is solved, and secondly, there is an additional incentive for the disclosure of the creative capabilities of each student.

A friendly atmosphere of the lesson, a calm, quiet conversation, attention to each sentence expressed, an adequate reaction of the teacher to the student's desire to express himself, tactful correction of mistakes, encouragement of independent thinking activity, an appropriate joke or a small digression - this is not the whole arsenal used by the teacher in his work to reveal the abilities of each child.

If the teacher does all of the above in his work, then the students enter the classroom not with fear of an unsatisfactory grade or remark, but with a desire to continue the conversation, show their knowledge, and receive new information. In the process of such a lesson, there is no emotional discomfort even when the student could not cope with the task or misunderstood something. Moreover, the absence of fear and tension contributes to the inner liberation from unnecessary psychological barriers, helps to speak out more boldly, expressing one's point of view.

References

- [1]. Tukhtarova, I., & Arslonzoda, A. (2022). Some aspects of popular scientific literature in teaching a foreign language. *Asian Journal of Multidimensional Research*, 11(11), 288-295.
- [2]. Tukhtarova, I., & Arslonzoda, A. (2023). The role of popular scientific literature in teaching a foreign language to students of non-language faculties of universities.

- [3]. Tukhtarova, I. (2022). THE IMPORTANCE OF USING POPULAR SCIENTIFIC LITERATURE IN TEACHING A FOREIGN LANGUAGE TO STUDENTS OF NON-LANGUAGE FACULTIES OF UNIVERSITIES. *Research Focus*, 1(3), 106-112.
- [4]. Tukhtarova, I. (2023). USE OF POPULAR SCIENTIFIC LITERATURE IN TEACHING A FOREIGN LANGUAGE.
- [5]. Tukhtarova, I. (2023). THE IMPORTANCE OF LITERARY TEXT IN TEACHING ENGLISH GRAMMAR.
- [6]. Tuxtarova, I. (2023). BADIY MATN INGLIZ TILINI O'QITISH VOSITASI SIFATIDA. *Talqin va tadqiqotlar*, 1(23).
- [7]. Saminjonov, B. (2021). The Role Of Teaching Fine Arts And Drawing In The Development Of Innovative Areas. *Студенческий вестник*, (11-4), 6-8.
- [8]. Tuhtarova, I. (2020). Some Aspects Of Using Examples Of Fiction In Teaching Foreign Languages. *Scientific Bulletin of Namangan State University*, 2(6), 409-415.
- [9]. Tukhtarova, I. (2024). STAGES AND RULES FOR WORKING WITH LITERARY TEXT IN TEACHING A FOREIGN LANGUAGE. *Best Journal of Innovation in Science, Research and Development*, 3(3), 665-673.
- [10]. Tukhtarova, I. (2024). RECOMMENDATIONS FOR USING LITERARY TEXTS IN FOREIGN LANGUAGE. *Miasto Przyszłości*, 46, 752-759.

PROSPECTS FOR IMPROVING THE RISK MANAGEMENT SYSTEM IN FOOD PRODUCTION

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Annotation: In this article, the general issues and hypotheses of improving the quality system based on risk management in food enterprises are considered. To improve risk management, develop a risk assessment plan taking into account all possible risks associated with food production, a systematic approach to identify and control potential risks during the production process, and throughout the production process it is necessary to develop and implement a comprehensive food safety training program for employees to ensure effective risk reduction.

Key words: Quality, safety, HACCP, risk management, food safety, feedback, change, leadership, potential risks, improved documentation and standardized procedures.

Аннотация: В данной статье рассмотрены общие вопросы и гипотезы совершенствования системы качества на основе управления рисками на предприятиях пищевой промышленности. Для улучшения управления рисками разработать план оценки рисков с учетом всех возможных рисков, связанных с производством пищевых продуктов, системный подход к выявлению и контролю потенциальных рисков в процессе производства, а на протяжении всего производственного процесса необходимо разработать и внедрить комплексную пищевую систему. программа обучения сотрудников технике безопасности для обеспечения эффективного снижения рисков.

Ключевые слова: качество, безопасность, HACCP, управление рисками, безопасность пищевых продуктов, обратная связь, изменения, лидерство, потенциальные риски, улучшенная документация и стандартизированные процедуры.

Annotatsiya: Ushbu maqolada oziq-ovqat korxonalarida risklarni boshqarish asosida sifat tizimini takomillashtirishning umumiy masalalari va farazlari ko'rib chiqildi. Xatarlarni boshqarishni takomillashtirish, oziq-ovqat mahsulotlarini ishlab chiqarish bilan bog'liq barcha mumkin bo'lgan xavflarni hisobga olgan holda xavflarni baholash rejasini ishlab chiqish, ishlab chiqarish jarayonida yuzaga kelishi mumkin bo'lgan xavflarni aniqlash va nazorat qilish uchun tizimli yondashuv va ishlab chiqarish jarayonida kompleks oziq-ovqat mahsulotlarini ishlab chiqish va joriy etish zarur. Xavflarni samarali kamaytirishni ta'minlash uchun xodimlarni xavfsizlik bo'yicha o'qitish dasturi tahlil qilindi.

Kalit so'zlar: Sifat, xavfsizlik, HACCP, xavflarni boshqarish, oziq-ovqat xavfsizligi, fikr-mulohazalar, o'zgarishlar, yetakchilik, potentsial xavflar, takomillashtirilgan hujjatlar va standartlashtirilgan protseduralar.

I. Introduction

In recent years, the food industry has become increasingly complex, with products being produced and distributed across various regions of the world. This complexity has led to a greater need for quality systems that prioritize risk management and safety in food production. Effective quality systems can help food enterprises ensure that their products meet the highest standards for safety, quality, and consistency [1]. In order to achieve these goals, food enterprises should incorporate risk management into their quality systems, taking into account the various risks associated with food production and distribution. By identifying potential hazards and developing strategies to mitigate these risks, food enterprises can reduce the likelihood of food contamination, foodborne illnesses, and other safety concerns. Thus, the improvement of quality systems based on risk management is essential to the success and sustainability of modern food enterprises.

- Brief overview of risk management in food enterprises

Food enterprises are faced with a plethora of risks that threaten food safety, quality, and brand reputation. Risk management, therefore, is a fundamental aspect of food enterprise operations aimed at identifying, assessing, and prioritizing risks. The goal of risk management in food enterprises is to prevent or minimize the likelihood or impact of negative events by developing and implementing proactive risk management plans. This involves a systematic and scientific approach to identifying potential hazards and implementing preventive measures throughout the food supply chain. Common risk management measures in food enterprises include hazard analysis and critical control points (HACCP), quality assurance and control systems, traceability and recall systems, food defense and security systems, and regulatory compliance. Effective risk management in food enterprises requires a deep understanding of the complex relationships among environmental, technological, economic, and social factors that influence the food system.

- Importance of improving the quality system based on risk management

In conclusion, the importance of improving the quality system based on risk management cannot be overstated. Food enterprises must understand that they are not only responsible for the production of safe, high-quality products but also liable for any damage or harm caused to consumers. A risk-based approach provides a structured and systematic process for identifying, assessing, and controlling potential hazards to food safety. It enables food enterprises to prioritize hazards and allocate resources accordingly. The adoption of risk-based principles can also help food enterprises save money by reducing wastage and improving productivity. Risk management is not a one-time event; it is an ongoing process that requires continual improvement and evaluation. Therefore, food enterprises must strive to promote a culture of risk awareness and encourage employees at all levels to participate actively in the identification and management of risks. This will ensure that risks are minimized, and the quality and safety of food products are maximized.

Another aspect that should be considered when implementing a quality system based on risk management is the communication of risks and responsibilities within the company. It is important that all employees understand the risks involved in the production process, as well as their responsibility in mitigating those risks. This requires an effective communication plan that ensures that all employees receive the same level of information and training on risk management. In addition, it is important that there are clear lines of responsibility for risk management within the company. This means that each employee should know their role in identifying and mitigating risks, and that there is a clear chain of command for reporting and escalating risks to senior management. By having a well-designed communication and responsibility framework, food enterprises can ensure that all employees are working towards the same goal of producing high-quality and safe products for consumers.[2]

II. The basics of risk management in food enterprises

Risk management is a crucial process in any food enterprise, as it requires constant monitoring and assessment of potential hazards and risks. The basic steps in risk management include risk identification, risk analysis, risk assessment, and risk control. In the identification stage, all potential hazards and risks related to food safety are identified, while in the analysis stage, the likelihood of these risks occurring and the severity of their consequences are analyzed. The

assessment stage involves determining the level of risk associated with the identified hazard, which aids in prioritizing mitigation efforts. The final stage of risk management involves risk control measures, which aim to reduce the hazard, minimize the likelihood of the risks identified, or reduce their impact if they occur. By following these basics of risk management, food enterprises can ensure food safety, promote consumer confidence, and meet regulatory requirements.

- Definition of risk management

Risk management is a systematic process of identifying, assessing, and prioritizing potential risks, followed by developing and implementing strategies to mitigate or prevent them. It involves a coordinated set of procedures, policies, and practices aimed at reducing the possibility of harm and minimizing losses associated with adverse events. The ultimate goal of risk management is to support decision-making by providing a comprehensive picture of the risks a business may face. In food enterprises, risk management strategies may include implementing hazard analysis critical control points (HACCP)[3-4], regular inspection of facilities and products, quality assurance measures, and training programs for staff. Overall, risk management is an essential component of any effective quality management system, as it enables organizations to identify and preempt potential problems, safeguard their customers' health and safety, and safeguard the organization's reputation and financial stability.



Figure 1. Definition of Risk Management [4].

- Identification of potential risks in food enterprises

Identifying potential risks in food enterprises is fundamental in risk management as it provides the basis for prioritizing the risks that require attention. Food enterprises are prone to numerous risks such as microbial contamination, chemical hazards like pesticides and food additives, physical hazards like broken glass, and natural hazards like floods and earthquakes. Risks could also arise from equipment and processes involved during production, storage, and transportation. These risks can result in serious food safety challenges and could potentially bring harm to the consumers of the food products. By identifying potential risks, enterprises can put in place control measures to mitigate or prevent the occurrence of these risks. Effective risk identification requires a thorough understanding of all the processes, operations involved in the food enterprise, and a comprehensive evaluation of all possible sources of potential risk. This, in turn, will inform the decision-making process of the food enterprise, thus making it possible to establish effective control measures and protocols to prevent and manage possible risks.

- Assessment of risks and their potential impact on consumers

Assessment of risks and their potential impact on consumers is an essential component of the quality system in food enterprises. By identifying potential hazards that may occur during the production and distribution of food products, companies can take measures to prevent or mitigate the risks. This may include implementing strict quality control measures, conducting regular testing of raw materials and finished products, and ensuring that all employees are trained in safe food handling practices. Companies must also consider the potential impact of these risks on consumers, including their health, safety, and overall satisfaction with the product. In cases where risks cannot be eliminated entirely, companies must communicate clearly with consumers about the potential hazards associated with their products and provide clear instructions on how to minimize the risks. Failure to effectively assess and manage risks can lead to serious consequences for both consumers and food enterprises alike, including illness outbreaks, recalls, and loss of consumer trust and confidence.

Moreover, the implementation of a risk-based quality management system is not enough, continuous improvement is necessary. As the food market is constantly evolving, enterprises should also upgrade their quality system to meet the changing requirements and challenges. The most efficient way to improve the quality system is by monitoring and assessing the system's effectiveness regularly. By doing so, food enterprises can identify the gaps in their quality system, make necessary changes, and reduce the possibility of non-compliance. Additionally, communication and cooperation between quality management teams, suppliers, and customers can promote the improvement of the quality system. The feedback and opinions from stakeholders can help food enterprises to identify areas for improvement and to make necessary changes to their quality system. By continuously enhancing their quality system based on risk management, food enterprises can ensure food safety, protect consumers' health, and maintain their reputation in the market [5].

III. Improving quality system through risk management

In conclusion, the process of improving the quality system through risk management is vital for food enterprises to deliver safe and consistent products to their customers. This approach requires the identification of potential risks in the food manufacturing process, the development of corrective measures, and the implementation of continuous monitoring and improvement procedures. Managers must be aware of the importance of integrating a risk management culture within the company to ensure a proactive approach to quality management. Furthermore, effective communication among staff, management, and stakeholders is essential to ensure all parties are aware of potential risks and are included in the decision-making process. Continuous education and training programs should also be given to staff to keep them abreast of industry standards and regulations. By employing a systematic and comprehensive approach to quality system improvement, food enterprises can ensure that they remain competitive and provide safe and healthy products to their consumers.

- Process flow of quality system improvement

When implementing a quality system improvement plan within a food enterprise, the process flow can be broken down into several key steps. Firstly, a risk assessment must be conducted to identify potential hazards within the production process, and determine the severity of their impact on the final product. Once these risks are identified, appropriate control measures should be implemented based on the level of risk they pose. The effectiveness of these control measures should be regularly reviewed, and any necessary adjustments made to ensure they are continuously effective. Ongoing monitoring and validation of the quality system should also take place, to ensure that it remains effective over time, and that any issues are identified and addressed promptly. Finally, regular documentation, including policies, procedures, and training materials should be updated as needed, to ensure that the quality system remains current, and that all employees are equipped with the knowledge and skills they need to implement it effectively. Through this process

flow, a culture of continuous improvement can be established within the food enterprise, leading to greater safety and quality outcomes for consumers.

- Integration of risk management into quality system

The integration of risk management into the quality system is essential for effective quality control and risk prevention in food enterprises. The quality system should be updated to reflect the incorporation of risk management strategies, including risk assessment, risk analysis, risk evaluation, and risk control. Effective implementation of risk management into the quality system will help food enterprises identify potential risks, mitigate them before they occur, and improve the safety and quality of food products. The risk management process should be dynamic and ongoing, using feedback to continuously improve the quality system and ensure that it remains relevant and effective. It is important for food enterprises to train their staff in risk management, including awareness of risks, risk communication, and risk response measures. The integration of risk management into the quality system is a critical step in ensuring the safety and quality of food products, and food enterprises should carefully consider its implementation for long-term success.

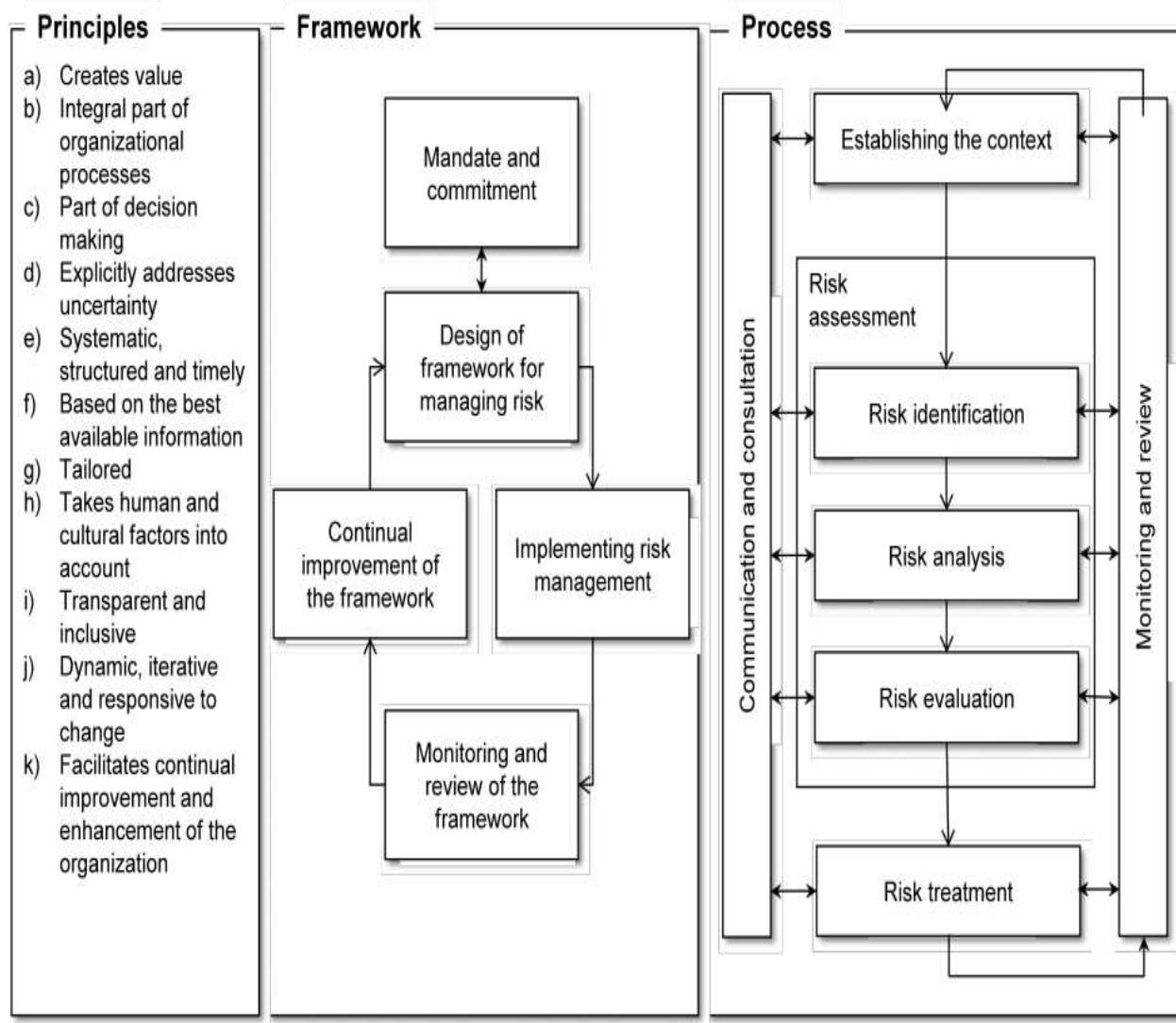


Figure 2. Risk management process (following ISO 31000) [5].

- Use of data and information to enhance the system

In conclusion, the use of data and information is an essential element in enhancing the quality system of food enterprises based on the principles of risk management. Data analysis

from both internal and external sources helps identify potential risks and threats to the quality system and develops appropriate measures to mitigate them in a timely manner. This process involves monitoring and controlling critical control points, conducting regular inspections, and maintaining effective communication with stakeholders. Information technology provides the tools to transform data into actionable information, enabling enterprises to make informed decisions and prioritize activities aimed at improving the quality system. Finally, a systematic approach to data collection, analysis, and management ensures continuous improvement of the quality system and enables enterprises to meet regulatory requirements and customer expectations. Therefore, the use of data and information is crucial in enhancing the quality system and achieving sustainable growth in the food industry.

- Benefits of quality system improvement to the food enterprise

The benefits of quality system improvement to the food enterprise are numerous. Firstly, it helps to increase customer satisfaction by providing high-quality products that meet or exceed their expectations. Secondly, it reduces the risk of food safety incidents, leading to a better reputation and reduced liability. Thirdly, it enhances the overall productivity and profitability of the enterprise, leading to cost savings in the long run. Fourthly, it ensures compliance with regulatory requirements and industry standards such as ISO and HACCP. Fifthly, it improves employee morale and engagement by providing a clear focus on quality and safety, leading to a better work environment. Lastly, it provides a competitive advantage in the market by differentiating the enterprise from other similar businesses and attracting customers who value quality and safety. Overall, the benefits of quality system improvement to the food enterprise are significant and provide a foundation for long-term success and growth.

Furthermore, implementing a quality system based on risk management can provide benefits beyond just improving food safety. By identifying potential risks and taking steps to mitigate them, an organization can also improve operational efficiency, reduce waste and costs, increase customer satisfaction, and enhance its overall reputation. This is because a quality system that focuses on risk management can help identify areas where improvements or changes can be made, such as streamlining production processes or implementing new technology to increase productivity. In addition, customers are increasingly demanding transparency and accountability when it comes to the safety and quality of the food they consume, and a well-designed quality system that incorporates risk management can help an organization demonstrate its commitment to these principles. Ultimately, investing in a robust quality system based on risk management is not just good for food safety, but it can also help organizations achieve a competitive advantage in the marketplace and build a loyal customer base[6].

IV. Factors to consider in implementing a risk management-based quality system

Several factors need to be considered while implementing a risk management-based quality system in any food enterprise. One of the critical factors is the availability of resources, including financial, human, and technological resources. Adequate resources are required to equip the organization to identify, assess, and control risks, as well as monitor compliance with the quality system. Another factor is the need for top management commitment and support to the quality system. This can be accomplished by training and providing guidelines for all employees on the importance of quality system implementation and continuous improvement. The organization must also regularly monitor and evaluate its risk management-based quality system to measure its effectiveness in mitigating risks. Lastly, it is essential to establish long-term goals and objectives and communicate these to all stakeholders, including customers, employees, and suppliers, to ensure that the quality system is continuously aligned with the necessary organizational objectives.

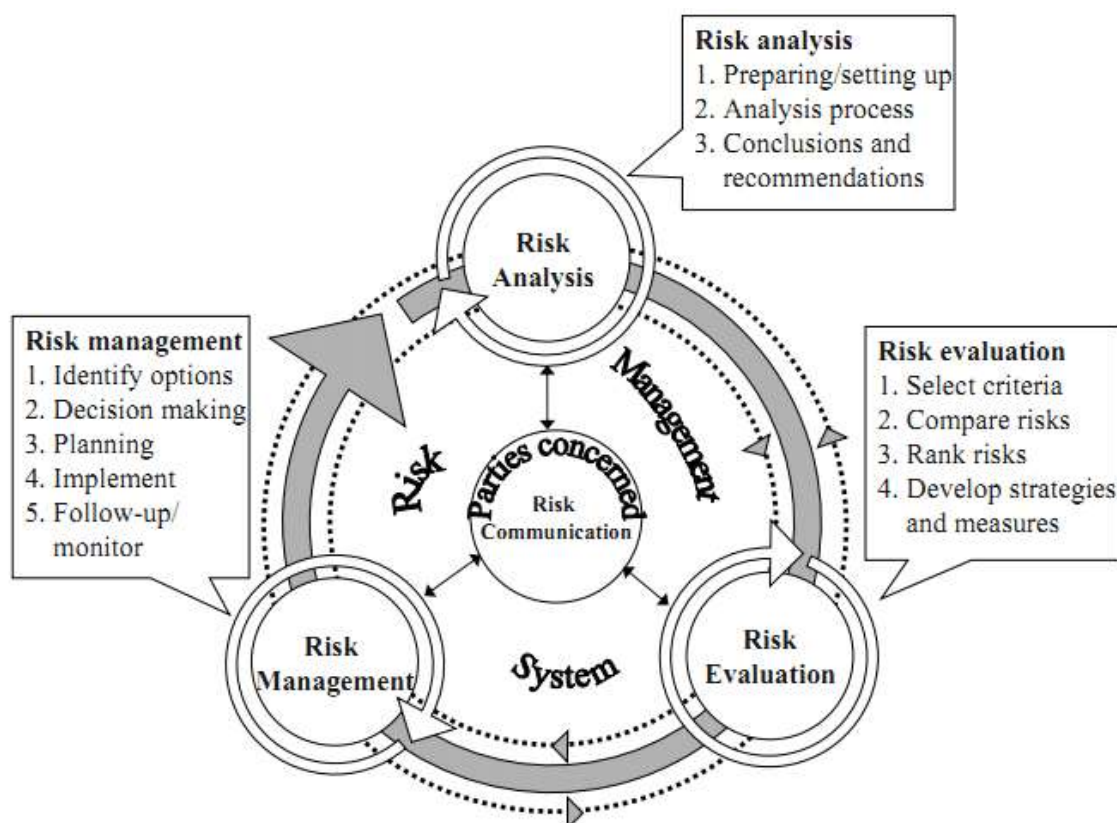


Figure 3. Main elements of the Risk Management System [6].

- Staff training and knowledge acquisition

In order to improve the quality system based on risk management in food enterprises, staff training and knowledge acquisition is a crucial aspect. This involves providing relevant training and education to employees in areas such as food safety, hygiene, quality control, risk assessment, and management. The training program should be designed to meet the specific needs of each employee and should be ongoing to keep staff updated with the latest regulations, technology, and industry trends. Effective training can help to improve staff performance, reduce errors and accidents, increase productivity, and enhance customer satisfaction. Additionally, regular training and continuous education can create a culture of quality and safety consciousness, making it easier to maintain high standards and mitigate risks in the long term. Therefore, food enterprises should invest in staff training and knowledge acquisition as part of their overall quality improvement strategy to ensure a safe and secure food supply chain for consumers.

- Availability of resources required for the system

The availability of resources required for the system is crucial for any quality system based on risk management. These resources will include funds, time, personnel, information, facilities, and equipment. Without adequate resources, the system will not function optimally, and the food enterprise will not achieve its desired results. For instance, there may be a lack of personnel to gather and analyze data, which can undermine the accuracy of risk assessments. Conversely, a surplus of personnel without adequate equipment and facilities can also render the system ineffective. Overall, a systematic approach is necessary to identify, prioritize, and allocate resources needed for the quality system. These resources should be sufficient, appropriate, and sustainable. A balanced allocation of resources should be based on the risk level involved, the criticality of tasks performed, and the importance of the quality system to the overall success of the food enterprise.

- Leadership commitment and support

Leadership commitment and support is crucial for the successful implementation of a risk-based quality management system in food enterprises. Management commitment is essential in creating a culture of quality and in building trust among stakeholders. It sets the tone for the

organization's commitment to continuous improvement and risk management. Leadership can influence employee behavior, provide resources, define expectations, and establish the necessary infrastructure for effective implementation. In addition, leadership commitment and support are key to overcoming resistance to change and shifting towards a risk-based approach to quality. A commitment to the quality management system creates a clear direction for the organization and provides a framework for long-term success. By demonstrating commitment and providing support, leadership will inspire the workforce to embrace the risk-based approach, enhancing the quality system throughout the food enterprise. Ultimately, leadership commitment and support are essential for the successful implementation of risk-based quality management systems in food enterprises.

In conclusion, the implementation of the quality system based on risk management is critical for food enterprises to ensure food safety and comply with regulatory requirements. The integration of risk management principles into the quality system can help to identify, analyze, evaluate and control food safety hazards more systematically and efficiently. The establishment of a risk-based approach can improve decision-making processes and prioritize resources towards critical control points. Moreover, the risk management approach can facilitate continuous improvement, through the establishment of performance indicators and monitoring systems. Therefore, food enterprises should adopt the risk management approach as a strategic tool to manage food safety hazards, reduce the likelihood of errors, and enhance customer satisfaction. With the support of well-trained personnel, improved documentation and standardized procedures, the implementation of a quality system based on risk management can enable food enterprises to deliver safe and high-quality food products to consumers.

V. Challenges in implementing a risk management-based quality system

One of the main challenges in implementing a risk management-based quality system is the cultural shift needed within the organization. It requires all employees to adopt a risk management mindset, which emphasizes the importance of identifying, evaluating, and mitigating risks. This cultural shift involves a change in habits, as risk management-based systems require constant monitoring and analysis of potential risks. Furthermore, it can be difficult to get employees to prioritize risk management, especially when their workloads are already high. In addition, the implementation of such systems requires significant investments in time and resources, such as training and software, which may deter some organizations. Finally, there may be resistance from leadership or co-workers who are hesitant to change their traditional quality assurance processes. Overcoming these challenges by communicating the value of risk management systems and investing in the technology and personnel necessary will pay dividends in the long run.

- Resistance to change from employees

Resistance to change from employees is a common problem in many organizations, including food enterprises seeking to improve their quality systems based on risk management. Employees may resist change for a variety of reasons, including fear of the unknown, lack of trust in management, and concerns about job security. To overcome this resistance, it is important for organizational leaders to communicate and involve employees in the change process from the beginning. This could involve explaining the reasons behind the change, the benefits that it will bring, and how it will impact employees' roles and responsibilities. In addition, leaders should provide training and support to help employees adapt to the new system. Ultimately, by addressing employee resistance to change in a thoughtful and strategic manner, food enterprises can successfully implement and sustain improvements in their quality systems, increasing the safety and satisfaction of their customers.

- Cost implications

Cost implications are one of the critical factors considered when implementing a quality system based on risk management in food enterprises. Risk management involves identifying potential hazards and their associated risks, and taking appropriate measures to mitigate them. These measures may include implementing quality control measures, purchasing new equipment, hiring additional personnel, or conducting training programs for employees. However, these measures also come at a cost, and food enterprises need to weigh the cost implications against the

benefits of implementing a risk management-based system. Therefore, it is essential to conduct a cost-benefit analysis to ensure that the benefits of a quality system based on risk management outweigh its costs. This analysis will provide invaluable information to management and help them make informed decisions about the best way to implement a risk management-based quality system while keeping costs manageable.

- Time considerations

Time considerations in the implementation of a quality system based on risk management are crucial in the food industry. As it takes considerable effort to thoroughly analyze, plan and execute changes, any delay can impact negatively on the anticipated benefits and cause additional problems. Time constraints affect the implementation of corrective actions and can delay or jeopardize their effectiveness, which is a fundamental aspect of the risk management process. The management of time also includes the documentation, monitoring, and evaluation of the quality system, necessary for the identification of weaknesses and opportunities for improvement. Adequate allocation of resources and delegation of responsibilities are ways to ensure the timely completion of tasks, communication, and sustainable results. Furthermore, the consideration of time in the design of the quality system may lead to better decision-making and prioritization of the actions taken. Thus, effective time management is critical for the successful implementation of a quality system based on risk management, which can ultimately enhance the safety and quality of food products.

In conclusion, implementing an effective quality management system that is based on risk management is crucial for ensuring the safety and quality of food products. This system helps food enterprises in identifying and managing risks and hazards at each stage of the food production process. By adhering to this system, food companies can prevent potential hazards from causing harm to consumers, and reduce the likelihood of costly product recalls. When quality system is based on risk management, it becomes more transparent, and the company gains a better understanding of issues that affect their products in the market. Food regulatory agencies also encourage companies to use risk-based approaches when designing their quality systems[7]. Therefore, food businesses must prioritize the implementation of a quality system that incorporates risk management approaches. They must also invest in training their staff on the importance of risk management and provide adequate resources needed to establish and maintain an effective quality management system.

VI. Conclusion

In conclusion, improving the quality system in food enterprises through risk management is a critical step towards mitigating potential risks and ensuring the safety of consumers. Companies must adopt a proactive rather than reactive approach to identify potential hazards and implement preventive measures to reduce their occurrence, impact, and severity. A well-designed QMS should incorporate risk assessment and continuous improvement to ensure that any potential issues are dealt with in a timely and effective manner. Implementation of risk management in food enterprises is a responsibility shared by all stakeholders in the food industry, including regulators, consumers, and manufacturers. Effective communication and collaboration among these stakeholders play a crucial role in achieving an efficient and successful quality management system that ultimately benefits the health and well-being of the public. Moving forward, the food industry must continue to prioritize risk management and quality assurance to ensure the delivery of safe, high-quality food products to consumers.

- Summary of key points

In summary, this article presents an overview of the current global food safety landscape and highlights the importance of a comprehensive risk-based approach in ensuring food safety in enterprises. The author underscores the different strategies that can be used to enhance risk management in the food industry, including the implementation of HACCP, the use of preventive controls, and the adoption of GFSI standards. The article emphasizes the need for a culture of continuous improvement for food enterprises and the importance of collaboration among stakeholders in the food industry. Additionally, the author stresses the role technological advancements can play in improving food safety and the need for systematic monitoring and

management of risks through regular audits and inspections. Finally, the author concludes by encouraging companies to implement a proactive risk management system that protects public health while promoting business sustainability and growth[8].

- Importance of risk management-based quality system in ensuring safe food to consumers

The effective implementation of a risk management-based quality system is fundamental in ensuring safe food to consumers. This system recognizes potential hazards and takes necessary actions to mitigate them through a comprehensive understanding of the entire supply chain, from the sourcing of raw materials to the final product delivery. It is vital to identify and analyze critical control points to minimize potential risks and prevent contamination or adulteration of food. A risk management-based quality system emphasizes continuous improvement, thereby promoting food safety culture and creating awareness about the potential hazards. It also ensures compliance with regulatory requirements and international standards, thus reducing the risk of product recalls or legal liabilities. Adopting a risk management-based quality system can improve the overall productivity and profitability of a food enterprise by minimizing the waste and reducing costs associated with recalls and legal litigations. Therefore, adopting an effective risk management-based quality system is essential for food enterprises to ensure safe and quality food to consumers.

- Recommendations for food enterprises to improve their quality system based on risk management.

To improve quality systems based on risk management in food enterprises, recommendations need to be made. The first recommendation is to develop a risk assessment plan that considers all potential risks involved in food production. The plan should cover all stages of production, including sourcing, processing, packaging, and distribution. The second recommendation is to implement a Hazard Analysis and Critical Control Points (HACCP) program, which is a systematic approach to identifying and controlling potential hazards in the food production process. A third recommendation is to develop and implement a comprehensive food safety training program for employees to ensure that risks are mitigated effectively throughout the entire production process[9]. Additionally, having a robust quality control team and using reliable testing methods can also improve the effectiveness of the quality system. Finally, management commitment is essential to ensuring the effective implementation of the quality system, and regular monitoring and audits should be carried out to ensure that the system is working as intended.

References

- [1]. J. Virant. "Design Considerations of Time in Fuzzy Systems." Springer Science & Business Media, 11/27/2013
- [2]. Daniela Bradutanu. "Resistance to change - a new perspective: A Textbook for Managers Who Plan to Implement a Change." Lulu.com, 9/1/2015
- [3]. O'zDSt ISO 31000:2016. Risk management. Principles and guidance.
- [4]. Хакимов Д. В., Кулдашев Ж. У., Эрматов А. Б. УЛУЧШЕНИЯ ПОТЕНЦИАЛА НАЦИОНАЛЬНОЙ ИНФРАСТРУКТУРЫ КАЧЕСТВА И ПРОБЛЕМЫ ЭКСПОРТА ПЛОДООВОЩНОЙ ПРОДУКЦИИ //Итоги и перспективы развития агропромышленного комплекса. – 2018. – С. 502.
- [5]. Khakimov D. V., Turgunov B. M., Muminov N. S. Development, Provision And Management Of Product Quality In Jsc «Jizzakh Battery Factory» //Acta of Turin Polytechnic University in Tashkent. – 2018. – Т. 8. – №. 2. – С. 112-116.
- [6]. Мамажонов А. А., Хакимов Д. В. У., Туйчиев А. Т. Управление входным контролем компонентов //Universum: технические науки. – 2020. – №. 6-1 (75). – С. 69-73.
- [7]. Odinayev, M. I., Hakimov, D. V., & Abdirayimov, A. R. (2022). Eksportbop qovun va tarvuz navlarini yetishtirish va ularning agrobiologik xususiyatlari. Academic Research in Educational Sciences, 3(12), 525–535.
- [8]. Karimov, U. M., Muminov, N. S., & Hakimov, D. V. (2022). SUT VA SUT MAHSULOTLARINI SIFAT VA XAVFSIZLIK KO" RSATKICHLARI TAHLILI. Academic research in educational sciences, 3(11), 606-616.
- [9]. Dilmurod Khakimov, Nilufarkhan Nosirova Analysis of the possibility of production processes based on modern methods. E3S Web of Conf. 376 02016 (2023). DOI: 10.1051/e3sconf/202337602016

TEXNIKA OLIY O'QUV YURLARIDA TALABALARNI IJTIMOYIY FANLARGA
QIZIQTIRISHNING AYRIM MASALALARI

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([Qabul qilindi 12.04.2024 y.](#))

Annotatsiya: *Texnika oliy o'quv yurtlarida ta'limni takomillashtirishning yangi usullarini izlash jamiyatning talablari bilan belgilanadi, buning natijasida an'anaviy o'qitish usullari kompetensiyaga asoslangan yondashuv bilan almashtiriladi. Ushbu maqolada texnika oliy o'quv yurtlarida talabalarini ijtimoiy fanlarga qiziqtirishning ayrim masalalari ko'rib chiqilgan.*

Kalit so'zlar: *texnika, texnologiya, ijtimoiy fanlar, ijtimoiy munosbatlar, jamiyat va inson, innovatsion ta'lim texnologiyalari, motivatsiya va uslub.*

Аннотация: *методика поиск новых способов совершенствования образования в высших учебных заведениях определяется требованиями общества, в результате чего традиционные методы обучения заменяются компетентностным подходом. В этой статье рассматриваются некоторые вопросы интереса студентов к общественным наукам в технических высших учебных заведениях.*

Ключевые слова: *технологии, технологии, социальные науки, социальные отношения, общество и человек, инновационные образовательные технологии, мотивация и стиль.*

Annotation: *Technique the search for new ways of improving education in higher education institutions is determined by the requirements of society, as a result of which traditional teaching methods are replaced by a competency-based approach. This article covers some issues of interest of students in social sciences in technical higher education institutions.*

Keywords: *technique, technology, social sciences, social relations, society and human, innovative educational technologies, motivation and methodology.*

Talabalar oliy dargohga ma'lum bir dunyoqarash, ilgari asosan o'rta ta'lim ma'lumotiga ko'ra shakllangan, e'tiqod va qarashlar bilan kirishadi. Ularning dunyoqarashining xususiyatlari va darajasini o'rganib chiqib, o'qituvchi ular ongi va qalbini qanday bilimlar bilan boyitish kerakligini, ularni nimaga ishontirish yoki ishontirmaslik kerakligini hal qiladi. Albatta, har bir talabaning umumiy dunyoqarash pozitsiyasini, uning qarashlari va hayotiy qadriyatlarini aniqlash kerak. Ushbu bosqichda har bir o'qituvchi muayyan qiyinchiliklarga duch keladi.

Agar ma'lum dunyoqarash muammolarini tushunish darajasi mashg'ulotlar va suhbatlar paytida aniqlanishi mumkin bo'lsa, unda yoshlarning qadriyat yo'nalishlari va qarashlari faqat talabaning barcha faoliyatini chuqur va har tomonlama tahlil qilish, uning biografik ma'lumotlarini o'rganish, jamoadagi xatti-harakatlar orqali aniqlanishi mumkin. Shuni yodda tutish kerakki, talabaning e'tiqodi nafaqat tarbiyaning natijasi, balki ular insonning tashqi dunyo bilan o'zaro munosabatlarining butun tizimi bilan belgilanadi[1].

Ta'lim tizimida mutaxassislarni tayyorlashga qo'yiladigan zamonaviy talablar, birinchi navbatda, o'quvchining motivatsion-qiymat sohasini shakllantirish uchun mutlaqo yangi vazifalarni ilgari suradi, bunda ularning bilim qiziqishini rivojlantirish ustuvor o'rin tutadi. Kognitiv qiziqishni rivojlantirishning boshlang'ich bo'g'ini uning umumiy ilmiy fanlarni o'rganishga kognitiv qiziqishni shakllantirishga qaratilgan. Aynan shu yerda zamonaviy mutaxassisning har tomonlama va uyg'un rivojlangan shaxsi sifatida talabaning rivojlanishiga turtki bo'ladi.

Oliy texnika o'quv yurtlarida ijtimoiy-gumanitar fanlarni o'rganish kelajakdagi mutaxassislarning kasbiy psixologiyasini, o'qitishning yo'nalish xususiyatlari, bakalavrlar, magistrlar, mutaxassislar profili bilan bog'liqligini hisobga olish lozim. Ijtimoiy - gumanitar fanlar mavzularining bo'limlarini tegishli maxsus fanlarning aniq materiallari bilan tasvirlash talabalarning tarixiy, ijtimoiy-iqtisodiy muammolarni o'rganishga qiziqishini oshirishning uslubiy vositalaridan biridir. Shu bilan birga, oliy o'quv yurti profili bilan bog'liqlik o'qituvchi va

talabalarni gumanitar fanning nazariy muammolarini o'rganishdan chetlashtirmasligi, nazariy masalalarni kasbiy muammolar bilan almashtirmasligi kerak.

Daliliy materialdan foydalanganda o'qituvchilar uni taqdim etilgan matnga kiritishning ishonchliligini, hajm va vaqt bo'yicha mutanosiblik tuyg'usiga rioya qilishni, turli xil uslubiy texnika va ko'rgazmali vositalardan, shu jumladan taqdimot shaklida axborot texnologiyalaridan foydalanishni hisobga olishlari lozim [2].

Oliy texnika o'quv yurtlarida talabalarga ijtimoiy-gumanitar fanlarni o'qitishda birnecha innovatsion ta'lim metodlaridan foydalanish mumkin. Masalan, "Tanqidiy fikrlash", "Debatli uslub", "Kichik guruhlarda ishlash uslubi", "Aqliy hujum", "Klaster" uslubi, "Munozara", "FSMU texnologiyasi", "Baliq skeleti", "T-sxema jadvali", "Case study" kabi bir necha ta'lim texnologiyalari va uslublaridan, shuningdek boshqa turdagi uslublardan ta'lim-tarbiya tizimida keng qo'llash mumkin.

Jumladan, "Munozara", ya'ni dars jarayonlarini yoki boshqa suhbat, davra suhbatlari, uchrashuvlarni, biron-bir muhim muammo va masalalarni ob'ektiv hal etishda munozarali metoddan foydalanish ko'zlangan natijaga erishishdama muhim ahamiyat kasb etadi. Bu metod yordamida talabalar, hatto o'qituvchilar ham muhokama etilayotgan mavzuni atroflicha, to'liq o'rganishligi uchun munozara jarayonida keng muhokama, munozara, tortishuv asosida muammoga tegishli ma'lumotlarni olishga muvaffaq bo'laladi[3]. Ushbu munozara uslubini o'tkazishda quyidagi tashkiliy sohalarga jiddiy e'tibor berish talab etiladi, chunki ushbu uslubda boshqa bir qator metodlar, ya'ni "Aqliy hujum" metodi bilan birgalikda foydalanib kichik guruhlar tuzilib, topshiriqlar berish uslublari parallel tarzda qo'llaniladi. Jumladan, mashg'ulot olib boruvchi o'qituvchi munozarani boshlashdan oldin mavzu tanlanib ishtirokchilarga e'lon qiladi, keyin o'qituvchi yoki tashkilotchi munozaraning "Aqliy hujum" shaklida talabalarga yoki ishtirokchilarga tartib, qoidalarini tushuntiradi. So'ng savollar e'lon qilinib, g'oya tariqasida – "kim tez javob beradi?" shaklida qisqa va tez javob berish, ya'ni "Blits so'rov" metodidan foydalanish taklif qilinadi. Ammo o'qituvchi yoki tashkilotchi ishtirokchilar tomonidan fikr va mulohazalarning to'g'ri yoki noto'g'ri aytilishidan qat'iy nazar tinglab bildirilgan hamma fikrlarni hisobga olinib boriladi. Muhokamaga hamma ishtirok etishi shart.

Munozara keskin tus olganda tartib, qoida buzilib "chegaradan" chiqishga yo'l qo'ymasligi kerak. Mavzu muhokamasi munozara tarzida oxiriga yetsa, o'qituvchi munozarani to'xtatib tanaffus e'lon qiladi. Ehtimol tanaffusgacha bo'lgan vaqtni "birinchi bosqich" deb ham atash mumkin. Tanaffusdan keyingi mashg'ulot ehtimol "ikkinchi bosqich" deb atab, mavzuga doir bildirilgan fikr, g'oyalarni yakun qilib o'qituvchi, tashkilotchi tomonidan bildirilgan fikr, g'oyalarni taxlil qilib to'g'ri javoblarni e'lon qiladi. Albatta bu uslub "Aqliy hujum"ga o'xshab ketadi, o'qituvchi, tashkilotchi muammo mavzuini e'lon qilib, o'zlarini munozarani tinglab turib yakunida to'g'ri fikr, g'oyani e'lon qiladi. Bu uslubdan foydalangan har bir o'qituvchi guruxni kichik guruhlar bilan ishlash metodiga aylantirib yuborishi mumkin. Ushbu mavzuni muhokama qilish, ushbu munozarali uslubda hamma ishtirokchi bevosita ishtirok etib o'z fikri va g'oyasini bildirishga harakat qiladi.

Guruh a'zolari orasida bu uslubning samarali jihati shundaki "passiv" ishtirokchi bo'lmaydi. Fikrlar, g'oyalar to'g'ri, yoki noto'g'rilardan qat'iy nazar hamma ishtirokchi "faol" ishtirok etib, haqiqiy, to'g'ri fikr va g'oyani o'qituvchi yoki tashkilotchi e'lon qiladi va munozarali mashg'ulotni yakunlaydi, ishtirokchilar bahosini e'lon qiladi.

Tadqiqot yondashuvining shakllanishiga muammoli o'qitish, o'qituvchilarning fanlararo aloqalarni ko'rsatishi, haqiqatni mustaqil ijodiy izlashga bo'lgan munosabati yordam beradi.

Muammoli o'qitish usulidan foydalanish o'qituvchi va talabalar auditoriyasining o'zaro ta'sirini oshirishga imkon beradi. Muammoli ta'lim - bu tayyor bilimlarni mexanik o'zlashtirishdan farqli o'laroq, muammoli vaziyatlarni yaratish orqali fikrlash mexanizmlarini o'z ichiga olgan holda, muammolarni hal qilishga talabalarning qiziqishini uyg'otadigan usullar tizimidir.

Muammoli vaziyat - intellektual qiyinchilik holati, tanlov qilish, qaror qabul qilish zarurati demakdir. Muammoli ta'lim bilimlarni ijodiy o'zlashtirishni ham, bilish usullarini o'zlashtirishni ham o'z ichiga oladi va shaxsning umumiy rivojlanishiga ijobiy ta'sir ko'rsatadi[4].

Muammoli vaziyatlarni yaratish usullari o'quv materialining muammoli darajasiga, talabalarning mustaqil kunlarning ma'lum bir turiga tayyorligiga bog'liq.

Muammoli ta'lim usuli quyidagilarni o'z ichiga olishi mumkin:

- 1) bir nechta variantlardan javobni tanlash va uni asoslash;
- 2) nomuvofiqliklarni, qarama-qarshiliklarni aniqlash, hodisalarni, faktlarni taqqoslash va tushuntirish;
- 3) faktlar, hodisalarning xronologik ketma-ketligini aniqlash va tushuntirish;
- 4) tushunchalar va ularning ta'riflari, shaxslar va ularning xatti-harakatlari, xronologiya va voqealar va boshqalarning muvofiqligini aniqlash va tahlil qilish;
- 5) nazariy qoidalar va ularni amalga oshirish amaliyoti o'rtasidagi ziddiyatlarni hal qilish va boshqalar.

Hozirgi kunda radio va televideniya qo'llanilayotgan uslublardan biri "ob'ektiv muloqot" uslubi bo'lib, dars mashg'ulotlari jarayonida ham qo'llanilsa talabalarni fanlarga qiziqishini oshirishda eng samarali va zeriktirmaydigan, faollikni oshiradigan uslublardan biridir. Bu uslubni ko'plar "o'z o'ringni top" deb ham nomlashadi. Ya'ni mavzuning munozarali muhokamasi davom etayotganda guruh alohida ikki guruhga bo'linib oldin noto'g'ri fikr bildirgan talaba yoki ishtirokchi, keyin o'z fikrining noto'g'riligini bilib, to'g'ri fikr aytgan guruhga borib qo'shiladi. Bu uslublar bevosita seminar mashg'ulotlarida amalga oshiriladi.

Shuningdek, bu uslubni tashkil etishda o'qituvchi yoki tashkilotchi mashg'ulot boshlanishida, darsning kirish qismida muammo mavzusi yoki predmet (fanning) mavzuidagi rejada ko'rsatilgan savollar e'lon qilinib, uni to'g'ri hal etish uchun turli xil yondashuvlardan foydalanishga ijozat berilishi, har bir talaba, tinglovchi yoki ishtirokchi o'z fikrini aytishi, munozara yoki muloqot jarayonida o'z xatosini tuzatilishi mumkinligi va dars mashg'ulotlari yakunida o'qituvchi, muammoning kim va kimlar (guruhlar mavjud bo'lsa) tomonidan to'g'ri aytilganligi yoki hech kim to'g'ri javob topaolmaganligini ham aytishni, to'g'ri javobni o'zlari aytishini mashg'ulot dars kirish qismida e'lon qilinadi va keyin esa dars mashg'uloti "ob'ektiv muloqot" uslubi asosida boshlanadi. Shu bilan birga ushbu uslubning o'ziga xos yana bir xususiyati borki, bunda darsni tashkil etish qoidalari, opponentlarning fikr, mulohazalari, bildirilgan g'oyalarning naqadar to'g'ri va noto'g'riligi ham muhokama qilinib, xulosa chiqariladi[5]. Dars, mashg'ulot oxirida o'qituvchi yoki tashkilotchi (boshqaruvchi) muloqot natijalarini yakunlab dars mashg'ulotining qanchalik ob'ektiv o'tganligini ta'kidlaydi, muloqotga ishtirok etib o'z fikr, mulohazalarini bildirganlarning ball-bahosini e'lon qiladi, mavzuning, javoblarning zamonaviyligi, dolzarbliligi, turmushga, hayotiy lahzalarga bog'langanligi, davlatimiz siyosatiga, xalqaro vaziyatga bog'langanligi jarayonlari ham mashg'ulot yakunida qayd etiladi. Shu sababli ushbu "ob'ektiv muloqot" uslubi zamonaviy original uslublardan biri bo'lib, bu uslubdan hamma fanlardan (nafaqat ijtimoiy fanlar) dars beruvchi pedagoglar foydalansa maqsadga muvofiq bo'ladi.

Umuman olganda, talabalar va o'qituvchilar o'rtasidagi innovatsion yondashuvning maqsadi:

- fikrlar, baholar, bilimlar, mulohazalar almashish;
- mustaqil, ijodiy fikrlashni rivojlantirish, o'rganilayotgan narsaga tanqidiy munosabat;
- o'rganilayotgan mavzuga qiziqishni yanada oshirish;
- talabalarning mavjudotga bo'lgan munosabatini kechikkan muammolardan zamonaviylikning dolzarb masalalarini tezkor o'rganish;
- talabalarning darsning eng murakkab va muhim qoidalarini tushunishlari to'g'risida ma'lumot olish uchun fikr-mulohazalarni taqdim etish[6].

Tavsiya etilgan o'quv nashrlaridan materialni tahlil qilish, asosiy va tanqidiy tushunishni aniqlash, lug'atlar va ilmiy ma'lumotnomalar yordamida mustaqil ravishda aniqlashtirish jiddiy ilmiy izlanishlar uchun zaruriy shartdir.

Talabalarning ilmiy-tadqiqot ishlari ularning intellektual rivojlanishiga hissa qo'shadi, o'quv materiallarini ijodiy o'zlashtirishga, kasbiy muhim shaxsiy fazilatlarni rivojlantirishga yordam beradi.

Albatta, talabalarning ilmiy ishlarida ishtirok etish ijodiy fikrlash, tashabbuskorlik va mustaqillikni rivojlantirishga, ma'lumotlarni tahlil qilish va undan oqilona foydalanish qobiliyatiga

yordam beradi. Talabalarning katta qismi ilmiy-tadqiqot faoliyatida ishtirok etishni kelajakdagi kasbga tayyorgarlikning ajralmas qismi sifatida ko'rish kerak.

Hozirgi kunda bir qator oliy o'quv yurtlarida talabalarga ijtimoiy-gumanitar fanlardan dars berishi jarayonida, ularning fanlarga qiziqishini uyg'otadigan uslublardan tashqari kundalik uchrashuvlarda, o'tkazilayotgan tadbirlarda, yig'ilish va anjumanlarda, teleradio ko'rsatuv va eshittirishlarda, davra suhbatlarda, konsultasiyalar, dialog-seminarlarda ko'rik tanlov va iqtidorli talabalar bilan ishlashda ko'plab turli xil uslubiy, holatlardan foydalanilmoqda. Shu sababli quyidagi tahlil qilinadigan uslubiy holatlardan foydalanishni o'quv jarayoniga tavsiya qilishdan ham maqsad talabalarga sifatli, natijali ta'lim va tarbiya berishdan, kelajakda Vatanimizga sadoqatli, bilimli, komil insonli kadrlar tarbiyalab yetishtirishdan iboratdir[7].

Xulosa qilib aytganda, texnika oliy o'quv yurti talabalariga ijtimoiy fanlarni o'qitish orqali talabalar o'zini ishonchli his qilishga, talabalar mavzusiga qiziqishni yuqtirishga yordam beradi. Umuman olganda, ijtimoiy fan o'qituvchisining o'zi talabalar bilan nazariy, amaliy, insoniy tajribalarini erkin suhbat shaklida baquvvat, g'ayrat bilan baham ko'rish zarurati, uning shaxsiy xususiyatlarini, muhokama qilinayotgan muammolarga individual qarashlarini aks ettirish, o'qitishning innovatsion usullarini keng qo'llash, gumanitar va texnik ta'limning organik aloqasini ta'minlash lozim.

Adabiyotlar:

- [1]. Харламова Т.И. Преподавание гуманитарных дисциплин с учетом профиля вуза. // Известия МГТУ, 2013, № 1 (15). Т. 6 с. 201-209.
- [2]. Bhattacharjee A. Social science research: Principles, methods, and practices. – University of South Florida, 2012.
- [3]. Surayyo D. HISTORICAL MEMORY AND NATIONAL SELF-AWARENESS IN EDUCATING YOUNG PEOPLE IN THE SPIRIT OF PATRIOTISM //EDITORIAL BOARD. – 2022. – С. 288.
- [4]. Winch P. The idea of a social science and its relation to philosophy. – Routledge, 2015.
- [5]. Фарходжонов Н. Ф., Жураев Ж. А. Влияние идеологических процессов на национальную идею в условиях глобализации //Теория и практика современной науки. – 2017. – №. 4 (22). – С. 15-18.
- [6]. Прямыкова Е. В. Социальные науки в современном образовании: обоснование нового подхода //Социально-гуманитарные знания. – 2009. – №. 6. – С. 196-208.
- [7]. Dehqonova S., Dilmurodov J. FORMATION OF SPIRITUAL EDUCATION OF YOUTH //Экономика и социум. – 2020. – №. 10 (77). – С. 48-51.

OLYI TEXNIKA TA'LIMIDA MEHNAT MUHOFAZASI VA TEXNIKA XAVFSIZLIGI QOIDALARINI O'QITISHNING ZAMONAVIY MODELI

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Annotatsiya: Ushbu maqolada innovatsion yondashuv asosida oliy texnika ta'limida mehnat muhofazasi va texnika xavfsizligi qoidalarini o'qitishning metodik asoslarini takomillashtirish, bo'lajak texnik soha kadrlarining kasbiy va shaxsiy rivojlanishi uchun zarur pedagogik shart-sharoitlarni yaratishning pedagogik asoslarini ishlab chiqish, psixologik-pedagogik shart-sharoitlar va ularning metodik tayyorgarligini belgilovchi mezonlarni ishlab chiqish yoritilgan.

Kalit so'zlar: texnik sabablar, xavfsizlik texnikasi, xavfsizlik psixologiyasi, mehnat faoliyati, baxtsiz hodisalar.

Аннотация: В данной статье освещается совершенствование методических основ преподавания правил охраны труда и техники безопасности в высшем техническом образовании на основе инновационного подхода, разработка педагогических основ создания необходимых педагогических условий профессионального и личностного развития кадров будущей технической

сферы, разработка психолого-педагогических условий и критериев, определяющих их методическую подготовку.

Ключевые слова: технические причины, техника безопасности, психология безопасности, трудовая деятельность, несчастные случаи.

Annotation: In this article, on the basis of an innovative approach, the development of pedagogical foundations for improving the methodological foundations of teaching the rules of labor protection and technical safety in Higher Technical Education, the creation of the necessary pedagogical conditions for the professional and personal development of personnel of the future technical sphere, the development of criteria determining psychological and pedagogical conditions and their methodological

Keywords: technical reasons, safety techniques, safety psychology, labor activity, accidents.

Zamonaviy ishlab chiqarish sharoitida baxtsiz hodisalarni (jarohatlanishlar, shikastlanishlar, kasallanishlar, yong'inlar va b.) kamaytirish muammosini faqatgina muhandislik uslublari orqali hal etib bo'lmaydi. Shu sababli, mehnat xavfsizligi psixologiyasi faoliyat xavfsizligini ta'minlashda muhim o'rin tutadi.

Tajribalarning ko'rsatishicha ishlab chiqarishdagi avariya va jarohatlanishlar mashinalardagi muhandislik-konstruktorlik nuqsonlar yoki texnik-texnologik sabablar orqali bo'lmay, balki tashkiliy-psixologik, ua'ni xavfsizlik texnikasi bo'yicha yetarli bilim ega bo'lmaslik, yetarli darajada o'qitilmaslik, ishchining bilib- bilmay xavfsizlik qoidalariga rioya qilmasligi, xavfli ishlarga maxsus o'qishlardan o'tmaganlarga ruxsat berish, ishga mutaxassislik bo'yicha qabul qilmaslik va shu kabi qator sabablar ta'sirida yuz beradi. Shu sababli, ko'pincha jarohatlanishlarning 60–70 foiziga bevosita jarohatlanuvchilarning o'zlari aybdor bo'ladi[1].

Xavfsizlik psixologiyasi deganda insonning mehnat xavfsizligini ta'minlashga qaratilgan psixologik bilimlardan foydalanish tushuniladi.

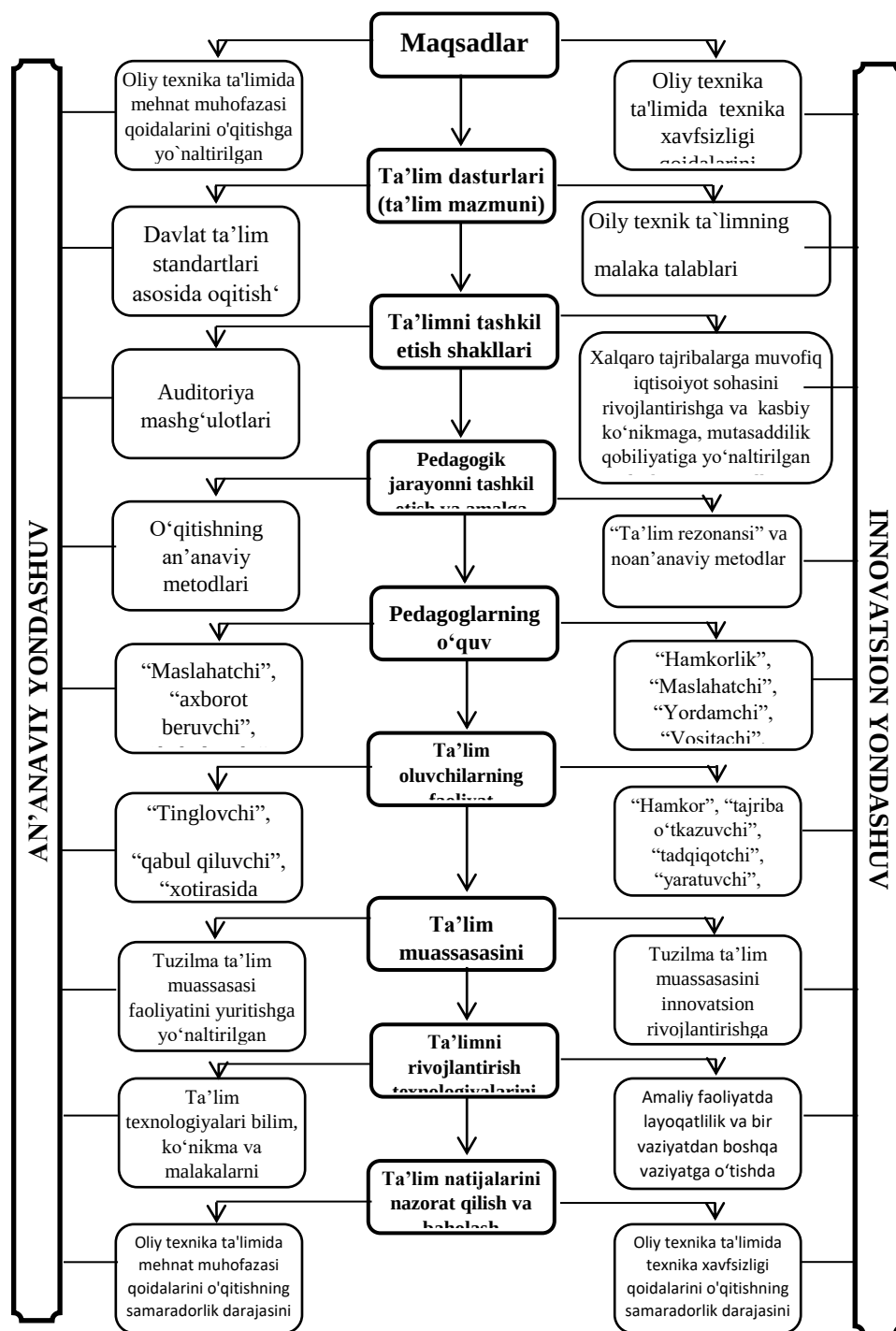
Oliy texnika ta'limida mehnat muhofazasi va texnika xavfsizligi qoidalarini o'qitishning metodik asoslarini takomillashtirishda xavfsizlik psixologiyasini o'qitishga alohida e'tibor qaratish va shu asosda mehnat faoliyati davomida yuzberadigan turli jarayonlarni, xususiyatlarni va holatlarga doir bilimlarni bo'lajak kadrlarda shakllantirish muhim hisoblanadi.

Insonning mehnat faoliyati samaradorligi (ish qobiliyati) ruhiy zo'riqish, ua'ni hayajonlanish darajasiga bog'liq holda o'zgaradi. Ruhiy zo'riqish ma'lum chegaragacha ish natijasiga ijobiy ta'sir ko'rsatadi. Lekin bu xususiyatni chegaradan, ya'ni kritik darajadan ortiq bo'lishi ish qobiliyatini pasayishidan tortib umuman yo'qolishigacha olib kelishi mumkin. Bunday ruhiy zo'riqish, chegaradan tashqari zo'riqishdeb belgilanadi. Ishchining mehnat faoliyat davridagi me'yoriyruhiy yuklanganligi maksimal yuklanish darajasining 40–60 foizini tashkil etishi lozim, aks holda, yuklanganlikning bu chegaradan oshishi ishchining ish qobiliyatini susayishiga olib keladi [2].

Chegaradan tashqari ruhiy zo'riqish tormozli va asabiyko'rinishlarga bo'linadi. Tormozli ruhiy zo'riqish harakatning cheklanganligi va sekinlashishi orqali tavsiflanadi. Bunday holatda, ishchi oldingi holatidagiday epchillik, chaqqonlik va ustalik bilan o'z kasbiy mahoratini namoyon qila olmaydi, ya'ni fikrlash jarayoni sekinlashadi, eslash qobiliyati susayadi, e'tiborsizlik va shu kabi boshqa salbiy belgilar yuzaga keladi.

Oliy texnika ta'limida mehnat muhofazasi va texnika xavfsizligi qoidalarini o'qitishning metodik asoslarini takomillashtirish bo'lajak kadrlarning ruhiy barqarorligiga va irodasini matonatli bo'lishiga e'tibor qaratish talab etiladi. Chunki ishchining ruhiy ishonchliligini belgilovchi alohida ruhiy holatlar: paroksizmal hushdan ketish, kayfiyatni psixogen o'zgarishi, ruhiy aktiv vositalarni (stimulatorlar, trankvilizatorlar, alkohol ichimliklar) qabul qilish ta'siridagi ruhiy o'zgarishlar ko'rinishlarida bo'ladi.

Paroksizmal holat – turli xil toifadagi hushdan ketish (bosh miyaning organik kasallanishi, epilepsiya, hushdan ketish), ua'ni bir necha sekunddan bir necha daqiqa oralig'ida hushni yo'qotishdir. Albatta, bunday holat turli xil og'ir oqibatlarga olib keluvchi, ba'zida o'lim bilan tugovchi baxtsiz hodisalarga sabab bo'lishi mumkin.



Bo'lajak texnik va texnologlarda, oliy texnik ta'lim muassasalari talabalarida mehnat faoliyati jarayonidagi ruhiy ta'sirlashuv natijasida psixogen o'zgarishlar va «affektiv» holatlarning yuzaga kelishi va bu jarayonda nimalar qilish mumkinligiga doir bilimlarni shakllantirish muhim hisoblanadi. Psixogen o'zgarishlar va «affektiv» holatlar ruhiy ta'sir orqali yuzaga keladi. Kayfiyatning tushishi va apatiya bir necha soatdan, bir necha oygacha davom etishi mumkin. Albatta, bunga turli xil ko'ngilsiz hodisalar, ixtilofli, mojaroli vaziyatlar sabab bo'ladi. Bunday holatda befarqlik, lanjlik, lohaslik, tormozlanganlik, e'tiborsizlik, muskul harakatining susayishi sodir bo'lishi yuzaga keladi va bu holatlar o'z-o'zini nazorat qilish qobiliyatini susayishiga, natija esa turli ko'rinishdagi baxtsiz hodisalarni kelib chiqishiga olib kelishi mumkin[3]. Xafa bo'lish, haqoratlanish, ishlab chiqarishdagi muvaffaqiyatsizlik

oqibatida esa affektiv holat yuzaga keladi. Insonda, affektiv holat vaqtida fikrlash-tafakkurlashning psixogen (emotsional) torayishi kuzatiladi. Bunda harakatning tezligi, agressivligi va qo‘polligi ortadi. Ruhiy aktiv vositalar, ya’ni dori-darmonlar va alkogol ichimliklarni qabul qilish ham ruhiy holatni salbiy o‘zgarishiga olib keladi. Ruhiy aktiv vositalarga: simulyatorlar (pervitin, fenamin) va trankvilizatorlar (seduksen, elenium) kiradi.

Shuningdek, oliy texnik ta’limda kasb kasalliklarining oldini olish va ishlab chiqarish jarohatlarini kamaytirishda, ushbu baxtsiz hodisalarni chuqur tahlil qilish asosida ularni keltirib chiqaruvchi sabablarni hamda ishlab chiqarishdagi xavfli va zararli omillarni puxta o‘rganish muhim rol o‘ynaydi.

Baxtsiz hodisalarning sabablari asosan quyidagi 4 guruhga bo‘linadi: texnikaviy, sanitar-gigiyenik, tashkiliy va psixofiziologik.

Texnikaviy sabablarga mashina va mexanizmlar hamda ish jihozlarining nosozligi, elektr qurilmalarining yerga ulanmaganligi, yuklashtushirish mashinalaridan noto‘g‘ri foydalanish, mashina va mexanizmlar konstruksiyasini mehnat muhofazasi talablariga javob bermasligi kabilar kiradi.

Sanitar-gigiyenik sabablarga mehnat gigiyenasi, sanitar me’yorlar va qoidalarga amal qilmaslik, yoritilganlik, harorat, nisbiy namlik, havoning harakatlanish tezligi, havoning bosimi kabi ko‘rsatkichlarni me’yordan chetga chiqishi, yuqori miqdordagi shovqin, titrash, havoning changlanganligi yoki gazlanganligini kiritish mumkin.

Tashkiliy sabablarga ish rejimi va dam olish rejimini noto‘g‘ri tashkil etilganligi, sog‘lom va xavfsiz ish sharoitini yaratilmaganligi, ishchilarni xavfsizlik texnikasi qoidalari bo‘yicha o‘qitilmaganligi, ish joylarida ogohlantiruvchi belgilarni bo‘lmasligi, nomutaxassislarni ishga qabul qilish, maxsus kiyim-boshlar hamda shaxsiy himoya vositalari bilan ishchilarni ta’minlanmaganligi va boshqalar misol bo‘la oladi.

Psixofiziologik sabablarga bajarilayotgan ishga e’tiborsiz qaralishi, ishchining o‘z faoliyatida bo‘lgan nazoratining bo‘shligi, jismoniy yoki asabiy toliqish va boshqa shu kabilar kiradi. Ishlab chiqarishdagi xavfli va zararli omillar baxtsiz hodisalarni keltirib chiqaruvchi sabablardan farq qiladi[4]. Baxtsiz hodisalarning sabablari mehnat muhofazasi bo‘yicha standartlar, qonun-qoidalar va ko‘rsatmalarning buzilishi, ularga amal qilmaslik oqibati bo‘lsa, ishlab chiqarishdagi xavfli va zararli omillar bevosita jarohatlanishlarni keltirib chiqaruvchi shart-sharoitlar hisoblanadi. Ishlab chiqarishdagi xavfli va zararli omillar ishning turi va mehnat sharoitiga bog‘liq holda 4 guruhga bo‘linadi: fizikaviy, kimyoviy, biologik va psixofiziologik.

Fizikaviy omillarga harakatdagi mashina va mexanizmlar, ularning himoyalangan qo‘zg‘aluvchi mexanizmlari, ish joyi havosining yuqori darajada changlanganligi, gazlanganligi, baland darajadagi shovqin, titrash, infratovush, ultratovush, turli xil nurlanishlar, statik elektr zaryadlari, yuqori kuchlanishdagi elektr yoki magnit maydonlari, yoritilganlik darajasining me’yordan chetga chiqishi kabi omillar kiradi.

Kimyoviy omillarga ishlab chiqarish jarayonlarida ishlatiladigan yoki ajralib chiqadigan turli xil kimyoviy moddalar kiradi. Ularni insonga ta’sir etish xususiyatiga qarab quyidagi guruhlariga ajratish mumkin: umumiy zaharlovchi, ko‘payish funksiyalariga ta’sir etuvchi; inson a’zolariga kirish orqali esa: nafas olish yo‘li orqalita’sir etuvchi, ovqatlanish va hazm qilish tizimi orqali va bevosita teri orqali ta’sir etuvchi bo‘la oladi.

Biologik omillarga har xil jarohatlar va kasalliklarni keltirib chiqaruvchi mikro va makro-organizmlar: bakteriyalar, viruslar, rikket, zamburug‘lar, har xil zaharli o‘simliklar va hayvonlar kiradi.

Psixofiziologik omillarga jismoniy va asabiy zo‘riqishlar misol bo‘la oladi. Jismoniy zo‘riqishlar statik, dinamik va giperdinamik holda bo‘lishi mumkin. Asabiy zo‘riqish kuchli aqliy mehnatdan, mehnatni doimiy bir xil ko‘rinishda bo‘lishidan, kuchli hayajonlanish yoki asabiylashishdan sodir bo‘ladi.

Ishlab chiqarishdagi ko'pgina holatlarda ushbu faktorlar umumlashgan holda uchraydi. Ishlab chiqarishda baxtsiz hodisalarning oldini olish zararli va xavfli faktorlarning ta'sir darajasini susaytirish maqsadida texnologik jarayonlarni to'liq mexanizatsiyalashtirish, avtomatlashtirish va ish joylarini germetiklashtirish, ishlab chiqarish xonalarida yoritilganlik, shovqin, titrash darajalarini hamda, mikroiqlim ko'rsatkichlarini me'yorlashtirish, ishchilarni maxsus kiyim-boshlar va shaxsiy himoya vositalari bilan ta'minlashni o'z vaqtida amalga oshirish talab etiladi.

Adabiyotlar:

- [1] Йўлдошев Ў.Р., Раҳимов О.Д., Хоъжакулов Р.Т., Ҳасанова О.Т. Мехнат муҳофазаси ва техника хавфсизлиги. – Тошкент.: «Давр нашриёти» МЧЖ, 2013, -Б. 30.
- [2] Расулова Г.А. Масофавий таълим тизимининг асосий хоссалари ва имкониятлари // Таълим ва технология / Услубий мақолалар тўплами. – Фарғона, 2006. – Б. 174 – 176.
- [3] Abduraxmanov O.K. O'zbekiston Respublikasida mehnatni muhofaza qilish tizimini boshqarish samaradorligini oshirish. T.: Fan., 2010. – 326 b.
- [4] Abdurahmonov Q.X. Mehnat iqtisodiyoti va sotsiologiyasi. Darslik. – T.: Fan va texnologiya, 2012. – 388 b.

SOME ASPECTS OF TEACHING FOREIGN LANGUAGES AT A TECHNICAL UNIVERSITY

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Annotatsiya: *Bugungi kunda ingliz tilini o'rganish global ahamiyatga ega masalalardan biri bo'lib, bu esa rivojlanish sari qadam tashlayotgan davlatlarda xorijiy tilni o'rganish dolzarb ahamiyatga ega ekanligini ko'rsatmoqda. Ushbu maqolada texnika oliy o'quv yurtlarida ingliz tilini o'qitishda e'tibor berilishi kerak bo'lgan muhim jihatlar va metodik takliflar yoritib berilgan.*

Kalit so'zlar: *texnika oliy o'quv yurti, fan-texnika rivoji, xorijiy til, kasbiy tayyorgarlik, xalqaro munosabatlar, o'qitish metodikasi.*

Аннотация: *Сегодня изучение английского языка является одним из вопросов глобального значения, что свидетельствует об актуальности изучения иностранного языка в странах, которые делают шаги к развитию. В этой статье освещаются важные аспекты и методические предложения, на которые следует обратить внимание при преподавании английского языка в технических высших учебных заведениях.*

Ключевые слова: *техническое высшее учебное заведение, научно-техническое развитие, иностранный язык, профессиональная подготовка, международные отношения, методика преподавания.*

Annotation: *Today, the study of English is one of the issues of global importance, which indicates that the study of a foreign language is of urgent importance in countries that are taking a step towards development. This article highlights important aspects and methodological proposals that should be paid attention to when teaching English in technical higher education institutions.*

Keywords: *technical higher educational institution, development of Science and technology, foreign language, Professional Training, International Relations, teaching methodology.*

Today, the increasing demands of the labor market on the knowledge of young professionals have led to the modernization of the development of domestic higher professional education, the main purpose of which, when learning a foreign language, is not only mastering linguistic and intercultural communication skills, but also skills of foreign-language professional communication. That is why the foreign language training of future specialists should be aimed at developing their communicative competence at the level of professional proficiency. For successful implementation in professional activities, science, modern society, and international communication, students of

technical universities need to master linguistic and cultural skills that form intercultural foreign language communicative competence, without which it is impossible to realize any type of activity in the intercultural space

In the modern world, in the era of globalization of the economy and communications, the development of cooperation in all areas of public, political and cultural life, there can be no doubt that English - the language of international communication, the Internet, science and technology - is an integral part of multidisciplinary education.

One of the principles of the competence-based approach in teaching a foreign language at a technical university is the formulation of learning goals based on the final result, i.e. the acquisition of knowledge, skills, attitudes, values or competencies for students to learn and then put into practice after the end of the academic period.

In this regard, in our opinion, the process of teaching a foreign language in a non-philological university, including engineering specialties, should be structured depending on and in accordance with specialized educational programs. The "competence-based approach" technology implies the planning of educational material, focusing on three stages of learning, depending on the tasks set:

- general training, basic phonetics, grammar, conversational practice;
- specialized training - skills of selecting, scanning, reading texts in the specialty, annotating, preparing messages in the specialty;
- socio-professional training - an advanced level of language proficiency, including the ability to listen and understand lectures in a foreign language, participate in seminars and discussions on professional topics, make presentations in the specialty.

To achieve the above, technical universities have chosen a practical training lesson as the basis of the educational process when teaching a foreign language, and they have also compiled a number of specialized programs in the discipline "Foreign Language" aimed at the effective development of students' foreign language communicative competence in professional training conditions for successful self-realization in professional situations created by the employer for future specialists.

For example, according to the new programs adopted by technical universities, students of technical specialties should know the results of studying a foreign language:

- 1) the linguistic structure of the studied language (phonetics, grammar, vocabulary);
- 2) the specifics of scientific and technical literature;
- 3) rules for the compilation of the main types of text compressions (abstract, abstract);
- 4) the structure of messages, reports, presentations;
- 5) rules for preparing summaries, business correspondence;
- 6) etiquette of business communication.

At the first stage of linguistic training, the main task is to develop general communication skills - that is, general competence (oral speech skills and reading comprehension).

The second stage, the stage of specialized training, includes initiation into specialized communication: mastering professional vocabulary units and structures of technical discourse, pragmatic understanding of texts, annotation and discussion of what has been read.

The third stage, the stage of socio-professional training, implies further improvement and development of acquired skills, namely, the development of oral and written discourse skills set by the proposed circumstances. This is the essence of sociolinguistic competence in the field of language learning; full mastery of it will allow students to be involved in the process of academic mobility, as well as make it possible for future specialists to participate in international projects and scientific activities[1].

The most relevant technologies that meet the listed tasks in the process of teaching a foreign language at a higher technical school are the following:

- The Project Method. This method, based on the "competence-based approach" in teaching spoken and professional language, implies motivation, interest and independence of students. The idea of developing, creative learning is embodied here. The project method in teaching a foreign language is used at all stages of learning, according to the "competence-based approach" method:

the proposed project topics will be different depending on the students' preparedness. Students work in a team, together with the teacher they not only look for extraordinary solutions, but also analyze every step of their training, identify shortcomings and mistakes, look for the causes of difficulties and find ways to correct mistakes. By correctly directing the discussion, suggesting the necessary vocabulary and refraining from correcting grammatical errors during the discussion (they will be taken on a pencil and discussed at the end of the lesson), the teacher can bring students not only to a new level of language proficiency, but also introduce a new vision of the problem itself.

- Case Study technology. This method is a method of analyzing a specific educational and business situation in a foreign language, and is also based on the "competence-based approach" method. Within the framework of this teaching methodology, students, instead of answering specific questions about texts, need to fully comprehend the proposed situation. This technique ensures the development of independence and initiative, removes barriers in the use of a foreign language (the desire to speak out prevails). This method is a difficult task for a teacher, requiring high professionalism in the practice of fluency in foreign speech, pedagogical skills and broad erudition.

- The "Debate" technology. This technology can be used in the second and third stages of training using the "competence-based approach" methodology. This can be an activity aimed at repeating, updating the completed module; organizing independent work of students in the selection of material; as well as a form of certification and testing of students. Using this technology, a foreign language teacher can achieve the following results: the ability to express his point of view in a foreign language, defend it; the ability to ask questions; the ability to critically comprehend an oral statement; the ability to work in a team.

With the help of this technologies, an English teacher can get the following results:

- the student's ability to express his own position on a specific issue regarding future professional activity in English (including using technical terms), to defend his own opinion;
- the ability to formulate questions correctly;
- the ability to critically comprehend oral speech;
- ability to work in a team.

Learning and mastering the English language (including technical) requires the student to be aware of its grammatical system and the correct use of grammatical and lexical constructions. In the process of activity, comparisons of the grammatical systems of the native and English languages are inevitable [2].

However, despite the fact that more and more attention is paid to teaching oral speech when teaching students of technical specialties, one of the most important skills of future specialists is reading and adequate perception of texts in the specialty, which involves the use of the classical grammatical and translational method of teaching a foreign language. Even with good conversational skills and an extensive vocabulary, but without knowledge of the grammatical features of written speech, it will be almost impossible to understand and translate a technical text.

Learning and mastering a foreign language requires awareness of its grammatical system and the correct use of lexical and grammatical structures.

When teaching a foreign language at a technical university, it is also necessary to take into account the specifics of the profile training of students. Students study according to the principle of progressive information processing, so they perceive standard language programs well, which include questions for assimilation, work with a dictionary, vocabulary analysis, etc. They are willing to study grammar, they first need to explain the rule, then suggest a way to complete the task. They need graphs, models, tables [3].

When working with lexical units, students of technical universities try to analyze them, memorize lists of lexemes by heart, and use bilingual dictionaries to check the exact meaning of

the term. Such students need help in developing fluency in speaking. It is also necessary to pay special attention to tasks for listening and for the development of reading fluency.

A number of studies have noted that students of technical universities are characterized by difficulties in speaking, as well as excessive self-control over spoken speech. In addition, during speech activity, they tend to use pre-learned phrases and texts that they include in their own speech without prior thought. Communicative tasks that promote memorization of whole phrases and blocks ensure the spontaneity of using the language of the specialty in speech without mechanical memorization, which helps to get rid of unnecessarily rigid self-control over what they say[4].

Technical students do the best job with written assignments, as well as those types of educational activities that allow them to analyze and draw independent conclusions both individually and in groups.

Despite the fact that their accuracy in using tokens and applying rules is usually higher than that of humanities students, students of technical universities are usually slower to complete written work, since they need more time to think about and carefully complete tasks.

Reading texts in the specialty should be based on translation, which should be considered as the main means of developing understanding. Untranslated understanding is the final stage of learning to understand a foreign language text, which is achieved later with the independent work of students. Translation is a necessary way to find an equivalent. Therefore, an explicit or implicit translation into the native language is always present.

It can be noted that the best results in teaching foreign languages to engineering students can be obtained with the integrated use of communicative methods and the grammatical translation method. In the learning process, the sequence of methodological steps proposed by the teacher involves a transition from mastering language tools to the formation of students' speech skills and the development of speech skills, both receptive and productive.

When teaching English at a technical university, it is necessary to take into account the specifics of the profile training of students. Students study English on the principle of progressive information processing. This approach makes it possible to perceive standard language programs well, which include questions on the assimilation of colloquial vocabulary and technical terminology, work with dictionaries (including technical ones), analysis of lexical expressions, etc.

The teachers of the practice note that when conducting classes with grammar, students must first explain the grammatical rule, and then suggest one or another way to complete the task.

However, it should be noted that one of the most important and multilevel methods of learning English as a foreign language today is linguo-sociocultural, which involves an appeal to such a component as the cultural and social environment. Proponents of this method firmly believe that a language will lose its existence if the goal is solely to master lexical and grammatical forms [5].

Listening tasks (listening perception, for example, listening to CDs with technical texts, as well as the development of reading fluency) deserve special attention.

As practice shows, when learning English, technical students perform best written assignments, as well as those types of educational activities that allow them to analyze and draw independent conclusions, both as a team and individually.

Finally, the final stage of learning is an untranslated understanding of the English text, which is achieved later when students work independently. Translation for tech students is a necessary way to find an equivalent. Therefore, a hidden or explicit translation into Russian will always be present.

Summarizing the above, it should be noted that the best results in teaching English to students of technical universities can be achieved with the integrated use of communicative methods and the grammatical translation method. In the process of teaching English to university students, the sequence of methodological steps proposed by the teacher involves a gradual transition from elementary mastery of available language tools to the formation of basic speech skills among tech students, as well as the development of speech skills, both productive and receptive. Thus, we can talk about the individuality of the thinking of students of technical universities, which is different from students of humanities.

References:

- [1]. Richards J. C., Rodgers T. S. Approaches and Methods in Languages Teaching / Cambridge University Press, 2004.
- [2]. Pokrovsky E.A., Savchuk E.V., Yurchuk L.Yu. On the problem of teaching a foreign (English) language in a technical university // Collection of scientific papers SWorld. 2012. Vol. 17. No. 1. pp. 21-25.
- [3]. Avdeeva I. P. Engineering communication as an independent speech culture: cognitive, professional and linguistic aspects. Publishing House of Bauman Moscow State Technical University, 2005. p. 368.
- [4]. Muqaddas B., Maftuna U. THE IMPACT OF COMMUNICATIVE COMPETENCE ON FOREIGN LANGUAGE SKILLS //American Journal of Pedagogical and Educational Research. – 2023. – T. 18. – C. 148-150.
- [5]. Rus D. Creative methodologies in teaching English for engineering students //Procedia Manufacturing. – 2020. – T. 46. – C. 337-343.

ФОТОЛЮМИНЕСЦЕНЦИЯ КРЕМНИЯ, ЛЕГИРОВАННОГО МЕДЬЮ

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Аннотация. В данной работе исследована люминесценция кремния, легированного медью. В спектрах люминесценции в области энергий 0,75-1,13 эВ обнаружены электронно-колебательные полосы излучения, появление которых зависит от условий легирования и скорости охлаждения кристаллов.

Ключевые слова:

В спектрах люминесценции, полоса с головной линией, спектр бесфононной линии, колебательные повторением с возбуждением поперечного акустического фонона кристалла.

Abstract. In this work, we investigated the luminescence of deep levels of silicon doped with Cu. The electron- vibrational bands have been found in the luminescence spectra in the energy runge from 0,75 to 1,13 eV. Apperance of the bands in spectra on the type of impurity atoms as wele as on doping conditions and cooling rate of crystals.

Keywords: In the luminescence spectra, a band with a head line, a spectrum of a phononless line, vibrational repetition with the exeitation of transverse acoustical phonon of the crystal.

Annotatsiya. Ushbu maqolada mis kiritilgan kremniyni chuqur sotli luminessensiyasi o'rganildi. Biz o'rganagan 0,75-1,13 eV asosiy chiziqli spektrini borligi aniqlandi.

Tayanch so'zlar: Luminessensiya spektri, asosiy chiziqli polosa, fononsiz chiziqli spektri, electron takrorlanuvchi polosa.

Из-за большого (порядка $10^{-5} - 10^{-6} \text{ см}^2/\text{с}$ при температурах больше 1000°C) коэффициента диффузии меди в кремнии легирование можно производить диффузионным способом. Диффузию проводили в откаченных кварцевых ампулах при 1150°C в течение 15-20 час.

Медь вводилась в кристаллы кремния также методом ионной имплантации с последующей разгонкой и закалкой.

При указанном режиме диффузии удельное сопротивление $n\text{-Si}$ с $\rho \approx 20 - 40 \text{ Ом.см}$ возрастало до $10^4 - 10^5 \text{ Ом.см}$. Более высокоомный $n\text{-Si}$ ($\rho \approx 80 - 200 \text{ Ом.см}$) переходил в $p\text{-Si}$ с $\rho \approx (3 - 5)10^4 \text{ Ом.см}$.

Измерение спектров фотолюминесценция кристаллов кремния проводилось при 4,2 и 77 К (образцы погружались непосредственно в жидкий гелий или азот), а также при 15-30 К (образцы прикреплялись к хладопроводу гелиевого криостата с помощью вакуумной замазки и находились в вакууме). После проведения легирования и перед постановкой в криостат образцы шлифовались и травились в стандартном травителе $CP-4(3HNO_3:1HF)$. Ионная имплантация проводилась в полированные кристаллы, поэтому для таких образцов дополнительной механической и химической обработки не требовалось.

Генерация неравновесных носителей заряда в кристаллах осуществлялась светом ксеноновой лампы сверхвысокого давления ДКСШ-1000, модулированном с частотой 16 Гц. Для фильтрации возбуждающего светового потока использовались фильтры из оптического стекла типа СЭС-22 и ВГ-17 (фирма «Карл цейсейена»), а также водяной фильтр толщиной 100 мм. Спектры анализировались инфракрасным монохроматором ИКМ-1 с дифракционной решеткой $600 \text{ штр}/\text{мм}$ и дисперсией $56^\circ/\text{мм}$. После выходной щели монохроматора помещался кремниевый фильтр толщиной 4 мм. В качестве приемника излучения использовалось охлаждаемое до 80 К фотосопротивление на основе германия, компенсированного медью (область спектральной чувствительности $h\nu \approx 0,75 \text{ эВ}$).

Электрический сигнал с фотоприемника путем синхронного детектирования на частоте модуляции светового потока выводился на двухкоординатный самописец.

Во всех случаях в спектре Фл Si(Cu) наблюдалась интенсивная полоса с бесфононной линией 1,015 эВ (см.рис.1). приписанная парам атомов меди (Cu Cu) [1], которые образуют изоэлектронные примесные центры, имеющие тригональную симметрию с осью вдоль направления [111] [2].

Участие атомов меди в образований этих излучающих ^{63}Cu на ^{65}Cu [1], а изоэлектронная природа дефекта- измерениями излучательного времени жизни [3]

На рис.2 показано тонкая структура полосы 1,015 эВ. Как уже отмечалось, отличительной особенностью таких спектров является участие в процессах излучательной рекомбинации локальных (резонансных) фононов с энергией, в данном случае, 7; 16,4; 25,1 мэВ. Участие локального фонона с определенной энергией может служить указанием на присутствие атомов

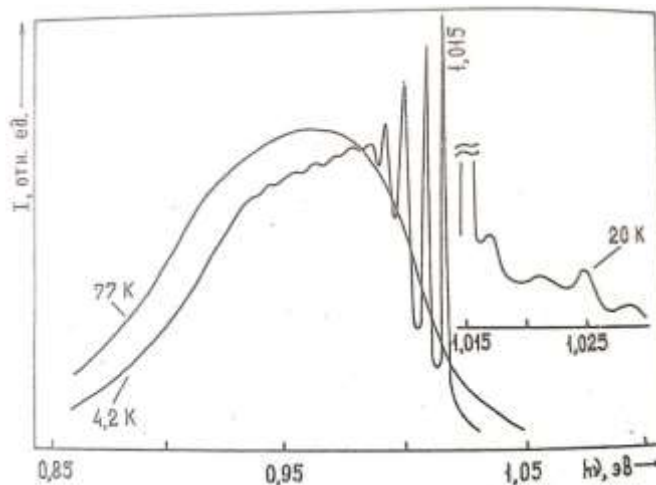


Рис.1. Спектр Фл Si (Cu). Спектральное разрешение 1 мэВ.

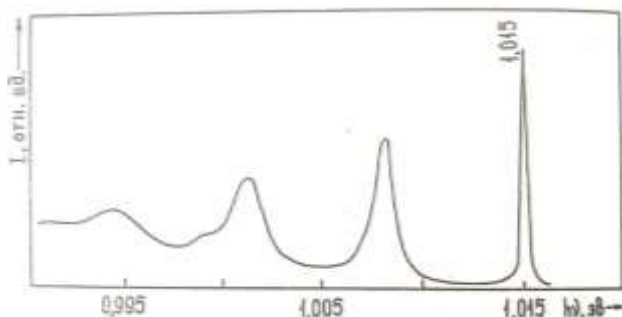


Рис.2. Тонкая структура полосы с линией 1,015 эВ, 4,2 К.

определенной примеси в составе данного излучающего центра [3]. Эффективность люминесценции на центрах, обуславливающих электронно-колебательную полосу с бесфононной линией 1,015 эВ, является высокой. Это объясняется тем, что ввиду нейтральности дефекта отсутствует конкурирующий излучательному оже-процесс безызлучательной рекомбинации: один носитель захватывается на центр короткодействующим потенциалом дефекта, второй-кулоновским полем первого носителя заряда, а третий носитель (оже-электрон), которому можно бы было передать энергию-отсутствует. В связи с этим полоса 1,015 эВ может наблюдаться в спектрах люминесценции даже при небольшой концентрациях излучающих центров. Действительно, экспериментальные результаты показывает, что эта полоса часто наблюдается в спектрах Фл Si легированного другими переходными металлами, например, Ag, Fe, Cr. По-видимому, в этих случаях была недостаточной очистка поверхности образцов. Благодаря высокой скорости диффузии атомы меди могли легко проникнуть в Si в процессе высокотемпературной обработки, либо при этом происходила активации примесных атомов меди, уже находившихся в исходных кристаллах.

Обнаружения и идентификация в Si изоэлектронного центра люминесценции 1,015 эВ (Cu Cu -пары) несомненно даст новую информации о состоянии атомов меди в решетке кристалла.

Список литературы

- [1]. Weber J., Bauch H., Sauer R. Phus.Rev.B.,1982,v.25,N12, p 7688-7699.
- [2]. Минаев Р.С., Мудрый А.В., Ткачев В.Д. Излучательная рекомбинация на термических дефектах в кремнии. // ФТП, 1979, вып.2, т.13, с. 395-398.
- [3]. Hauenstain R.J., Mc Gill T.C., Feenstra R.M. // Defects in Silicon . Eds. Billis W.M., Kimerling L.C. Pennington N.Y., 1983, p. 503-511.

OPERATIONAL CHARACTERISTICS OF MOTOR VEHICLES

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Abstract: *The dynamic growth of the economy of Uzbekistan is directly related to the increase in the volume of cargo and passenger transportation. Trade and passenger transport are covered in the community. Vehicle transportation is covered by the community. During the process of transporting cargo in cars, the organization of the transportation process for new logistics norms was considered based on modern requirements*

Key words: *Operational process, Passenger transport, Operational conditions, construction*

Аннотация: *Динамичный рост экономики Узбекистана напрямую связан с увеличением объемов грузовых и пассажирских перевозок. В поселке охвачены торговля и пассажирский транспорт. Перевозка автотранспорта осуществляется за счет сообщества. При перевозке грузов в автомобилях была рассмотрена организация процесса перевозки по новым нормам логистики с учетом современных требований.*

Ключевые слова: *Эксплуатационный процесс, Пассажирский транспорт, Условия эксплуатации, строительство.*

Anotatsiya: *Ushbu maqola O'zbekiston Iqtisodiyotining dinamik o'sishi bevosita uning yuk passajirlarni tashish hajmi ortishi bilan bog'liq. Savdo va yo'lovchi tashish jamiyatda qamrab olingan. Avtomobillarda yuk tashish jamiyatda qamrab olingan. Avtomobillarda yuk tashish jarayoni mobaynida zamonaviy talablar asosida yangi logistik normalari uchun tashish jarayoni tashkil qilish korib chiqildi*

Kalit so'zlar: *Ekspluatatsion jarayon, Yo'lovchi tashish transporti, Ekspluatatsiya sharoiti, konstruksiya.*

Transport is a component of the productive forces of any country. Transport acquires economic, political and psychological importance in the country.

Because without transportation, it will not be possible to receive raw materials, sell finished products, send workers to work, go home from work, and send students to and from school. In a word, transport is an arterial means of daily life. It is not possible for you to implement production and sales processes. One of the important factors determining the good operation of transport is the regularity of cargo and passenger transportation. Timely and regular transportation of the necessary products, raw materials, spare parts, fuel, mineral fertilizers, building materials, ensures continuous operation of production. It gives great impetus to the wide development of transport networks. The high speed of transportation, their modern design has a great impact on the increase in the level of passenger traffic. Provisions were made for determining the requirements for the organization of the transportation of dangerous goods by road transport, regulating the rights, obligations and responsibilities of the participants in the transportation process. (1) Rules for the transportation of dangerous goods by road transport in the Republic of Uzbekistan the list of goods was implemented from April 1, 2011. State committees and agencies of the ministries, the Council of Ministers of the Republic of Karakalpakstan, regions, districts and city hokims take the necessary measures to ensure compliance with the requirements of the rules of transportation of dangerous goods by road transport in the Republic of Uzbekistan (185 rules) by departmental organizations, legal entities and individuals. events have been set. The organization of transportation by road transport was classified according to the region in which it is performed, the task and the form of organization. Depending on the region, it is divided into urban, suburban, rural, intercity and regional and international transportation. According to the task: it is divided into permanent directions, excursion, tourist, and service related directions. Transportation of passengers in the city by buses is carried out within cities and urban-type settlements. In such transportations, the largest relative part of the transportation of all types of buses is 65 percent by the number of routes and 35 percent by the number of routes. The increase of such transportation during the last 20 years is 3

times in terms of passengers and 6 times in terms of passenger turnover. all types of transport in cities (tram, metro) the relative share of passenger transportation in buses is more than 60 percent, and it is increasing year by year. [4]

In general, the volume of passenger transportation in cities is related to the growth of the urban population. The current period is characterized by the expansion of the territories of large cities and the growth of the population's demand for the use of transport, and this leads to an increase in the number of passengers, taking into account the increase in the average travel distance of passengers. If it was 4.8 km in 1980, now it has reached 5.8 km. [5]

Currently, ATs in cities are being filled with large-capacity buses, which leads to an increase in their total nominal capacity. The volume of passenger transportation in cities is characterized by large changes in the days of the week and hours of the day. During the "peak" hours of the morning and evening traffic, traffic increases excessively, and decreases during other hours of the day. Passenger transportation by buses is organized mainly on permanent routes and according to the schedule.

Passengers are transported by light taxi cars in all areas of the city and surrounding districts. In major cities, light taxis operate around the clock. In some cases, taxis also serve passengers based on a pre-determined order.

The most urgent problem in the transportation of passengers in cities is the improvement of transportation processes during "peak" hours. Another characteristic of urban and suburban transportation is the large change in transportation volumes during the days of the week and months of the year. A significant increase in the volume of traffic is noticeable before the holiday, especially in the summer months.[6]

Transportation in rural areas is intended to connect district centers, collective farm centers, dairy farmers, residential areas; As the roads connecting them are not always improved paved roads, traffic can be interrupted throughout the year. In addition to buses of public transport palaces, private taxis are widely used for such transportation.

Table

Ability to transport passengers in cars [5]

Motor transport	ISUZU	GAZEL		DAMAS	NEKSIYA	MATIZ
Harturs 10	Bus	start	start	start	Ligh	Ligh
Average	transport	24/4	26/5			30/6
Comfortability points	4	5			6	9
Transportation	narx	500/	50/5			500/1000
Convenience is in the score	4				6	
LLC's		4	5		6	6
On rent		5	6		7	7
Individual private	-	7		8	8	8
Individual private	-			8	8	8
Transportation security score	-	8	6		5	7
For the shortness of the interval	4	3		8	5	4

Motor transport enterprises are fully responsible for transporting goods in full and without reducing their quality. If the cargo is partially or completely lost and their quality is damaged, an appropriate document is drawn up when the cargo is handed over to the owner. In this case, motor transport enterprises must fully compensate the damage caused to the client. [7]

In conclusion, it should be said that in order to accelerate the research related to solving the malfunctions of cars in various climatic conditions in the automotive industry and cargo transportation system, which are becoming popular in the territory of the Republic today, I am conducting my scientific research on the topic of the analysis of the flow of malfunctions in the operation of cars in various climatic conditions. I prepared Because of this, the operation of the engine in different climatic conditions has a great impact on cars. The reliable operation of internal combustion engines and its resource is related to maintaining the optimal temperature of the engine and its components and systems.

Summary

The performance quality of cars was studied during operation. One of the main proposed rules (when evaluating the change in the quality of cars) is to take into account the change in the intensity of work of the car over time. To implement it, the seasonal change of exploitation intensity was determined; random processes of change of exploitation intensity were determined.

References

- [1]. Mirziyoyev.Sh.M We will build a free and prosperous, democratic country of Uzbekistan together. Speech at the joint session of the chambers of the Oliy Majlis dedicated to the inauguration ceremony of the President of the Republic of Uzbekistan.. - T.: "Uzbekistan", 2016. -56 p.
- [2]. Mirziyoyev.Sh.M. We will build our great future with our brave and noble people. - T.: "Uzbekistan", 2017. - 488 p.
- [3]. On the Strategy of Actions for further development of the Republic of Uzbekistan. February 7, 2017. Decree No. PF-4947.
- [4]. I.A.Karimov Mirovoy financial and economic crisis, puti i mayor po yego odoleniyu v usloviyakh Uzbekistan. - T: Uzbekistan, 2009. - 67p.
- [5]. Abdubannopov Abdulatif Abdulhaq son. Analysis of geographical features of loading and unloading places. Article <https://internationaljournals.co.in/index.php/giirj/article/view/1479>
- [6]. Abdubannopov Abdulatif Abdulkhaq son article ORGANIZATION OF CAR TRANSPORT <https://bestpublication.org/index.php/pedg/article/view/1150>
- [7]. Abakumov G.V. Correcting air pressure in tires during winter operation of vehicles: Dissertation abstract. dis. ... sincere. technology. Sciences. - Tyumen, 1999. - 18 p.

ERKAKLAR KLASSIK USLUBDAGI KAMZULI BO`YICHA ZAMONAVIY MODA TAHLILI

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Annotatsiya: Maqolada hozirgi kunda ishlab chiqarilayotgan erkaklar klassik uslubidagi kamzulini, bir qator kiyimlar bilan uyg'unlashtirib zamonaviy uslubda kiyish uchun tavsiya etiladigan modellar ko'rsatib o'tilgan.

Kalit so'zlar: dizayn, modelyer, djensi, sharf, fudbolka, klassik uslub, kundalik kiyinish uslubi, modalar jurnali

Аннотация: В статье показаны модели мужских жилетов классического фасона, которые выпускаются сегодня и которые рекомендуется носить в современном стиле в сочетании с рядом одежды.

Ключевые слова: дизайн, модельер, джинсы, шарф, футболка, классический стиль, стиль повседневной одежды, журнал мод.

Annotation: The article shows the models of men's classic-style waistcoats that are produced today and are recommended to be worn in a modern style in combination with a number of clothes.

Key words: design, fashion designer, jeans, scarf, t-shirt, classic style, daily wear style, fashion magazine.

Moda, kiyim-kechak, poyabzal, aksessuarlar, bo‘yanish, soch turmagi, turmush yoki madaniyatda muayyan did yoki qiziqishning ma’lum vaqtgacha qaror topishini o‘z ichiga olgan estetik ifodadir. Uslubdan farqli o‘laroq turmush buyumlari va badiiy asarning tashqi shakllarining qisqa muddatli hamda yuzaki o‘zgarishlarini ifodalaydi(1).

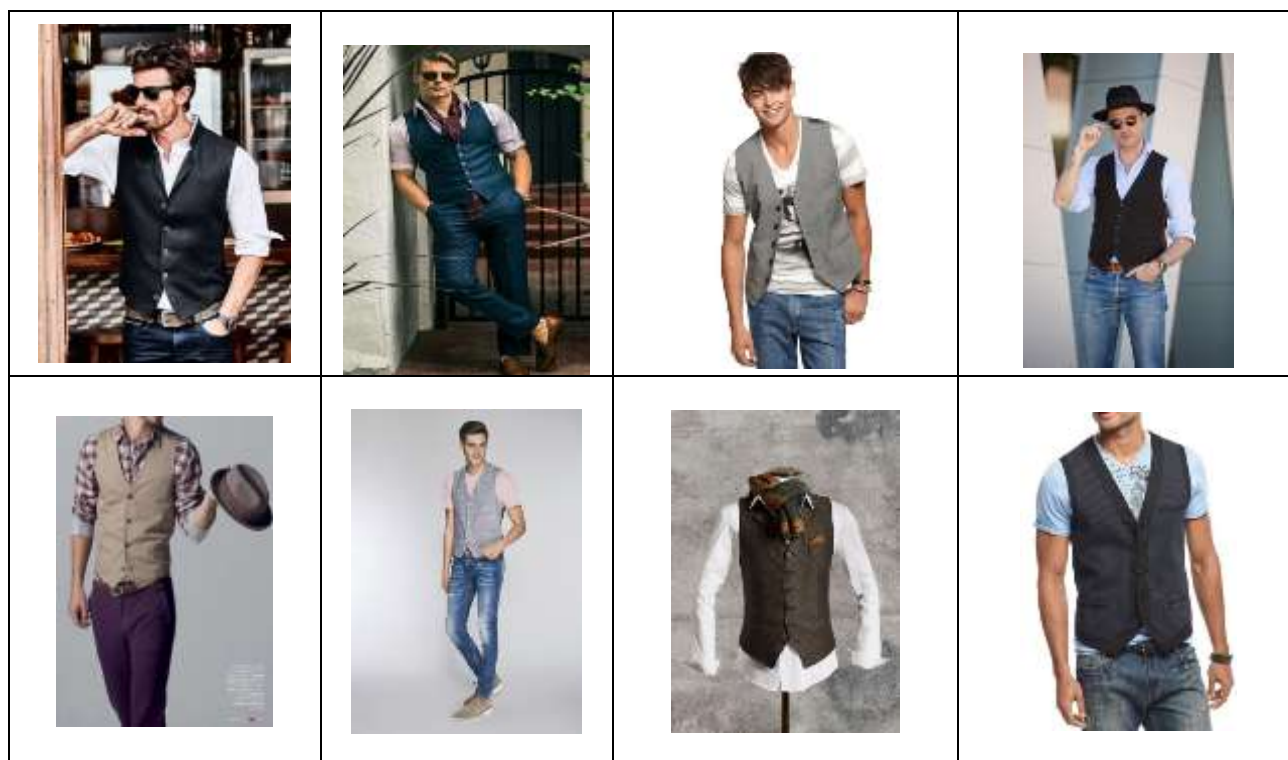
Moda, uslub, dizaynerlik usullari insonga har kun, tashqi xarakter trendlarini hamda ichki kayfiyatni aniqlagan holda ta’sir qiladi. Kutuyordan top kiyimlarni, eksperimental markalarni, o‘zliklarini material, ranglar, fakturalar va birikmaydigan birikmalarni yaratishni qobiliyat, mutaxassislar didi va boshqalar birlashtiradi.(3)

Dizaynerlar turli kiyinish uslublarini uyg‘unlashtirilgan holda yangicha modalar taklif etishadi, shu jumladan erkaklar klassik uslubdagi kamzulini djensi hamda sport uslublari bilan uyg‘unlashtirish ahamiyatga egadir. Klassik uslubdagi kamzul asosan rasmiy tadbirlarga va maxsus joylar uchun kiyiladi lekin yuqoridagi yangi uslubda kiyilsa, kundalik ish joylar uchun ham noqulaylik tug‘dirmaydi(3).

Yengil sanoat va to‘qimachilik sohasida bir qator mutaxassis dizaynerlar dunyo moda sanoati bilan hamkorlikda bir qator ishlar ilib borishmoqda va albatta qatoq yutuqlarga ham erishilyapti. Dunyo miqyosidagi moda namoyishlarida o‘zbek milliy kiyimlari namoyish etilishi albatta bunga misol bo‘la oladi.

1-jadval

ERKAKLAR KLASSIK USLUBDAGI KAMZUL MODELLARI



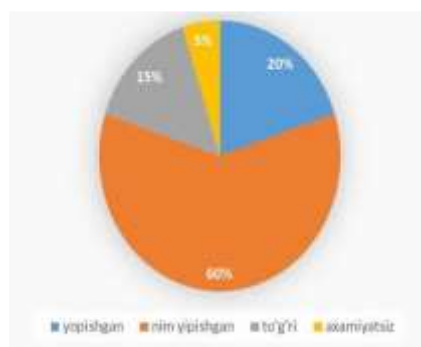
Erkaklar kamzuli turli shaklli, ya’ni bo‘ksagacha uzunlikda, bo‘ksa chizig‘idan tushib turadigan yoki belgacha uzunlikda, turli shakldagi klassik yoqali yoki yoqasiz, old taqilmasi tugmacha qadaladigan va yashirin taqilmali bo‘lishi mumkin. Kamzul turli shakldagi cho‘ntaklar, applikatsiyalar, shinur-tasmalar, temir yoki yelim taqilmalar bilan bezatiladi (2).

Erkaklar kamzuli uchun kiyim ishlab-chiqaruvchilar to‘g‘ridan to‘g‘ri istemolchilarning o‘zlaridan talab va takliflilarini o‘rganish tavsiya etiladi. Misol uchun quyidagicha savolnomalar orqali.

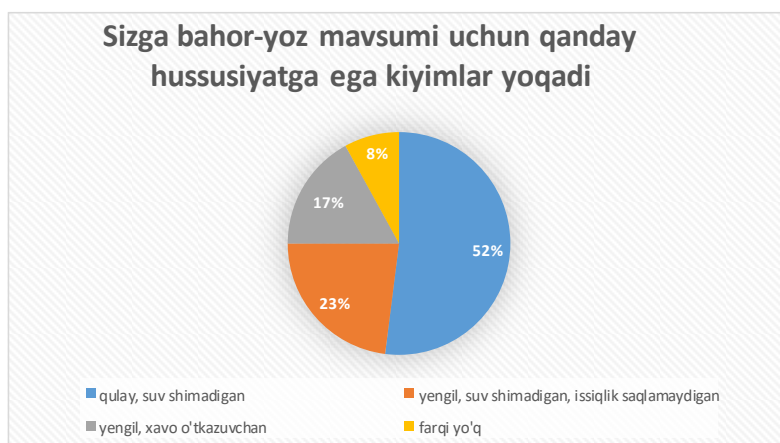
1. Erkaklar kamzuli bahorgi-kuzgi ko‘ylagi qanday seluetda bo‘lishini xohlaysiz?

- yopishgan
 - nim yopishgan
 - tog'ri bichimli
- Sizga bahor-kuz mavsumi uchun qanday xususiyatga ega kiyimlar yoqadi?
 - qulay, suv shimadigan, havoni yaxshi o'tkazadigan
 - yengil, suv shimadigan, issiqlik saqlamaydigan
 - yengil, xavo o'tkazuvchan, qulay, issiqlik saqlovchi
 - farqi yo'q
 - Siz uchun bahor-kuz mavsumidagi kamzul qanday rangdagi matolardan bo'lishi kerak deb o'ylaysiz?
 - aralash
 - to'q
 - farqi yo'q
 - yorqin
 - Sizningcha kamzul uzunligi qanday bo'lishi kerak?
 - belgacha
 - tizzagacha
 - bo'ksa va tizza oraligida
 - farqi yo'q
- Quyida o'smir qizlar uchun o'tkazilgan so'rovnoma natijalari diagramma asosida keltilgan.

Erkalar kamzulini bahor-yoz uchun qanday siluatda bo'lishini xoxlaysiz?



1-rasm.



2-rasm.

Erkalar kamzulini bahor-yoz uchun qanday siluatda bo'lishini xoxlaysiz? Degani so'rovnomaning imkon darajasida ko'proq o'g'il bolalarga tarqatib, natija olish zarur. Bu so'rovnomaning natijasini quyidagicha tahlil qilsak. 400 ta o'g'il bolalardan olindan so'rovnoma natijasi 1-rasmda aks etgan. Xuddi shu singari qolgan savollarga ham javob olish mumkin.

Sizga bahor-kuz mavsumi uchun qanday xususiyatga ega kiyimlar yoqadi? Berilgan so'rovnomaga quyidagicha natija olindi. So'rovnomaning taxlili bo'yicha 400 nafar respondentdan 56% o'g'il bolalar qulay, suv shimadigan, 25% o'g'il bolalar yengil, suv shimadigan, issiqlik saqlamaydigan, 18% o'g'il bolalar yengil, xavo o'tkazuvchan, 1% o'g'il bolalar farqi yo'q deb belgilagan.

Xulosa: Yuqorida o'tkazilgan so'rovnoma asosida o'g'il bolalarga qanday kiyimlar mos tushishini aniqlandi. So'rovnoma marketing tahlilini diagramma usulida ko'rib chiqildi, o'g'il bolalarga mos kiyim turlarini ishlab chiqish uchun o'rganilishi lozim bo'lgan savolnoma muammolari tahlil qilindi va quyidagilarni ko'rsatdi: 1- so'rovnomada o'g'il bolalar bahorgi-kuzgi ko'ylagi qanday siluatda bo'lishini xohlaysiz? degan savolning tahlil natijasi, bunda 60% nafari nim yopishgan uslubidagi kiyimlar yoqishini tanlashgan. 2- so'rovnomada "Sizga bahor-kuz mavsumi uchun qanday xususiyatga ega kiyimlar yoqadi?" degan savolning taxlili bo'yicha 56% istemolchilar qulay suv shimadigan kiyimlarni deb belgilagan. Shunga ko'ra, o'smir qizlar uchun shu tadqiqot usulidagi kiyimlarning modellaridan foydalanib kiyim ishlab chiqarilsa, maxsulot marketing yuqori bo'ladi.

Erkaklar nimchasining asosiy vazifasi insonning kiyinish uslubini va estetik didini namoyon qilishi kerak. Erkaklar nimchasi uchun asosan havoni yaxshi o'tkazadigan tabiiy tolali gazlamalardan foydalanish maqsadga muvofiq hisoblanadi.

Adabiyotlar

- [1]. Nizamova, B. B., & Mamatqulova, S. R. (2021). Analysis of the Range Of Modern Women's Coats. The American Journal of Engineering and Technology, 3(9), 18-23.
- [2]. Tursunova, X.Sh., Mamatqulova Saida Rahmatovna. (2020). Ayollar paltosi uchun gazlamalar taxlili. 3 rd international congress of the human and social science researches (itobiad).
- [3]. Ш., Т. Х., Низамова, Б. Б., & Маматкулова, С. Р. (2021). Анализ ассортимента современных женских пальто. Американский журнал инженерии и технологий, 3(09), 18-23.
- [4]. Каххорович, Н.К., Джураевич, Ю. Н., Нозимджоновна, О. И., и Бахтиеровна, Н. Б. (2021). Перспективные направления развития шелководства. Американский журнал инженерии и технологий, 3(09), 24-27.
- [5]. Уралов Л., Обидова И., Низамова Б., Холиков К., Охунов Р. и Маматова Х. (2023, июнь). Анализ влияния технологических параметров на физико-механические показатели двухслойных трикотажных полотен. В серии конференций Американского института физики (Том 2789, № 1, стр. 040120).

CHARM TURLARI VA BUYUMLARINING TAHLILI

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Annotatsiya: Ushbu maqolada charm matosinig turli turlari tahlil qilindi hamda charm mahsulotlaridan turli buyumlar olinishi haqida yoritildi. Terilarni tahlil qilish orqali ularni orasida silliq charmdan sifatli mahsulotlar va qimmatbaho buyumlar olinishi aniqlandi. Nubuk, velyur, lakli charmlar nafisligi va jozibaligi bilan ajralib turadi. Zamsha va nappa mustahkam va chidamli material bo'lib, ular sifati, estetik jihatdan xaridorgirligi va foydalanishga qulayligi bilan ajralib turadi. Bugungi kunda terining juda ko'plab turlari mavjud bo'lib, uni qayta ishlash orqali sifati, chidamliligi, nafisligi va jozibaligi oshiriladi.

Kalit so'zlar: Charm, teri, tabiiy charm, sun'iy charm, silliq charm, nubuk, velyur, zamsha, anilin, nappa, lakli charm, nappalan, layka.

Аннотация: В данной статье были проанализированы различные виды кожи и изделия из кожи. Установлено, что среди них качественные изделия и ценные предметы получают из гладкой кожи. Нубук, велюр, лаковая кожа отличаются красотой, элегантностью и привлекательностью. Замша и наппа – прочные и долговечные материалы, отличающиеся качеством, эстетической привлекательностью и удобством в использовании. Сегодня существует множество видов кожи, и благодаря ее обработке повышается ее качество, долговечность, элегантность и привлекательность.

Ключевые слова: Кожа, натуральная кожа, искусственная кожа, гладкая кожа, нубук, велюр, замша, анилин, наппа, лаковая кожа, наппалан, лайка.

Annotation: In this article, various types of leather and leather products were analyzed. It has been established that among them, high-quality products and valuable items are made from smooth leather. Nubuck, velor, patent leather are distinguished by their beauty, elegance and attractiveness. Suede and nappa are strong and durable materials that are distinguished by their quality, aesthetic appeal and ease of use. There are many types of leather available today, and its processing enhances its quality, durability, elegance and attractiveness.

Key words: Leather, leather, natural leather, artificial leather, smooth leather, nubuck, velour, suede, aniline, nappa, patent leather, nappalan, laica.

KIRISH:

Hayvon terilari bu charm xom-ashyosi asosiy manbayi hisoblanadi. Haqiqiy teri insoniyatning qadim zamonlaridan beri ishlab chiqariladi Dunyo bo'ylab terining juda ko'p turlari yaratilgan. Charm mahsulotlari turlaridan xar xil turli mahsulotlar olinadi bulardan: sumkalar, kiyim-kechaklar, poyabzallar, shlyapalar, qo'lqoplar, turli aksesuarlar va boshqa mahsulotlar tayyorlanadi.

Tabiiy charm insoniyat tomonidan qadim zamonlardan beri ishlab chiqarilmoqda, va sun'iy charmdan ustunligi jihatidan ajralib turadi. Birinchidan teri tozalash bosqichlaridan o'tadi va yarim tayyor mahsulotga aylanadi. Undan keyingi bosqich teriga fizik-mechanik ishlov berish. Terini oshlash jarayoni orqali, yaroqli holatga keltiramiz, salbiy xususiyatlarini bartaraf etamiz. So'nggi bosqich bu terini bo'yash, mum va laklardan foydalanish orqali bo'yoqni mahkamlash. Buning natijasida terining mustahkamligi, elastikligi va chidamliligi oshadi.

Charm sanoatini rivojlanishiga juda ko'p olimlarimizni xizmatlari beqiyos. M.Temirova, T.Qodirovlarning "Charm va mo'yna texnologiyasi" o'quv qo'llanmasida [2, 10 bet] terining tuzilishi, charm va mo'yna xomashyolari va ularning xossalari, charm va mo'yna tayyor mahsulotlari, ularni konservalash usullari, charm va mo'yna ishlab chiqarishda tayyorlash, oshlash va pardozlash jarayonlari, ularning nazariy asoslari va amalda bajarilishi bayon etilgan.

S. N. Sadirovaning "Charm va mo'yna xomashyolariga dastlabki ishlov berish" kitobida [2, 133-bet] charm va mo'yna xom ashyosi turlarining tavsiflari, ularning xossalari va ishlatilishi, xom ashyoga dastlabki ishlov berish jarayonlarining ahamiyati va amalda bajarilishi, shuningdek, xomashyoni saqlash va nazorat qilish tartiblari keltirilgan.

A. V. Ostrovskaya "Ximiya i texnologiya koji i mexa" kitobida [3] teri va mo'yna ishlab chiqarish xomashyosi tasvirlangan, shuningdek, uni noorganik moddalar bilan qayta ishlash texnikasi va usullari bayon etilgan.

Silliqli charm - bu mahsulotlar ichida eng mashhuri hisoblanib, sifatli mahsulotlar olinadi. Terida teshiklar mavjud bo'lib nafas olishni yaxshilaydi va uzoq xizmat qiladi. Bu teri mustahkamligi bilan ajralib turadi undan qimmatbaho poyabzal, mebel madellari tayyorlanadi.



Nubuk- qoramol va cho'chqa terisidan olinadi, xromlash orqali, bo'yashga ko'proq moyil, chiroyli va nozik material. Nubuk terisidan poyabzal ustki qismi va mebellarni qoplashda foydalaniladi.



Velyur- tuzilishi jihatidan nubukka o'xshaydi. Xrom bilan islov beriladi, cho'chqa yoki qo'y terisidan tayyorlanadi, terining ichki va tashqi tomoni silliqqlanadi. Qayta ishlab chiqarilishiga qarab yumshoq, qalin, nozik va qattiq bo'ladi. Materialdan kiyim-kechak, poyabzalning ustki qismi va charm buyumlari ishlab chiqiladi.



Zamsha – charmning eng mashhur turlaridan biri hisoblanadi. U echki, qo'y, cho'chqa, bug'i terisidan tayyorlanadi. Mustahkam material bo'lib, foydalanishda qulay. Materiallardan ustki kiyim, poyabzal, sumka, noyob aksessuarlar tayyorlanadi.



Anilin – yuqori sifatli teri hisoblanadi, organik bo'yoqlar bilan bo'yalgan.



Nappa- katta va yosh hayvon terilaridan tayyorlanadi, nihoyatda yumshoq va chidamli, yuqori sifatli mahsulotlar olinadi, namlikka qarshi tozalash qulay. Charm aksessuarlari tayyorlanadi.



Lakli charm - yuqori haroratda teri bo'yaladi va lak orqali qoplanadi. Ko'rinishi jozibali ammo tabiiy teriga nisbatan kam bardoshli, bunga misol -10°C past +25°C yuqori haroratda yorilib ketadi.



Nappalan- kauchik eritmasi bilan ishlov beriladi buning natijasida yomg'ir va qordan himoya qiladi. Bir qanca vaqtdan keyin yorilishi mumkin chizilib qolsa o'sh joyini qayta tiklab bo'lmaydi.



Layka- qo'zi va uning bolalari terisidan olinadi, xrom-yog' va xrom bilan ishlov beriladi. Bu materialdan xar doym qo'lqop tayyorlanadi.



Tabiiy charmdan tayyorlangan kurtkalar xavoni yaxshi o'tkazadi va tanani nafas olishini imkon beradi va bir necha yil davomida o'z shaklini o'zgartirmaydi.

Har xil hayvon terisidan turli sumkalar tayyorlanadi, bulardan eng sifatli va bardoshligi sigir va buzoq terisidan olinadi. Arzon teri bu cho'chqa terisi hisoblanadi.



Yurtimizda tabiiy teridan oyoq kiyim tayyorlashda ham keng foydalaniladi. Yozgi mavsum uchun asosan qo'y, echki, qishki mavsum uchun esa qalin mol terisidan foydalaniladi.



Dunyoda eng qimmat teri bu timsoh terisi hisoblanadi. Sirti chiroyli, terisi qalin va suv o'tkazmaydi. Ishlov berish jarayoniga qarab silliq teri eng arzon teri hisoblanadi. Zamsha va velyur yomg'irni yoqtirmaydi suvdan olib qochish kerak uni quritishda radiatorlardan va issiq haroratdan foydalanilmaydi, uy haroratida quritiladi.



Xulosa:

Charm matosi hamda charm mahsulotlari turlari o'rganildi va tahlil qilindi. Charm matolarining tahlili asosida, silliq charmdan sifatli mahsulotlar va qimmatbaho buyumlar olinishi aniqlandi. Nubuk, velyur, lakli charmlar nafisligi va jozibaligi bilan ajralib turadi. Zamsha va nappa mustahkam va chidamli material bo'lib, ular sifati, estetik jihatdan xaridorgirliigi va foydalanishga qulayligi bilan ajralib turadi. Bular o'z navbatida tayyor mahsulot turini o'sishiga va charm sanoatini rivojlanishiga ta'sir etadi. Bugungi kunda terining juda ko'plab turlari mavjud bo'lib, uni qayta ishlash orqali sifati, chidamliligi, nafisligi va jozibaligi oshiriladi.

Adabiyotlar

- [1]. M.Temirova, T.Qodirova "Charm va mo'yna texnologiyasi" Toshkent "Turon-Iqbol" 2005.
- [2]. S.Sobirova. Charm va mo'yna xomashyolariga dastlabki ishlov berish. Toshkent "Yangi asr avlod" 2010.
- [3]. Островская, А. В. Химия и технология кожи и меха Москва : Издательство Юрайт, 2024. — 162 с.
- [4]. И.П.Страхов. "Химия технология меха" М.Легпробитиздат 1985.
- [5]. А.Н.Михайлов. Коллоген кожного поправа Легкая индустрия" 1971.
- [6]. Л.П.Гайдарова "Технология кожи Легкая индустрия" 1974.
- [7]. <https://www.derimarket.net/ru/blog/vidy-i-osobennosti-naturalnoy-kozhi>.

KUNNING QORONG'I VAQTIDA RANGLI KIYIMLARNI KO'RINISH MASOFASI

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Annotatsiya: Ushbu maqolada kiyimlarni uzoqdan ko'rinishida kiyim ranglari qanchalik

darajada ko'rinish uchun farq qilinishi yoritilgan.

Kalit so'zlar: *kiyim, ranglar, material, dizayn, maxsus.*

Annotatsiya: *в данной статье рассмотрен степень видемости и различия на расстоянии, одежды из разных цветных материалов.*

Ключевые слова: *одежда, светлы, материал, дизайн, индивидуальный.*

Abstract: *This article examines the extent of the statement and the differences in distance, clothes made of different colored materials.*

Keywords: *clothing, colors, material, design, individual.*

Kiyimlarni tikish texnologiyalarini hamda ular uchun foydalanilayotgan gazlamarni tadqiq etish orqali kiyimlarni mukammallashtirish, tikuvchilik korxonalari sifatli materiallarni tanlash, ulardan samarali foydalangan xolda zamon talablariga mos, sifat va istemolchi talablarini to'laqonli qondira oladigan, foydalanishda qulay, himoya darajasi yuqori bo'lgan kiyim turlarini keng miqyosda ishlab chiqarish vazifalari qo'yilmoqda, bu vazifalarni yechimini topishda turli rangdagi va strukturaga ega materiallardan foydalanilmoqda.

Zamon talablaridan kelib chiqqan holda dolzarb vazifalardan biri bu kiyimlarni inson uchun ergonomik konstruksiyasini yaratib, ulardan chiroyli va xush bichim kiyimlarni tayyorlashdir. Kiyimlar tayyorlashda rang barangligi katta ahamiyatga ega bo'lib, ular kiyimlarni ko'rkamligini oshirib, odamni o'ziga jalb qilsa, yana bir tomondan texnika xavfsizligi uchun juda muxim omillarini hisobga olsak ular turli tuman vazifalarni bajaradi. Barcha kiyimlar ma'lum ranglarga mansub materiallardan tayyorlanadi. Bu materiallar shu kiyim uchun mos bo'ladi. Ranglarni kiyimlar uchun tanlashda albatta bu kiyimni ekspluatatsiya sharoitidan kelib chiqqan xolda tanlash maqsadga muvofiq xisoblandi. Maxsus kiyimlarni ranglariga qarab bu kiyim qayerda ishlatilishini ajratib olsa bo'ladi. Maxsus kiyimlarga qo'yilgan nur qaytargichli lentalar, nafaqat chiroyli dizaynga xos xolatni balki ekspluatatsiya uchun xam muxum xisoblanadi. Material sifat ko'rsatkichlari turi va uning ahamiyatini xisobga olganda uch xil ko'rsatkich bo'lib, kompleks ko'rsatkich, guruh ko'rsatkichi, birlamchi ko'rsatkichlarga bo'linadi.

Kompleks ko'rsatkichlarga ijtimoiy ahamiyati, funktsionalligi, ishonchliligi, estetikligi, ergonomiklik, ekologikligi, loyihaviy-texnologik ko'rsatkichlar kiradi. Bu ko'rsatkichlar ichida estetikligi, ergonomiklik, ekologikligi, loyihaviy-texnologik ko'rsatkichlar aloxida o'rin egallab dastlabki loyixalashdan kiyimlarni tayyorlashda kunning qorong'u vaqtlarida kiyimlarni ko'rinishini yetarli bo'lishiga etibor beriladi. Kiyimlarga materiallarni tanlash jarayonining barcha bosqichlarda materialshunos-mutaxassislarning ishtiroki kerak bo'ladi. Modeler va konstruktorlar bilan hamkorlikda rejalashtirilayotgan mahsulotning model va konstruktorlik tahlili asosidagi tadqiqotlar, materiallarni tayyorlash va foydalanishga qo'yiladigan dastlabki talablarni belgilab beradi.

Olib borilgan tadqiqotlarning natijasida shuni aniqlanganki maxsus kiyimlar va barcha ustki kiyimlarni qorong'ida ko'rinish masofasi bo'lib, bu masofalar ranglarga bog'liq bo'ladi. Kiyimda ranglarni xar xilligi chiroyli va o'ziga xos ko'rkamlikni tashkillasa, yana bir tomondan bu maxsus belgilar uchun xam xizmat qiladi. Kiyim ranglari bo'yicha tadqiqotlar qiydagicha olib borildi. Kunning qorong'i vaqtlarida eng ko'p ishlatiladigan olti hil rangdagi kiyimlar tanlab olindi, ularni o'chamlari bir hil, qorong'ilikning xar-xil sharoitlarida (namgarchilikda ham) masofaga o'rnatilgan kiyimlarga yorug'lik berildi.

O'tkazilgan tadqiqotlarga asosan qorong'i vaqtda kiyim ranglarini ko'rinishi taxlil qilinganda quydagi ko'rsatkichlar olindi.

	Kiyim ranglari	Kiyim	Ko‘rinish masofasi metr
1	maxsus qora kiyim		18-20
2	maxsus qizil kiyim		24-26
3	maxsus sariq kiyim		37-39
4	maxsus oq rang kiyim		56- 60
5	maxsus kiyimlarga nur qaytargichli lentalar yopishtirilganda		130-135
6	nur qaytargichli maxsus kiyim		150-160

Yuqoridagi jadvalga ko‘ra maxsus kiyimlarning ko‘rinish masofasi berilgan bo‘lib, mayishiy kiyimlar ham shunday masofada ko‘rinishi tadqiqotda aniqlandi.

Yuqoridagi tadqiqotlardan ko‘rinadiki kiyimlarni ishlab chiqarishda insonni tashqi tasirdan doimiy saqlash uchun maqsag qilinsa, ikkinchi tomondan uning ko‘rkamligiga katta ahamiyat beriladi.

Xulosa qilib aytadigan bo‘lsak, kiyimlarni yaratishda ilmiy yangiliklarga tayanib, kunning ko‘rinishi cheklangan davrda ham yaqqol ko‘rinishini ta‘minlay oladigan, ergonomik talablarga mos keladigan holda ishlab chiqarishni joriy qilish kerak. Muhim ilmiy vazifalardan biri kompleks himoyalovchi mayishiy va maxsus kiyimlarni ko‘p xususiyatga ega bo‘lgan turlarini ishlab chiqishdir. Ustki kiyimlarni dizaynini yaratilishida ranglarga aloxida etibor qaratish lozim. Ko‘rinish masofa chegarasiga etibor berilsa va ustki kiyimlarga turli yaltiroq nur qaytaruvchi firnaturalar qadalsa, yoki nur qaytaruvchi lentalar qo‘yilsa uzoqdan ko‘rinishi yaxshilansin, bu tanlov albatta texnika xavfsizligi uchun ma‘lum yechim bo‘ladi.

Adabiyotlar

- [1]. А.Е Чайковская, П.В.Полищук, И.С,Галык, Б.Д.Семак Комплексная оценка качества текстильных материалов. Киев 1989.

- [2]. В.П.Скляnnиков Гигиеническая оценка материалов для одежды. М. 1985
[3]. К.Г.Гушина Эксплуатационные свойства материалов для одежды и методы оценки их качества. М. 1984
[4]. Internet malumotlari.

O'ZBEKISTONNING QADIMIY MILLIY MATOLARIDAN YANGI MODELLAR YARATISH

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Annottatsiya: Ushbu maqolada O'zbekiston xududida qadimda tayyorlangan matolar haqida ma'lumot berilgan. Shu matolar asosida yaratilgan yangi materiallardan zamonaviy modellar yaratilganligi haqida so'z yuritiladi. Shu bilan birga modellarimizga ko'rinishiga tikilishiga va bezatilgan bezaklariga ham alohida ta'rif berilgan. Modellarimiz qaysi yosh vakillariga mos ekanligi alohida aytib o'tilgan.

Kalit so'zlar: miniatyura, beqasam, kolorit, zanjira, qashoq, abr, xonatlas, yakro'ya, adras, chervon-shoyi, libit, abrband, xonatlas, jiyak, lentali, tasma.

Annotatsiya: V stat'e dono svedenie o materialax, kotorie izgotovlyali v regione sovremen'y Uzbekistan a takje izgotovlenie sovrimennye modeli ispol'zovov eti materialy.

Klyuchevie slova: miniatyura, mayak, zamok, abr, xan-atlas, solo, adras, trotuar, lenta.

Annotation: The article dono information about the materials that were produced in the region by modern Uzbekistan as well as the manufacture of these materials.

Key words: miniature, lighthouse, castle, abr, han-atlas, solo, adras, sidewalk, tape.

O'rta Osiyo shoyi gazlamalari bilan ham mashhur edi: ma'lumki XVI asrda Samarqandda ishlangan to'q qizil duxoba ko'p joylarga eksport qilinganligi to'g'risida "Boburnoma"da yozilgan.

Tarixchilarimiz ilk ma'lumotlariga ko'ra O'rta Osiyoda asosan sidirg'a gazlamalar ishlangan. Miniatyuralarda tasvirlangan gazlamalarning ko'plari shunday bo'lgan. Ammo, sidirg'a gazmollar toifasiga bosma (XIV asrda) va to'qima usulda naqshlangan gazlamalar (VIII-IX asrlarda) ishlanardi.

O'zbekistonda XIX asrda ip gazlama chiqarish keng tarqalgan. O'rta Osiyo xalqlari qadimdan shoyi gazlamani to'qishardi, ammo XVII asrda ko'p joylarda bu narsa esdan chiqarilgandi. Faqat Fargona vodiysida (asosan Marg'ilonda) va Buxoroda bu soha rivojlandi.

Shoyi gazlamalarni faqat aslzodalar kiyishgani uchun, uni ishlab chiqarish markazlari o'zbek xonliklar poytaxtlarida bo'lgan. Ip gazlamalari esa ko'p xunarmandchilik markazlarida ishlanardi.

Ip gazlamalar jumlasida nimshoyi gazlamalari ham to'qilardi. Naqsh san'ati bo'yicha yuqori yutuqqa erishgan gazlama „beqasam“ edi. Beqasam ipak tanda va qalin paxta arqoq ranglar ipidan to'qilgan zich yo'l-yo'l gazlama [1].

Farg'ona vodiysi gazlamalarning sovuq koloritiga binafsha rangini sovuq yorqin yashil va oq ranglar yordamida erishilgan. Oz miqdorda ingichka malina rangli yo'l-yo'l va ba'zan beshinchi rang kiritiladi. Marg'ilonda bu naqsh ranglar soni bo'yicha nomlangan: uch „qashoq“ (uch rangli), beshqashoq (besh rangli) yoki „bayroq“ bo'lgan. Farg'ona vodiysi shaharlarida malina va pushti ranglar faqat ayollar va bolalar kiyimlari uchun ishlangan beqasamga kiritiladi. Erkaklar kiyimida qizil rang kiritish man etilgan [1].

Buxoroda asosiy ton doimo pushti bo'lgan va naqshda bu yo'lning eni oq binafsha va yashil rangli yo'llardan kengroq bo'lgan. Samarqand va Urgut beqasamlarida maxsus texnikada ishlangan kul rang keng yo'llar qilinardi. Shunday to'qish usuli yengil olachipor naqsh zanjirani hosil qiladi.

Keyingi paytlarda beqasamlar qadimgi an'analar bo'yicha ishlanib umumiy fonni hosil qilgan. Ular asosan yangi ranglari va naqshlari bilan farqlanardi. Farg'onaga xos odmi koloritli eni

bir xil binafsha qora va oq rangli yo‘l-yo‘llar birikmalarini yaratadi. Bu gazlama nomi chervon-shoyi deb atalardi chunki bir ko‘ylak yoki kamzul uchun gazlama parchasi bir chervon turar edi.

„Abr“ atamasi (fors tilida „bulut“ deb tarjima qilinadi) naqsh nomi sifatida XVII asr adabiy ma‘lumotlarda uchraydi. Birinchi afsonaga ko‘ra abr naqshlari, dastavval xovuz suvida yuguruvchi bulutlarni taqlidi, ikkinchisiga ko‘ra xovuz suvidagi to‘kilgan yog‘ni yoyilgan dog‘larning taqlidi bo‘lgan. Bular tasvirlar ilk bor kamalakni aks ettirgan qadimiy kashta (abri-bahor)kabi bo‘lgan.[1]

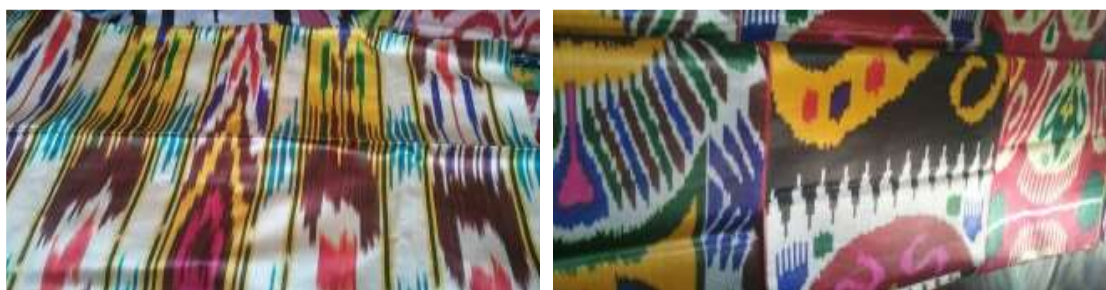
Abr usulida tanda ipini bo‘yash texnikasi juda murakkab. 200-300 metr uzunlikda tanda ipi maxsus dasgoxda mayda tutam- libitlarga taqsimlanadi. Gazlamaning zichligi va eniga binoan har bir libitda iplar soni 40-60 tagacha edi.Libitlar ikkitadan qo‘shilib rom dastgohni ko‘ndalang bruslariga o‘raladi.Bruslar orasidagi masofa naqsh rapporti bilan bog‘liq. Libitlar tashkil etgan yuzaga rassom- abrband ingichka yog‘och bilan suvda eritilgan qorakuya yordamida vertikal oqi bo‘yicha naqshni yarmini ko‘ndalang chiziqlar bilan belgilaydi. Usta trafaret eskizlardan foydalanmaydi.

Atlas o‘rilish guruxidagi sof paxtadan tikilgan gazlamalar kiradi: „to‘rt tepkilik“lari – atlaslar, „sakkiz tepkilik“ va „o‘n ikki tepkilik“ lari – xonatlaslar, nimshoyi -„yakro‘ya“ . Tepkilik qanchalik ko‘p bo‘lsa, abr gazlama shunchalik bashang bo‘ladi. Eski ma‘lumotlarga ko‘ra xonatlas Qo‘qon xoni Xudoyorxonning buyrug‘iga binoan (1856 yil) ixtiro qilingan va uning sharafiga xonatlas deb nomlangan. Dastavval bu qimmatbaxo gazlamadan faqat xon oila a‘zolari kiyishi mumkin edi. Xon atlas vatani Marg‘ilondir.

O‘zbek milliy badiy gazlamalarida rang muhim ro‘l o‘ynagan. O‘zbekistonning barcha mintaqalariga an‘anaviy kolorit va ranglar birikmalari mansub. Berilgan ma‘lumotlarga ko‘ra Farg‘ona gazlamalarida qizil ranglar kamrog‘ bo‘lib, za‘faron-sariq ranglar, Xo‘jandda –qizil ranglar, Qo‘qonda –moviy ranglar ustunlik qilardi. Gazlamaning zichligi va rangiga ko‘ra u qacda ishlanganini bilish mumkin edi.Undan tashqari har bir rang ma‘lum yoshga mo‘ljallangan.Buxoro gazlamalarida asosan to‘q qizil sariq va pushti ranglar qo‘llanilgan. Farg‘ona gazmollarida asosan yetti rang bo‘lgan: sariq, to‘q qizil, yashil, ko‘k, pushti, binafsha va qora. Bir rangni ichiga ikkinchi rangni kirgani va fon ta‘siri ranglar uyg‘unligini yaratadi. Abr gazlamalarida koloristik mukammallik yuqori darajada bo‘lganligi uchun naqsh o‘z ma‘nosini deyarli yo‘qotgandi. Gazlamada fon yoki naqshga asosiy e‘tibor berilganligiga ko‘ra bir shakl ikkinchisiga oqib kiradi naqshdl och ranglar to‘qiga, iliq ranglar sovug‘iga o‘tadi.

Bu gazlamalar naqshining tasvirlari bo‘yicha farqlanadi. Rangi razmeri va joylanishi bilan ajralib turadigan asosiy elementiga ko‘ra kompozitsiyaga umumiy nom beriladi. [1]

Zamonaviy gazlamalar naqshlash usuli bora-bora o‘zgargandi: naqshda shartli shakllar tasvirlanadigan bo‘ldi. Figuralar kattalashdi. Shakl aniqligi yo‘qoldi. Yozilgan kompozitsiya yaratiladigan bo‘ldi. Ammo an‘anaviy dekorativ san‘at qonunlari saqlanib qolgan.



1-rasm.Milliy matolar rasmi.

Libos insonni chiroyiga chiroy qo‘shuvchi uning bor jozibasini aks ettiruvchi vositadir.Ayniqsa, uning egnida ko‘zni quvontiruvchi, kishini bir qarshda maftun etuvchi libos bo‘lsa.

Bunday liboslarni yaratish uchun qadimiy gazlamalar asosida tayyorlangan zamonaviy matolardan foydalanishimiz mumkin. Bunga quyidagi yaratilgan liboslarni ko‘rsatishimiz mumkin.

Ushbu libos adras matosidan tikilgan bo‘lib ustidagi chopon yarim quyosh shaklida bichib olinadi. Keyin ikki yelka qismi birlashtiriladi. Atrofiga jiyak va tasma tikiladi. Ko‘ylak qismi to‘g‘ri bichilib, korset qo‘yib tikiladi (2-rasm).

Duxoba matosida tikilgan xalat. Bu xalat go'zal qizlarimizni yanada xushbichim ko'rinishlariga yordam beradi. Unga tikilgan o'zbekona bezak gullar va toshlar qizlarimizga yanada viqor bag'ishlaydi. Xalatning tepa va past qismi alohida bichiladi. Etak qismi esa o'lchovga nisbatan uzunrog' bichiladi.

Yengi tirsakdan kengaytiriladi. Jaketining old va orqa vitochka qo'yilib, etak qismiga o'rnatiladi. Xalat asosan, beldan etakka qarab kengaytiriladi. Yeng uzunligi 75sm bo'lishi kerak. Xalatning yeng, yoqa o'mizi va etak qismiga lentali tasma taxlama qilib tikiladi. Ichidan kiygan qaymoq rangli ko'ylagi xalatni yanada ko'rkam qilib turadi. (3-rasm).

Beqasam matosidan tikilgan kelinlar libosi. Shoxona ko'rinishga ega. Bu xalat to'y libosini eslatadi. Xalatni oldi va etak qismlari chiroyli toshlar bilan bezatilgan. Libosning tepa qismlari alohida bichiladi. Beliga vitochka



2-rasm. Adras matosidan libos.



3-rasm. Duxoba maesidan tikilgan libos.

qo'yiladi. Etak qismi yarim quyosh shaklida bichilib yuqori qismiga birlashtirib tikiladi. Yengi tirsakdan kengaytiriladi va bezak beriladi. Xalat bel qismidan kengaytirilib oldi va orqa qismlariga vitochka qo'yiladi. Yengning past qismiga atlasdan 8sm lenta tayyorlab, taxlama qilinadi (4-rasm).

Atlas matosidan tikilgan libos, uni yuqori pastki qismi alohida bichiladi. Ko'krak qismiga 12sm vitochka bel qismiga esa 10sm manjet qo'yiladi. Etak qismi o'lchovga nisbatan kengroq bichiladi. Tayyor ko'ylakning bel, yeng va etak qismlariga jiyak tikib chiqiladi. Ko'ylakning yengi old va orqa qismi bilan yaxlit bichilgan. Libos old va orqa qismiga qo'lda kashta bilan bezatilgan. Bu libos o'zbek qizlariga o'zining rang-barang va jozibali kashtasi bilan ko'rk bag'ishlaydi. Chiroyli kashtalarni maxsus gul tikadigan mashinalarda ham tikish mumkin. Bu libosni qizlarimiz va yosh ayollarimiz uchun tavsiya etamiz (5-rasm).



4-rasm. Beqasam matosidan tikilgan libos.



5-rasm. Atlas matosidan libos.

Ma'lumki, tabiiy matolarning inson sog'lig'iga hech qanday yomon ta'siri va zarari yo'q. Aksincha, u tana nafas olishiga, yordam beradi, terlatmaydi, ventelyatsiya vazifasini yaxshi bajaradi. Xon atlas matosidan zamonaviy bichimda bichilgan bashang liboslarni o'rta yoshli ayollarga, balki yosh qizlarga ham birdek yoqadi. Hashamdorligini, jozibadorligini oshirish maqsadida dekor sifatida setka va qimmat baho toshlar bn bezatilgan [6].

Xulosa qilib aytishimiz mumkinki bu maqolada O'zbekiston xududida qadimda tayyorlangan matolar asosida yaratilgan yangi materiallardan zamonaviy modellar yaratilganligi haqida so'z yuritiladi. Shu bilan birga modellarimizga ko'rinishiga, tikilishiga va bezatilgan bezaklariga ham alohida ta'rif berilgan. Modellarimiz qaysi yosh vakillariga mos ekanligi alohida aytib o'tilgan.

Adabiyotlar:

- [1]. G.Xasanova „To'qimachilik dizayn tarixi “, Toshkent „Iqtisod-moliya“ 2006 yil.
- [2]. Atele „Fariz“ qo'llanma jurnal 2015 yil.

- [3]. M. M. Ulugboboyeva , & Tursunova, X. S. (2021). Ways to solve problems in the production of knit wear. *Asian Journal of Multidimensional Research*, 10(9), 29-33.
- [4]. Maripdjanovna, U.M., & Xilola, T. (2022). Problems of automation of technological processes of sewing manufacturing. *Galaxy International Interdisciplinary Research Journal*, 10(1), 550-553.
- [5]. Ulugboboyeva, M. M. (2021). Creation of new modern clothes from national fabrics. *Innovative Technologica: Methodical Research Journal*, 2(11), 63-68.
- [6]. Maripdjanovna, U. B. M., & Valiyevich, X. J. (2021). Research and analysis of physical and mechanical properties of the national fabric-adras. *Innovative Technologica: Methodical Research Journal*, 2(12), 77-88.
- [7]. Ulugboboyeva, M. M. (2022). Development of the Concept of a Collection of Dresses from KhonAtlas Fabric. *Eurasian Journal of Engineering and Technology*, 10, 121-124.
- [8]. Ulugboboyeva, M. M..From tradition to trend:craftingadress series with national satin fabrics. ISSN (E):2832-1766 JIF:7.235.www.americanjournal.org.

YOSH BOLALAR YENGIL KIIYIMLARINING GAZLAMALARI TAHLILI

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Annotatsiya: Ushbu maqolada yosh bolalar yengil kiyimlari assortimenti uchun iste'molchilar talabiga mos keluvchi, ekspluatatsion hamda gigiyenik talablarga mos keluvchi gazlamalar tahlili hamda ushbu matolardan yosh bolalar yengil kiyimlari uchun modellar haqida ma'lumotlar yoritilgan.

Kalit so'zlar: Trikotaj, interlok, sifat, qulaylik, mustahkamlik, xomashyo, ekspluatation talab, estetik talab, tabiiy tolalar, kimyoviy tolalar.

Аннотация: В данной статье представлен анализ тканей, соответствующих потребительскому спросу, эксплуатационным и гигиеническим требованиям к ассортименту легкой одежды для детей раннего возраста.

Ключевые слова: Вязание, интерлок, качество, комфорт, долговечность, сырье, эксплуатационные требования, эстетические требования, натуральные волокна, химические волокна.

Abstract: In this article, the analysis of gas products that meet consumer demand, operational and hygienic requirements for the assortment of light clothes for young children has been covered.

Key words: Knitting, interlock, quality, comfort, durability, raw materials, operational requirements, aesthetic requirements, natural fibers, chemical fibers.

Iste'molchi talabiga mos zamonaviy kiyim modelini yaratishda unga mos bo'lgan gazlamani tanlash muhim ahamiyatga ega. Gazlamani xossalar tola tarkibi, urilish strekturasi va pardozlashga bog'liq. Gazlamani asosiy xususiyatlaridan biri uning egiluvchanligidir. Bu xususiyat modelga o'ziga xos ko'rinishni beradi. Gazlamaning fizik mexanik xususiyatlarini bilish to'g'ri shakl berishi uchun ham zarurat bo'lganda tikishdan oldin materiallarni dekarativ qilib olish namlab isitib ishlov berish uchun ham imkon beradi.

Yosh bolalar kiyimi ayniqsa ob – havo sharoitidan kelib chiqib tikilishi kerak. Ob – havoning birdan isib yoki sovib ketishi, bolalarning sog'ligiga tez ta'sir qiladiki, buni nazardan chetda qoldirmaslik kerak. Shuningdek, shaharda va qishloqda yashaydigan bolalarning kiyimlari ham ob – havosi va ijtimoiy kelib chiqilishiga qarab tikilishi maqsadga muvofiqdir [1].

Iqlim sharoitidan kelib chiqqan holda kuz mavsumiga bolalar kiyimlarini ishlab chiqarishda paxta tolali bo'lgan gazlmalarda foydalanish eng maqbul. Zero yosh organizm to'g'ri rivojlanishi va shakllanishida nafaqat kiyim, balki uni ishlab chiqarishda foydalanilgan material va furnitura katta ahamiyatga ega. Bolalar kiyimini loyixalashda to'g'ri tanlangan materialning ahamiyati kattadir. Bolalar kiyimini tanlash uchun, arzonroq, yuqori darajali gigienik, ekspluatation va estetik sifatga ega bo'lgan materiallar tavsiya etiladi. Masalan, bolalar organizmi kattalarnikiga nisbatan nozikroq bo'ladi, sababi ularning organizmida to 18 yoshga to'lgunga qadar o'sish kuzatiladi. Shuning uchun ham bolalarga tabiiy materiallardan kiyim yaratish tavsiya etiladi. Bolalar kiyimi juda tor bo'lishi

tavsiya etilmaydi. Chunki, bola organizmi rivojlanishda bo'lganligi sabab, ichki organlarida salbiy oqibatlarni yuzaga keltirishi mumkin. Bolalar kiyimlariga qopllanilayotgan material chidamlilik xususiyatiga ham ega bo'lmog'i darkor, sababi serharakat bo'ladilar. Ularning kiyimlari pishiq va yuvishga chidamli bo'lishi lozim. Kiyim yuvilganda, tanlangan material o'z xususiyatini yo'qatmasligi ayniqsa muhimdir [2].

Trikotaj (frans, tircoter to'qimoq) — bir yoki bir necha iplardan halqalar hosil qilib, ularni o'zaro biriktirish (o'rish) natijasida olinadigan mato yoki buyum. T. iplarning tarkibiga, ishlatilishi, pardozlash usuli va tuzilishiga qarab turlarga bo'linadi. Tarkibi ga qarab, paxta ipi, jun, ipak va kimyoviy tola aralashgan iplardan to'qilgan xillarga bo'linadi. Ishlatilishiga qarab, kostyum, jemper, kofta, palto, qo'lqop, ko'ylak, ichki kiyim, paypoq va boshqa matolariga sun'iy mo'yna, sun'iy charm kiradi; bular texnik maqsadlarda va turli xil kiyimlar tayyorlashda ishlatiladi. Tolalari tarkibiga qarab trikotaj mahsulotlar uch guruhga—A, B, V ga bo'linadi. Shu o'rinda A guruhiga tabiiy tolalar yoki tabiiy tolalar va kimyoviy tolalar aralashmasidan olingan kalava iplaridan to'qilgan trikotaj matolar kiradi. Ko'rsatilgan kalava iplar va kimyoviy iplardan to'qilgan matolar ham shu ikki guruhga taluqlidir.

B guruhini suniy ip va kalava iplar, ular bilan sintetik ip va kalava iplarning qoshilishidan toqilgan trikotaj matolar tashkil etadi.

V guruhga esa sintetik ip va kalava iplar, aralash kalava iplar (tarkibida 30 foizgacha sintetik tolalari bolgan) va ularning boshqa iplar aralashmasidan toqilgan trikotaj matolar kiradi.

A va B guruh tarkibidagi sintetik iplar miqdori 30 foizdan oshmasligi lozim. Tarkibi 95 foiz jun bolgan matolar toza jun mato, 45 foizdan kam bolmagan mato esa yarim jun mato hisoblanadi.

Quyida yosh bolalar yengil kiyimlari tayyorlash uchun tavsiya etiladigan matolar hamda modellar keltirilgan.

t/r	Tasnifi	Taklif gazlama ko'rinishi	Yosh bolalar yengil kiyim ko'rinishi
1	„Djinsi“ matosi paxta tolasi to'qimasidan iborat mustahkam mato turiga kiradi. Ushbu yosh bolalar ko'ylagi yoshiga munosib badiiy bezaklar bilan ishlov beriladi.	 Djinsi matosi	
2	„ Trikotaj-tabiiy tolalar yoki tabiiy tolalar va kimyoviy tolalar aralashmasidan olingan kalava iplaridan to'qilgan matolar hisoblanadi. Ushbu model yosh bolalar yengil kiyimi bo'lib, bahor va kuz mavsumiga mo'ljallangan.	 Trikotaj	

3	Interlok trikotaj mato - ikki tomonlama trikotaj mato hisoblanadi. Mato ixcham ko‘rinishga ega, Interlok trikotaj mato oddiy trikotajdan mustahkamroq. Bu mato bolalar yengil kiyimlarini tayyorlash uchun juda mos keladi.		
4	Ushbu mato glad to‘qimasi asosida arqoqli trikotaj hisoblanadi. Yosh bolalar uchun mo‘ljallangan sport uslubidagi ko‘ylak (tolstovka) ko‘p harakatda bo‘luvchi, sport bilan shug‘ullanuvchi bolalarga juda ham qulaylik beradi.		

Trikotaj kiyimlarning 60% dan ko‘rog‘i bichilgan kiyimlardir. Trikotaj kiyimlarni modellashtirishda va konsruksiyalashda ularning zarur xususiyatlaridan biri bo‘lmish suvga kirishini, cho‘ziluvchanligi darajasini etiborga olish shart. Ko‘krak chizigi bo‘yicha qo‘shimcha haq Rg miqdorini tanlashda trikotaj matolarning xossalari e‘tiborga olinadi. Trikotaj kiyimlarining oddiy kiyimlardan farqi shundaki, Rg miqdori ularda gazlamadan tayyorlangan kiyimlarga qaraganda ancha kichik. Sanoatda ko‘krak chizigi bo‘yicha qo‘shimcha haq Rg qiymati djem‘erlar uchun 1-4 sm, jaketlar uchun 2-4 sm, kurtkalar uchun 46 sm, ichki kiyimlar uchun esa Rg . Trikotaj mahsulotlari modellar uyi qo‘shimcha haq Rg miqdorini qo‘yidagicha taxsimlashni tavsiya etadi: orqa bo‘lakga 25-30%, yeng o‘miziga 50-55%, old bo‘lakga 20%. Trikotaj matolarining afzalligi ularning mayinligi, ishqalanishga chidamligi va yuqori qayshqoqligidadir. Ularning burma bo‘lmasligi, g‘ijimlanmasligi, issiqni saqlash qobiliyati va gigienik xususiyatlari juda yaxshi. SHuning bilan birga trikotaj matolarining cho‘ziluvchanligi va chetlari buralgani sababli ularni bichish va tikish jarayoni qiyinlashadi. Trikotaj matolari yuvilganda va xatto kimyoviy tozalashda ham bo‘ylamasiga kirishadi, eniga esa kengayadi [3].

Xulosa: Yosh bolalar kiyimlari gazlamalarini tahlil qilingan, yosh bolalar kiyimlari har tomonlama qulay, estetik hamda gigiyenik talablarga javob bera oladigan, ishqalanishga chidamliligi, mayinligi, tabiiy matodan foydalanilganligi hamda kiyim sifati va foydalanishga qulayligiga katta e‘tibor berilgan hamda ushbu matolardan yosh bolalar yengil kiyimlari uchun modellar tavsiya etildi.

Adabiyotlar:

- [1]. "Materialshunoslik" U. A. Ziyamuxamadova. Toshkent. 2018.
- [2]. "Gazlamashunoslik" J. Ochilov. Davlat nashriyoti
- [3]. "Tikuv buyumlari texnologiyasi asoslari". N.S. Gaipova, M.Z. Ismatullayeva, A.S. Axmetova, X.Z. Ismatullayeva. Toshkent. 2016.
- [4]. Foydalanilgan internet saytlari:
- [5]. <http://lex.uz>
- [6]. <http://wikipedia.uz>
- [7]. <http://library.ziyonet.uz>
- [8]. <https://dropt.ru>

ЯРИМЎТКАЗГИЧЛИ ЛАЗЕРЛАРНИНГ ЭФФЕКТИВЛИГИНИ ОШИРИШДА АСОСИЙ ОМИЛЛАР

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Аннотация. Яримўтказгичли лазерларда зона-зона ўтишлар учун инверс бандликни ҳосил бўлиш шарти содда усулда кўрсатилиб, амалда кучли легирланган p - n ўтиш зарурати мавжудлиги кўрсатилган.

Таянч сўзлар: инверс бандлик, зона- зона ўтиш, лазерларлар, кучли легирлаш, p - n ўтиш, номувозанатли концентрация

Аннотация. Упрощенно показано условие обратной заселенности при межзонных переходах в полупроводниковых лазерах и на практике показана необходимость сильнолегированного p - n перехода.

Ключевые слова: обратная заселенность, зональный переход, лазеры, сильное легирование, p - n переход, неравновесная концентрация.

Abstract. The condition of inverse occupancy for zone-to-zone transitions in semiconductor lasers is shown in a simple way, and the necessity of strongly doped p - n junction is shown in practice.

Key words: inverse occupation, zone-zone transition, lasers, strong doping, p - n junction, nonequilibrium concentration.

Кириш.

Бугунги кунда, яримўтказгичли лазерларда инверс бандликни ҳосил қилишда ўзига хос бўлган электр майдон таъсири усуллари кенг фойдаланилади.

Инверс бандлик олиш учун электронларни турли хил зона-зона, зона-киришма, киришма-киришма каби сатхлараро ўтишлардан фойдаланиш мумкин [1]

Аниқлик учун инверс бандликни зона-зона ўтишда ҳосил бўлиш шартини қараб ўтамыз.

Агар валент зонадан ўтказувчанлик зонасига электронларни ўтказиш учун етарли энергия берилса, улар фотон чиқариш орқали қайта ўз ҳолатига ўтиши мумкин.

Ўтказувчанлик зонасига томон ўтишлар сони ΔN_2 шу частотада ютилиши мумкин бўлган энергия узатувчилар сонига, валент зонадаги электронлар сонига N_{ev} ва ўтказувчанлик зонасидаги бўш ҳолатлар N_c сонига пропорционал бўлади [2]

яъни

$$\Delta N_2 = \int B_{21} \omega_{21} N_{ev} N_c dE \quad (1)$$

бу ерда B_{21} - бирлик вақт ичида ўтишлар эҳтимоли

ω_{21} - мос частоталарда нурланиш зичлиги

ΔN_1 фотон чиқариш билан боғлиқ мажбурий ўтишлар эса, ўтиш частотасидаги фотонлар сонига, ўтказувчанлик соҳасидаги электронлар N_{ec} сонига ва валент зонада электронлар учун бўш жойлар N_v сонига пропорционалдир

$$\text{яъни} \quad \Delta N_1 = \int B_{21} \omega_{21} N_{ec} N_v dE \quad (2)$$

Манфий ютилиш ҳосил бўлиши учун қуйидаги шарт бажарилиши керак

$$\int B_{21} \omega_{21} N_{ec} N_v dE > \int B_{21} \omega_{21} N_{ec} N_c dE \quad (3)$$

$$\text{ёки} \quad N_{ec} N_v > N_{ec} N_c \quad (4)$$

Ўтказувчанлик ва валент зонада электронлар (n) ва коваклар (p) сонини зоналарда электронлар учун $\sigma(E)$ ҳолат зичлигини ҳолатлар бўйича энергетик тақсимот функциясини $f_c(E)$ билган ҳолда аниқлаш мумкин. Яримўтказгичларда панжара атом ва ионлари билан электрон ва ковакларни кучли ўзаро таъсирда бўлишидан ҳатто номувозанатли концентрациялар ҳолида ҳам тақсимот функцияси Ферми тақсимоти бўйича аниқланади [3]

$$\text{яъни} \quad f(E) = \frac{1}{e^{\frac{E-\mu}{kT}} + 1} \quad (5)$$

Бу ерда μ Ферми энергия сатҳи бўлиб, номувозанатли ҳолдаги Ферми сатҳи дейилади ва μ қиймати қуйидаги шартдан аниқланади:

$$\int f(E) \sigma(E) dE = n \quad (6)$$

Ўтказувчанлик соҳасида $f_c(E)$ ифодани $\sigma_c(E)$ ҳолатлар сони зичлигига кўпайтириб қандайдир E_c энергия қиймати атрофида бирлик энергия интервалидаги электронлар сонини N_{ec} оламиз. Шундай мос ҳолда валент зонада коваклар сонини ҳам шу тарзда N_v аниқлаш учун қуйидагиларни кўпайтириб ҳосил қилиш мумкин.

$$[1 - f_v(E - hv)] \quad \text{ва} \quad \sigma_v(E - hv)$$

Буларни эътиборга олиб (4) ифодани қайта қуйидагича ёзамиз

$$f_c(E) \sigma_c(E) [1 - f_v(E - hv)] \sigma_v(E - hv) > \\ > f(E - hv) \sigma_v(E - hv) [1 - f_c(E)] \sigma_c(E)$$

ёки

$$f(E) [1 - f_v(E - hv)] > f_v(E - hv) [1 - f_c(E)] \\ f_c(E) - f_c(E) f_v(E - hv) > f_v(E - hv) - f_v(E - hv) f_c(E) \\ f_c(E) > f_v(E - hv) \quad (7)$$

Шу ерда электрон ва коваклар учун худди икки турдаги манфий ва мусбат ишорали зарядлардан икки турдаги эффектив массали, Ферми сатҳлариги эга, манфий ва мусбат ишорали зарядлар каби қараб уларни тақсимот функцияларини киритамиз.

Бунда электрон энергиясининг зонаси тубидан юқорига қараб, коваклар учун валент зонаси шипидан пастга қараб ҳисобланади. Унда f_c ва f_v учун қуйидаги ифода ўринли бўлади:

$$f_c = \frac{1}{e^{\frac{E_c - \mu_c}{kT}} + 1} \quad (8)$$

$$f = \frac{1}{e^{\frac{E_p - \mu_p}{kT}} + 1} \quad (9)$$

Бу белгилашларда $hv = E_c - E_p$ деб олинди

(8) ва (9) ни (7) га қўйиб яримўтказгичларда манфий ютилиш шартини оламиз.

$$\mu_c - \mu_p > hv \quad (10)$$

(10) шартни қаноатлантириш учун кучли легирланган яримўтказгичли p-n тузилма яратиш лозим. Бу ҳолда уларни Ферми сатҳи валент ва ўтказувчанлик зоналарида жойлашади [4]

Шундай тузилмага тўғри силжиш кучланиши қўйилганда асосий ташувчилари камбағаллашган соҳада инверс бандлик ҳосил бўлиши мумкин.

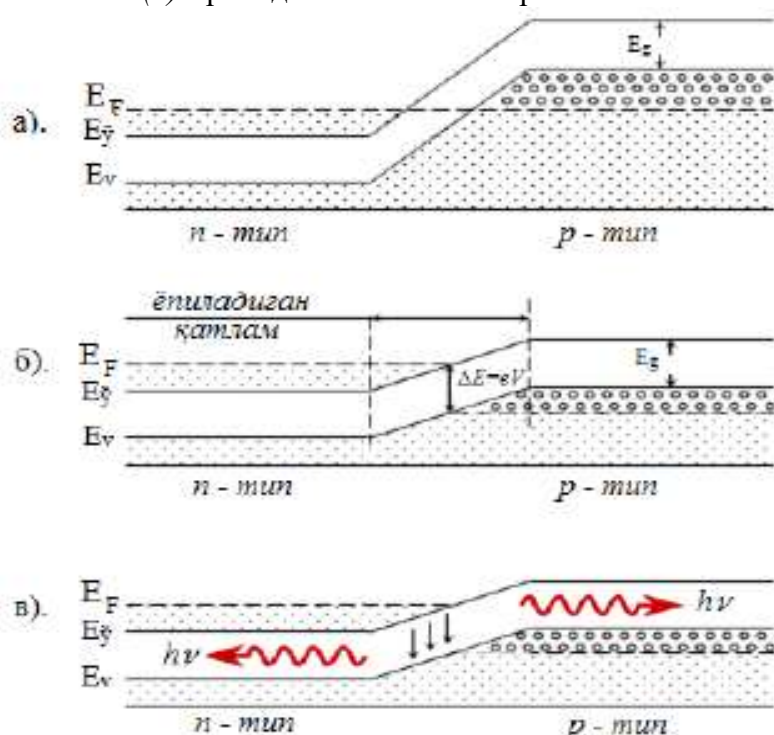
Яъни p-n диод структурага тўғри силжиш кучланиш қўйилганда p ва n соҳа орасидаги потенциал барьер нол қийматга қадар камайиб, ўтиш соҳасидан тўғри йўналишда нисбатан

катта ток оқади ва бевосита р-п ўтиш соҳасида электрон ва ковакларни рекомбинацияси жараёни рўй бера бошлайди. Зарядлар рекомбинацияси рўй бераётган соҳада инверс бандлик шарти бажарилади, чунки рухсат этилган (ўтказувчанлик) зонасининг юқори энергетик сатхларини электрон билан тўлдириш валент зонанинг қуйи сатхларини тўлдириш эҳтимоллигидан каттадир. Шу сабабли мажбурий нурланишли ўтиш ютилиш ўтишларидан устунроқ бўлади.

Бунда яримўтказгичли лазерлар учун р-п ўтиш соҳасида электронлар ва тешиқлар бир вақтда иштирок этиши катта аҳамиятга эга. Бу шарт кучли легирланган яримўтказгич донор ва акцепторни ҳосил қиладиган элементларни яримўтказгичнинг кристалл панжарасига киритиб концентрациясини бир сантиметр куб ҳажмда 10^{17} - 10^{18} та атомга етказишда бажарилади. Кучли легирланган яримўтказгичларда Ферми сатҳи E_F ўтказувчанлик зонасининг ичида жойлашади. n-типтаги яримўтказгичда донор сатҳи электронга тўлади ва қисман ўтказувчанлик зонасига ҳам ўтади. р - типли ярим ўтазгичда эса акцептор сатҳи тўлмайди ва валент зонасида тирқиш пайдо бўлади. Ферми сатҳи эса валент зонасида жойлашади. Шу икки хил кучли легирланган яримўтказгичлар туташтириб қўшилса, энергетик сатҳлар силжийди ва Ферми сатҳи иккала тип учун бир хил қийматга эга бўлади.

1 (а) - расмда кучли легирланган р-п типли яримўтказгичнинг энергетик схемаси келтирилган. Агар электр манбанинг мусбат кутбини р - типига ва манфийсини n - типига уласак, электронлар мусбат электродга, тешиқлар эса манфий электродга қараб йўналади. Ана шу икки хил зарядли заррачалар икки типли яримўтказгичнинг қўшилган чегарасида, яъни р-п ўтиш чегарасида учрашади. Электронлар тешиқлар билан учрашиб, рекомбинациялашади ва квант нурланишини ҳосил қилади. Квант нурланишининг энергияси $h\nu = E_g$ га тенг.

Электр майдони таъсирида энергетик соҳаларнинг силжиши кузатилади. Бу силжиш 1 (б) - расмда схематик келтирилган.



1 - расм. Кучли легирланган р-п ўтишли яримўтказгичларнинг энергетик соҳалари ва квант нурланиш схемаси: а)Электр майдон таъсири бўлмаганда соҳаларнинг силжиши кузатилмайди. б) Электр майдон таъсирида соҳаларнинг р - тип томонга силжиши. в) Рекомбинация вақтида ёпиладиган қатламдан квант нурланиши.

Силжиш қиймати электр майдон потенциали билан боғланган:

$$\Delta E = eV$$

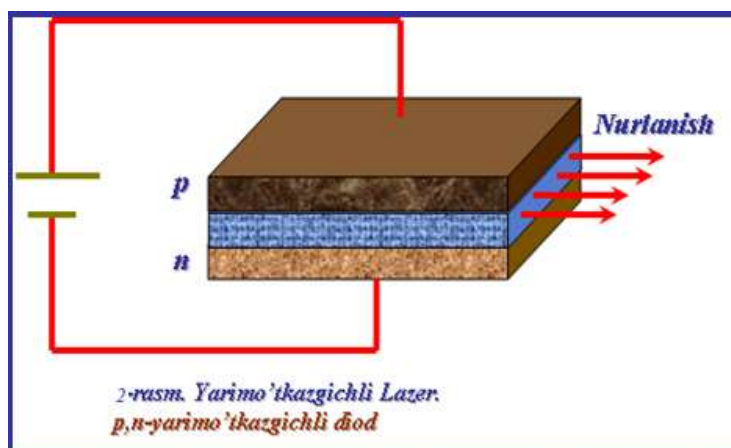
e - электрон заряди, V - электр майдон потенциали.

Яримўтказгичнинг икки типи томонга бериладиган токнинг электр майдони таъсирида р-п ўтиш чегарасида “ёпиладиган қатлам” ҳосил бўлади. Бу ёпиладиган қатламда инверсион бандлик ҳосил бўлади. Яримўтказгичга электр манбаи улаганда ташқи электр майдони таъсирида ёпиладиган қатламда электронларни n - типли яримўтказгичнинг ўтказиш соҳасидан ва тешиқларни эса р - типнинг валент соҳасидан тортиб тўплайди. Шу пайтда ёпиладиган қатламда электрон билан тешиқ учрашиб рекомбинациялашиш натижасида

ёруғлик нуруни чиқаради (1(в) -расмга қаранг). Шуни айтиш лозимки, р-п ўтишли

яримўтказгич яхлит монокристаллдан тайёрланади ва р-п ўтиш шу монокристаллнинг ичида ҳосил қилинади. Электр майдон таъсирида ёпиладиган қатламда р-п ўтиш чегарасида заряд ташувчилар электрон ва тешикларнинг одатдагидан ортиқча концентрациясини ҳосил қилиш шу яримўтказгич чегарасида инверсион бандлик ҳосил қилишнинг айнан ўзидир. Ёпиладиган қатламни фаол қатлам дейилади. Электр зарядини ташувчи электрон ва тешиклар биргаликда фаол марказларни ҳосил қилади. Яримўтказгич лазерларнинг фаол моддалари: *GaAs, InAs, InSb, PbSe* [5].

Хулоса. Инжекцион ярим ўтказгичли лазер ярим ўтказгичли диод бўлиб, $p-n$ ўтиш ва гетепереход текислигига перпендикуляр бўлган икки яссипаралел қирралари оптик резенатор кўзгулари вазифасини ўтайди (қайтариш коэффициенти 30 %) Айрим ҳолларда ташқи кўзгу ишлатилади. Диод орқали катта тўғри электр токи ёрдамида ортиқча заряд ташувчиларнинг ўтиш ёнидаги қатламларда тўпланиши натижасида инверс бандлик ҳолатига эришилади. Четки люминестсенция полосасида оптик кучайтириш нурланишни ташқарига чиқариш, фаол муҳитда ютилиш ва резенатор ичидаги йўқотиш (сочилиш) энергияларидан ортиқ бўлганда когерент лазер нурланиши содир бўлади [6] Кристални бу фаол соҳасига резенатор жойлаштириб 2-расмдагидек ёруғлик генерациясини олиш мумкин. Амалда кристал диодни ён томонлари резенатор вазифасини бажаради.



Адабиётлар

- [1]. Мириновтов М. М. Лазер физикаси ва техникаси, Ўқув қўлланма
- [2]. А.Т.Турсунов, О.Тухлибоев. Квант электроникасига кириш. Т:Ўқитувчи, 1992
- [3]. <http://www.colorado.edu/physics/2000/lasers/index.html>. Лазерлар, ишлаш принципи, анимациялар.
- [4]. Качмарик Ф. Введение в физику лазеров. М. Мир 1981.
- [5]. Ш.М.Содиқова, Ш.О.Отажонов, М.Қурбонов. Лазерлар ва уларнинг амалиётдаги ўрни. Ўқув-услубий қўлланма. Тошкент - 2018
- [6]. А. Тешабоев, С. Зайнобиддинов, С. Власов, У Качимов, В. Абдуазизов Яримўтказгичлар сирти физикаси Тошкент Илм Зиё, 2010

NOTURAR JOY BINOLARINI ISITISHDA ISHLATIB BO‘LINGAN TRANSFORMATOR MOYIDAN FOYDALANISH

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Annotatsiya: Noturar joy binolarini isitish tizimida isitilish suyuqligi (suv) va chiqindi transformator moyidan foydalanish bo'yicha tadqiqot olib borilgan. Tadqiqot ishida, issiqlikni saqlash va issiqlikni tashish suyuqligi sifatida chiqindi transformator moyidan foydalanish istiqbollari yoritilgan.

Kalit soʻzlar: Noturar joy binolari, transformator moyi, issiqlik radiator, suvli isitish, izolyatsiya.

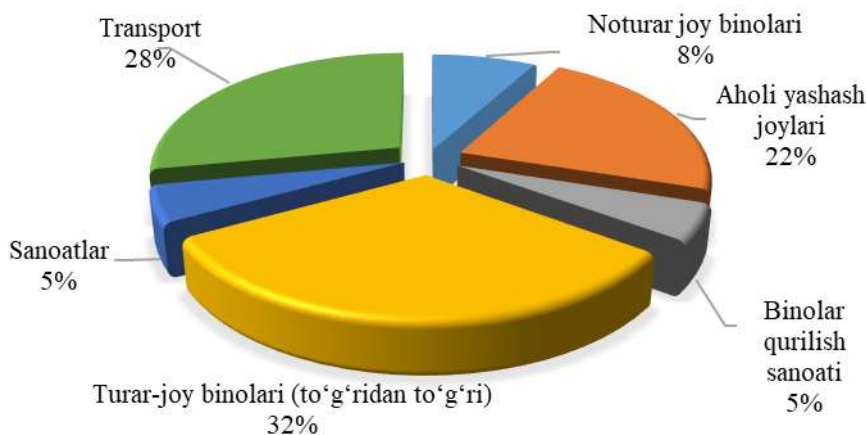
Аннотация: Проведено исследование по использованию теплоносителя (воды) и отработанного трансформаторного масла в системе отопления нежилых зданий. В научной статье освещены перспективы использования отработанного трансформаторного масла в качестве теплоаккумулирующего и теплопереносящего жидкости.

Ключевые слова: нежилые здания, трансформаторное масло, радиатор отопления, водяное отопление, изоляция.

Abstract: Research on the use of heating liquid (water) and waste transformer oil in the heating system of non-residential buildings was conducted. In the research paper, the prospects of using waste transformer oil as a heat storage and heat transport fluid are highlighted.

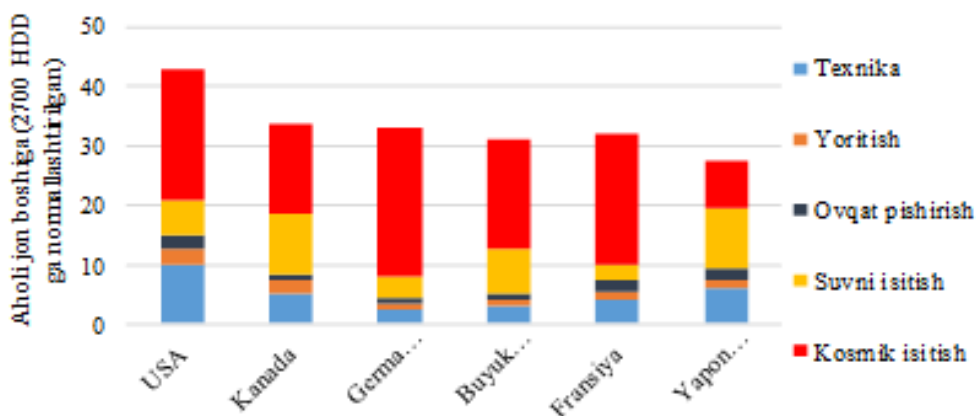
Keywords: Non-residential buildings, transformer oil, heat radiator, water heating, insulation.

Kirish. Hozirgi kunda issiqlik taʼminoti tizimini avtonomlashtirish, yoqilgʻi energetikasini tejash hamda muqobil energiya manbalaridan keng foydalanishga qaratilgan davlat qarorlari qabul qilinmoqda va ushbu masalalar yechimiga qaratilgan ilmiy tadqiqot ishlari koʻplab olib borilmoqda. Olib borilgan tadqiqotlar tahlili natijalari shuni koʻrsatdiki, “Xalqaro energetika agentligi” (IEA) maʼlumotlariga koʻra 2019-yil uchun butun dunyo boʻylab yillik issiqlik energiya isteʼmoli 1.1-rasmda keltirilgan ulushlarni oʻzida jamlagan [1].



1.1-rasm. Dunyo boʻyicha yillik issiqlik energiya isteʼmoli balansi.

Koʻplab rivojlangan davlatlarda turar joy binolarini isitish uchun avtonom isitish tizimidan foydalaniladi. Rivojlangan mamlakatlarda issiqlik energiya isteʼmolining kunlik sarfi koʻrsatkichlari 1.2 - rasmda keltirilgan [1].



1.2-rasm. Rivojlangan mamlakatlarda aholining kunlik issiqlik energiyasidan foydalanish koʻrsatkichlari: HDD - kunlik isitish darajasi [1].

Ishlatilib boʻlingan transformator moylaridan foydalanish xorijiy davlatlarda koʻplab maqsadlarda foydalanib kelinmoqda. Misol uchun AQShda ishlatilib boʻlingan transformator

moyining taxminan 60 foizi qayta ishlashga yuboriladi, qolgan qismi utilizatsiya qilinadi, shu jumladan kichik va o'rta isitish tizimlarining foydalaniladi. G'arbiy Yevropa mamlakatlarida chiqindi moylarning 75 % i to'planadi, bulardan- 25% i qayta tiklanadi va 50% i yoqilg'i sifatida ishlatiladi turli maqsadlarda foydalaniladi [2].

Noturar joy binolari, omborlar, parrandachilik fermer xo'jalik binolarini va avto servis shahobchalarini issiqlik energiyasi bilan ta'minlash uchun ishlatilib bo'lingan transformator moyidan foydalaniladi. Moyni yoqish orqali issiqlik energiyasiga aylantiradi (2, 3-rasmlar).



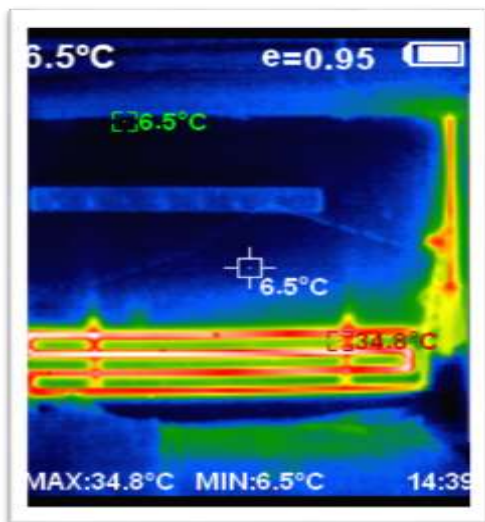
2-rasm. T 1500 markali
ishlatilmagan transformator
moyi



3-rasm. Ishlatilib bo'lingan
transformator moyini yoqish orqali
issiqlik energiyasiga aylantirish

Chiqindi moylarni yoqish turli omillarga, masalan, yoqish texnologiyasiga, moyning tarkibiga, emissiya nazorati choralari va me'yoriy hujjatlarga muvofiqligiga qarab, atrof-muhitga ham ijobiy, ham salbiy ta'sir ko'rsatishi mumkin. Chiqindi moyda og'ir metallar, xlor, oltingugurt va boshqa ifloslantiruvchi moddalar kabi xavfli moddalar bo'lishi mumkin. Yoqilganda bu moddalar havoga, tuproqqa va suvga tarqalib, ekotizimlar, hayvonot dunyosi va inson salomatligi uchun xavf tug'diradi. Chiqindi moylaridan yoqilg'i sifatida foydalanish, atmosferaga karbonat angidrid (CO_2) va boshqa gazlarini chiqaradi.

Transformator moyining sovitish va dielektriklik xususiyatlaridan transformatorlar chulg'amlarini uzoq muddat ishonchli ishlashini ta'minlashda keng foydalaniladi.



4-rasm. Moyli isitish tizimida ajralib
chiqayotgan issiqlikni teplovizor orqali tahlil
qilish.

Ishlatilib bo'lingan transformator moyining issiqlik o'tkazuvchanligi suvdan yuqoriligini inobatga olib uni issiqlik tashuvchisi sifatida qayta ishlatishimiz mumkin [3]. Noturar joy binolari va servis shahobchalarini isitish uchun chiqindi moydan foydalanish natijasida sezilarli darajada enegiya resurs tejamlorligiga erishish mumkin.

Ushbu tizimda moy yoqilg'i emas balki issiqlik energiyasining tashuvchisi bo'lib xizmat qiladi. Uzoq muddat ishlagan issiqlik radiatoridagi moy, hatto isitgich o'chirilgandan keyin ham o'zida issiqlikni yaxshi saqlaydi [4]. Bu shuni anglatadiki, xona uzoq vaqt davomida doimiy energiya sarfisiz issiqlikni saqlab qoladi, bu esa issitish uchun sarflangan xarajatlarni tejashga olib keladi. Natijada energiya sarfini optimallashtirish va kommunal to'lovlarni

kamaytirishga yordam beradi.

Xulosa. Boshqa isitish tizimlari moyli isitish tizimlaridan ikki baravar qimmatga tushishi mumkin. Bundan tashqari, moyli isitgichidan foydalanish yoqilg'i tannarxini taxminan 5% kamaytirish imkonini beradi. ***Moyli radiatorlar issiq havoni bino bo'ylab tez va samarali ravishda tarqatadi. Moyli radiator orqali xosil bo'lgan issiq havo elektr yoki yog'ochni yoqish tizimlari bilan isitiladigan bino havosidan ko'ra namligi yuqoriroq bo'ladi. Bu honaning iqlim xolatini yaxshilaydi.*** Tabiiy gaz va propanli isitish tizimlari 11 yildan 14 yilgacha ishlashi mumkin bo'lsa-da, moyli isitish tizimlari deyarli 30 yildan ortiq muddat xizmat qiladi.

Adabiyotlar

- [1]. Low-GHG T. Global Alliance for Buildings and Construction //International Energy Agency, UN Environment: Paris, France. – 2016.
- [2]. Григорьев А. В. Отопление на отработанном масле //Промышленные и отопительные котельные и мини-ТЭЦ. – 2011. – №. 2. – С. 22.
- [3]. Lindberg N., Magnusson C. Improving building heating efficiency using machine learning: An experimental study. – 2021.
- [4]. YILMAZOĞLU M. Z. Isı enerjisi depolama yöntemleri ve binalarda uygulanması //Politeknik Dergisi. – 2010. – T. 13. – №. 1. – С. 33-42.
- [5]. Sernhed K., Jönsson M., Olsson M. Riskhantering för underhåll av fjärrvärmenät //Energiforsk rapport. – 2015. – T. 185. – С. 106.

GLOBAL TARMOQDAGI HUJUMLARNI OLDINI OLISH TARTIBI VA CHORALARI

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Аннотация: Данная тема включает в себя обсуждение различных процедур и мер, направленных на предотвращение и смягчение атак внутри глобальной сети. Это включает в себя изучение различных стратегий и технологий кибербезопасности, которые могут быть реализованы для защиты сетей от несанкционированного доступа, утечки данных и других киберугроз. Он также включает обсуждение лучших практик защиты данных, выявление уязвимостей и внедрение надежных мер безопасности для обеспечения целостности и конфиденциальности данных в сетевой среде.

Ключевые слова: кибербезопасность, сетевая безопасность, предотвращение атак, защита данных, киберугрозы, глобальная сеть, меры безопасности.

Abstract: This topic includes a discussion of various procedures and measures aimed at preventing and mitigating attacks within the global network. This includes exploring various cybersecurity strategies and technologies that can be implemented to protect networks from unauthorized access, data breaches, and other cyber threats. It also includes discussing best practices for data protection, identifying vulnerabilities, and implementing robust security measures to ensure data integrity and confidentiality in a networked environment.

Keywords: cyber security, network security, attack prevention, data protection, cyber threats, global network, security measures.

Annotatsiya: Ushbu mavzu global tarmoq ichidagi hujumlarning oldini olish va yumshatishga qaratilgan turli tartib va choralarni muhokama qilishni o'z ichiga oladi. Bunga tarmoqlarni ruxsatsiz kirish, ma'lumotlar buzilishi va boshqa kiber tahdidlardan himoya qilish uchun amalga oshirilishi mumkin bo'lgan turli kiberxavfsizlik strategiyalari va texnologiyalarini o'rganish kiradi. Shuningdek, u ma'lumotlarni himoya qilish bo'yicha ilg'or tajribalarni muhokama qilishni, zaifliklarni aniqlashni va tarmoq muhitida ma'lumotlarning yaxlitligi va maxfiyligini ta'minlash uchun mustahkam xavfsizlik choralari amalga oshirishni o'z ichiga oladi.

Kalit so'zlar: kiberxavfsizlik, tarmoq xavfsizligi, hujumlarning oldini olish, ma'lumotlarni himoya qilish, kiber tahdidlar, global tarmoq, xavfsizlik choralari.

Internet va boshqa aloqa tizimlarini o'z ichiga olgan global tarmoq axborot almashinuvi uchun muhim platforma bo'lib xizmat qiladi va ko'plab biznes operatsiyalarini osonlashtiradi. Biroq, global tarmoqning ochiq va o'zaro bog'liqligi uni moliyaviy, operatsion va strategik jihatdan katta zarar etkazadigan turli xil kiberhujumlarga ham moyil qiladi. Shu sababli, hujumlarning oldini olish va global tarmoqning yaxlitligini himoya qilish uchun mustahkam tartib va choralarni amalga oshirish juda muhimdir.

Global tarmoqdagi hujumlarning oldini olishning asosiy protseduralaridan biri kirishni nazorat qilishning qat'iy choralari o'rnatish va qo'llashdir. Kuchli autentifikatsiya va avtorizatsiya protokollarini qo'llash orqali tashkilotlar maxfiy tizimlar va ma'lumotlarga kirishni cheklashi mumkin, bu esa ruxsatsiz kirish va potentsial hujumlar xavfini minimallashtirishi mumkin. Ko'p faktorli autentifikatsiya, shifrlash va rolga asoslangan kirishni boshqarish bu boradagi samarali chora-tadbirlardan biridir. Bundan tashqari, foydalanuvchi faoliyatini muntazam tekshirish va monitoring qilish har qanday shubhali xatti-harakatlar yoki ruxsatsiz kirish urinishlarini aniqlash va kamaytirishga yordam beradi.

Tarmoq infratuzilmasini himoya qilish hujumlarning oldini olishning yana bir muhim chorasidir. Bu tarmoq bo'ylab harakatlanayotganda ma'lumotlarni himoya qilish uchun xavfsizlik devorlari, hujumlarni aniqlash va oldini olish tizimlari va mustahkam shifrlash protokollarini o'rnatishni o'z ichiga oladi. Tarmoq segmentatsiyasi muhim tizimlarni izolyatsiya qilish va potentsial hujumlar ta'sirini kamaytirish uchun ham ishlatilishi mumkin. Muntazam ravishda xavfsizlikni baholash va kirish testlari tarmoq infratuzilmasidagi zaifliklarni aniqlash va bartaraf etishga yordam beradi va shu bilan uning potentsial hujumlarga chidamliligini oshiradi.

Bundan tashqari, xodimlarni kiberxavfsizlik bo'yicha ilg'or tajribalar haqida o'rgatish va o'rgatish global tarmoqdagi hujumlarning oldini olishda muhim ahamiyatga ega. Firibgarlik qurboni bo'lish yoki zaif parollardan foydalanish kabi inson xatosi xavfsizlik buzilishining keng tarqalgan sababidir. Kibertahdidlar haqida xabardorlikni oshirish va ushbu tahdidlarni aniqlash va ularga javob berish bo'yicha keng qamrovli treninglar o'tkazish orqali tashkilotlar muvaffaqiyatli hujumlar ehtimolini sezilarli darajada kamaytirishi mumkin.

Hujumlarning global tarmoqqa ta'sirini yumshatishda kuchli hodisalarga javob berish va ofatlarni tiklash rejalarini amalga oshirish ham muhim ahamiyatga ega. Tashkilotlar xavfsizlik intsidentlarini zudlik bilan aniqlash, o'z ichiga olish va yo'q qilish, shuningdek, ta'sirlangan tizimlar va ma'lumotlarni qayta tiklash va tiklash bo'yicha aniq tartiblarni o'rnatishi kerak. Muntazam mashqlar va simulyatsiyalar ushbu rejalarining samaradorligini tasdiqlashga yordam beradi va hujum sodir bo'lgan taqdirda tezkor va muvofiqlashtirilgan javobni ta'minlaydi.

Ushbu protsessual choralarga qo'shimcha ravishda, kiberxavfsizlik sohasidagi so'nggi tahdidlar va o'zgarishlardan xabardor bo'lish juda muhimdir. Bu global kiberxavfsizlik tendentsiyalarini faol monitoring qilish, axborot almashish va hamkorlik tashabbuslarida ishtirok etish hamda dasturiy ta'minot va tizimlar uchun o'z vaqtida xavfsizlik yangilanishlari va yamoqlarini joriy etishni o'z ichiga oladi. Sohaga oid xavfsizlik forumlari bilan shug'ullanish va tahdidlar bo'yicha razvedka xizmatlaridan foydalanish, shuningdek, global tarmoqdagi paydo bo'ladigan tahdidlar va potentsial zaifliklar haqida qimmatli ma'lumotlarni taqdim etishi mumkin.

Global tarmoqdagi hujumlarning oldini olish texnik, protsessual va ta'lim choralarining kombinatsiyasini o'z ichiga oladi. Global tarmoqdagi hujumlarning oldini olishga yordam beradigan bir necha asosiy tartib va choralar:

1. Kiberxavfsizlik bo'yicha mustahkam chora-tadbirlarni amalga oshirish: Bunga zararli dasturlar, to'lov dasturlari va fishing kabi turli xil hujumlardan himoya qilish uchun xavfsizlik devorlari, hujumlarni aniqlash tizimlari va antivirus dasturlariga ega bo'lish kiradi.

2. Muntazam dasturiy ta'minotni tuzatish: Ma'lum zaifliklarni bartaraf etish va tajovuzkorlar tomonidan ekspluatatsiya qilinishining oldini olish uchun barcha tarmoq qurilmalari va dasturlari muntazam ravishda eng so'nggi xavfsizlik yamoqlari bilan yangilanib turishini ta'minlang.

3. Tarmoq segmentatsiyasi: potentsial buzilish ta'sirini cheklash va muhim tizimlar va ma'lumotlarga ruxsatsiz kirishni cheklash uchun tarmoqni alohida segmentlarga ajratish.

4. Kirish nazorati va autentifikatsiya: Ruxsatsiz kirish xavfini kamaytirish uchun kuchli kirish boshqaruvlaridan foydalaning va maxfiy ma'lumotlar va tizimlarga kirish uchun ko'p faktorli autentifikatsiyani talab qiling.

5. Muntazam xavfsizlikni baholash: Tarmoqdagi zaifliklarni aniqlash va bartaraf etish uchun muntazam xavfsizlikni baholash va kirish testlarini o'tkazing.

6. Xodimlarni o'qitish va xabardor qilish: Xodimlar va foydalanuvchilarni kiberxavfsizlik bo'yicha eng yaxshi amaliyotlar, jumladan, fishing urinishlarini tan olish, kuchli parollardan foydalanish va qo'shimchalarni yuklab olish yoki shubhali havolalarni bosishdan ehtiyot bo'lish haqida o'rgating.

7. Hodisalarga javob berish rejasi: Aloqa protokollari va tiklash tartib-qoidalarini o'z ichiga olgan tarmoq xavfsizligi buzilgan taqdirda ko'rilishi kerak bo'lgan choralarni ko'rsatuvchi hodisaga javob rejasini ishlab chiqish va muntazam yangilash.

8. Sotuvchi risklarini boshqarish: Uchinchi tomon sotuvchilari va yetkazib beruvchilari ishonchli xavfsizlik amaliyotlariga rioya qilishlarini va ularning tarmog'ingiz bilan o'zaro bog'langan tizimlarini himoya qilish uchun zarur nazoratni amalga oshirishlarini ta'minlang.

9. Ma'lumotlarni shifrlash: Tarmoq buzilgan taqdirda ma'lumotlarni o'g'irlash xavfini kamaytirish uchun tranzit va dam olish vaqtida nozik ma'lumotlarni himoya qilish uchun shifrlashdan foydalaning.

10. Doimiy monitoring: potentsial hujumlarni erta aniqlash imkonini beruvchi har qanday shubhali harakatlar yoki anomalialarni tarmoqni doimiy ravishda kuzatib borish uchun xavfsizlik ma'lumotlari va hodisalarni boshqarish (SIEM) vositalaridan foydalaning.

Ushbu tartib va chora-tadbirlarni amalga oshirish orqali tashkilotlar global tarmoqdagi hujumlar xavfini sezilarli darajada kamaytirishi va kiberxavfsizlikning umumiy holatini yaxshilashi mumkin.

Xulosa qilib aytganda, global tarmoqdagi hujumlarning oldini olish protsessual, texnik va ta'lim choralari o'z ichiga olgan kompleks yondashuvni talab qiladi. Qattiq kirish nazoratini o'rnatish, tarmoq infratuzilmasini ta'minlash, xodimlarni o'qitish va hodisalarga javob berish va tabiiy ofatlarni tiklash rejalarini amalga oshirish orqali tashkilotlar global tarmoqning kiber tahdidlarga chidamliligini sezilarli darajada oshirishi mumkin. Bundan tashqari, hushyorlikni saqlash va rivojlanayotgan kiberxavfsizlik landshafti haqida xabardor bo'lish potentsial zaifliklarni faol ravishda aniqlash va bartaraf etishda juda muhimdir. Ushbu tartib va chora-tadbirlarni amalga oshirish orqali tashkilotlar global tarmoqning yaxlitligi va ishonchliligini himoya qilishga hamda kiberhujumlarning potentsial ta'sirini yumshatishga yordam berishi mumkin.

Adabiyotlar

- [1]. Anderson, R., & Moore, T. (2006). Information security economics—and beyond. In M. Tan & S. Wu (Eds.), Security and Privacy in the Age of Uncertainty: IFIP TC11 18th International Conference on Information Security (pp. 238-249). Springer.
- [2]. Dhillon, G., & Torkzadeh, G. (2006). Secure E-business: Models and Applications. Idea Group Inc (IGI).
- [3]. Alladi, T., & Tominov, L. M. (2019). Security vulnerabilities and solutions in the Internet of Things. In 2019 IEEE 19th International Conference on Communication Technology (ICCT) (pp. 569-574). IEEE.

COMPUTER ERRORS AND THEIR SOLUTIONS

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Аннотация: В этой статье рассматриваются проблемы, с которыми сталкиваются пользователи в области компьютерных ошибок, и предлагаются практические решения для их решения. В эссе рассматриваются общие проблемы, возникающие в цифровой среде, от сбоев

системы до снижения производительности, и даются сведения о методах устранения неполадок. Он подчеркивает важность понимания коренных причин этих ошибок и выступает за активные меры по повышению общей надежности компьютерных систем.

Ключевые слова: ошибки компьютера, устранение неполадок, синий экран смерти (BSOD), производительность системы, сбои приложений, проблемы с подключением к Интернету, сообщения об ошибках, предотвращение потери данных, перегрев, проблемы с питанием, не отвечающие системы, проблемы с принтером, сбои обновления системы.

Annotation: This article explores the challenges users face in the realm of computer errors and offers practical solutions to address them. From system crashes to slow performance, the essay delves into common issues encountered in the digital landscape and provides insights into troubleshooting techniques. It emphasizes the importance of understanding the root causes behind these errors and advocates for proactive measures to enhance the overall reliability of computer systems.

Keywords: Computer Errors, Troubleshooting, Blue Screen of Death (BSOD), System Performance, Application Crashes, Internet Connection Issues, Error Messages, Data Loss Prevention, Overheating, Power Issues, Unresponsive Systems, Printer Issues, System Update Failures.

Annotatsiya: Ushbu maqola foydalanuvchilarning kompyuter xatolari sohasida duch keladigan muammolarni o'rganadi va ularni hal qilish uchun amaliy yechimlarni taklif qiladi. Tizimning ishdan chiqishidan tortib sekin ishlashgacha bo'lgan insho raqamli landshaftda uchraydigan umumiy muammolarni o'rganadi va muammolarni bartaraf etish usullari haqida tushuncha beradi. U ushbu xatolarning asosiy sabablarini tushunish muhimligini ta'kidlaydi va kompyuter tizimlarining umumiy ishonchliligini oshirish uchun faol choralarni qo'llab-quvvatlaydi.

Kalit so'zlar: Kompyuter xatolari, muammolarni bartaraf etish, o'limning ko'k ekrani (BSOD), tizimning ishlashi, ilovalarning ishdan chiqishi, Internetga ulanish muammolari, xato xabarlar, ma'lumotlar yo'qotilishining oldini olish, qizib ketish, quvvat muammolari, javob bermayotgan tizimlar, printer muammolari, tizimni yangilashda xatolik.

In the rapidly evolving landscape of technology, computers have become an indispensable part of our daily lives. From streamlining complex tasks to connecting people across the globe, computers have revolutionized the way we live and work. However, in this intricate web of zeros and ones, users often find themselves facing the daunting challenge of computer errors. These errors, ranging from the mildly inconvenient to the potentially catastrophic, can disrupt our digital experience. In this article, we will explore some common computer errors and their pragmatic solutions.

One of the most infamous and anxiety-inducing computer errors is the Blue Screen of Death (BSOD). This ominous blue screen, adorned with cryptic error codes, often sends shivers down the spines of users. Typically caused by hardware or driver issues, the BSOD can be mitigated by updating drivers, checking for hardware problems such as faulty RAM or hard drives, and running system file checks.

Beyond the terror of the BSOD, many users encounter the frustration of slow computer performance. This sluggishness may stem from insufficient RAM, numerous background processes, malware, or a fragmented hard drive. Upgrading RAM, closing unnecessary programs, conducting regular antivirus scans, and defragmenting the hard drive can breathe new life into a lethargic system.

Application crashes are another common annoyance. Whether due to software bugs or conflicts with other programs, these crashes disrupt workflow and hinder productivity. Solutions include updating the problematic application, reinstalling it, and investigating potential conflicts with other software.

Internet connection issues can be a source of immense frustration. Whether caused by network problems, router issues, or troubles with the Internet Service Provider (ISP), a disrupted connection can bring work to a standstill. Simple remedies such as restarting the router, checking network cables, and contacting the ISP can often resolve these issues.

Error messages, such as those related to missing or corrupted DLL files, are frequent stumbling blocks for users. These messages may arise from incompatible software or corrupted

system files. Resolving such issues involves reinstalling or updating the problematic software and running system file checks.

Hard drives, the digital repositories of our data, can also present challenges. Noisy hard drives may signal impending failure or loose components. Users are advised to back up their data, replace failing hard drives, and tighten any loose components to avoid potential data loss.

Overheating is a silent threat that can cripple a computer's performance and longevity. Dust buildup or malfunctioning cooling systems are common culprits. Regular cleaning of internal components, ensuring proper ventilation, and replacing malfunctioning fans can prevent overheating-related issues.

Power problems, ranging from faulty power supplies to electrical issues, can result in sudden shutdowns or hardware damage. Users should test their systems with a different power supply, use surge protectors, and inspect power cables to address these issues.

Unresponsive systems, characterized by freezes and slowdowns, often result from resource exhaustion or software conflicts. Closing unnecessary programs, checking for malware, and upgrading hardware when necessary can restore system responsiveness.

Data loss, a nightmare scenario for any computer user, can occur due to accidental deletion, hardware failure, or malware. To safeguard against data loss, regular backups, the use of data recovery software, and maintaining reliable antivirus solutions are crucial.

Printer issues, such as driver problems or paper jams, can disrupt the smooth flow of office work. Updating or reinstalling printer drivers, checking connections, and clearing paper jams are straightforward solutions to these problems.

Computer errors can occur for various reasons, and troubleshooting them often involves identifying the underlying issue and implementing the appropriate solution. Here are some common computer errors and their possible solutions:

Blue Screen of Death (BSOD):

Cause: Hardware or driver issues, system file corruption.

Solution: Update drivers, check for hardware issues (RAM, hard drive), run system file checker (sfc), and install Windows updates.

Slow Performance:

Cause: Insufficient RAM, too many background processes, malware, fragmented hard drive.

Solution: Upgrade RAM, close unnecessary programs, run antivirus/malware scans, defragment the hard drive.

Application Crashes:

Cause: Software bugs, conflicts with other programs, corrupted files.

Solution: Update the application, reinstall the application, check for conflicts with other software.

Internet Connection Issues:

Cause: Network problems, router issues, ISP problems.

Solution: Restart the router, check network cables, contact your ISP, update network drivers.

Error Messages (e.g., DLL errors):

Cause: Missing or corrupted system files, incompatible software.

Solution: Reinstall or update the problematic software, run system file checker (sfc), update Windows.

Noisy Hard Drive:

Cause: Failing hard drive, loose components.

Solution: Backup data, replace the hard drive, check and tighten loose components.

Overheating:

Cause: Dust buildup, malfunctioning cooling system.

Solution: Clean the internal components, ensure proper ventilation, replace malfunctioning fans.

Power Issues:

Cause: Faulty power supply, electrical issues.

Solution: Test with a different power supply, use a surge protector, check power cables.

Unresponsive System:

Cause: System resource exhaustion, software conflicts.

Solution: Close unnecessary programs, check for malware, upgrade hardware if necessary.

Data Loss:

Cause: Accidental deletion, hardware failure, malware.

Solution: Regularly backup important data, use data recovery software, maintain a reliable antivirus solution.

Printer Issues:

Cause: Driver problems, connection issues, paper jams.

Solution: Update or reinstall printer drivers, check connections, clear paper jams.

System Update Failures:

Cause: Network issues, corrupted update files.

Solution: Check network connectivity, run Windows Update Troubleshooter, manually download and install updates.

For specific error messages, it's often helpful to search online forums or the official support pages of the relevant software or operating system for more targeted solutions. If you encounter persistent issues, seeking professional technical support may be necessary.

Finally, system update failures can be a thorn in the side of users striving to keep their systems secure. Network issues or corrupted update files may be at fault. Addressing these problems involves checking network connectivity, running update troubleshooters, and manually downloading and installing updates when necessary.

In conclusion, while the digital world is fraught with potential pitfalls, understanding common computer errors and their solutions empowers users to navigate the complexities of modern technology. By staying informed, implementing preventive measures, and seeking assistance when needed, users can ensure a smoother and more resilient digital experience. In this dynamic and ever-changing landscape, the mastery of computer troubleshooting is an essential skill for the digital citizen.

References

- [1]. Tanenbaum, A. S., & Woodhull, A. S. (2015). Operating Systems: Design and Implementation (3rd ed.). Prentice Hall.
- [2]. Dill, D. L., & Stevens, D. R. (2004). Guide to UNIX Using Linux (4th ed.). Cengage Learning.
- [3]. Windows Support Documentation. (<https://support.microsoft.com/>)
- [4]. Stallings, W. (2018). Operating Systems: Internals and Design Principles (9th ed.). Pearson.
- [5]. Tanenbaum, A. S. (2014). Modern Operating Systems (4th ed.). Pearson.

TRANSFORMATOR MOYINING TASHQI MUHIT HARORATIGA BO'G'LIQLIK MODELINI ISHLAB CHIQISH

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Annotatsiya. Ushbu maqolada Matlab dasturidagi sun'iy neyron tarmog'idan foydalanib, ekspluatatsiyadagi transformator moyining tashqi muhit haroratiga bog'liqlik modeli ishlab chiqilgan. Ushbu model ishlab chiqarishda ekspluatatsiyadagi transformator moyining qaysi vaqtlarda qizib ketishini oldindan bashorat qilish uchun xizmat qiladi.

Kalit so'zlar: Elektr sxema, yuklama, Matlab, Sun'iy neyron tarmoq, aktiv quvvat, reaktiv quvvat, shinalar.

Аннотация: В данной статье с помощью искусственной нейронной сети в программе Matlab разработана модель зависимости трансформаторного масла в эксплуатации от внешней

температуры. Эта модель позволяет заранее предсказать, когда работающее трансформаторное масло нагреется на производстве.

Ключевые слова: Электрическая цепь, нагрузка, Matlab, Искусственная нейронная сеть, активная мощность, реактивная мощность, шины.

Abstract. In this article, using artificial neural network in Matlab program, a model of dependence of transformer oil in operation on external temperature was developed. This model serves to predict in advance when the transformer oil in operation will heat up in production.

Keywords: Electric circuit, loading, Matlab, Artificial neural network, active power, reactive power, tires.

Tatqiqot obyekti sifatida “Farg‘onaAzot” AJ korxonasidagi ТРДН-32000/110* кВА li transformator tanlab olindi.

Bu yerda:

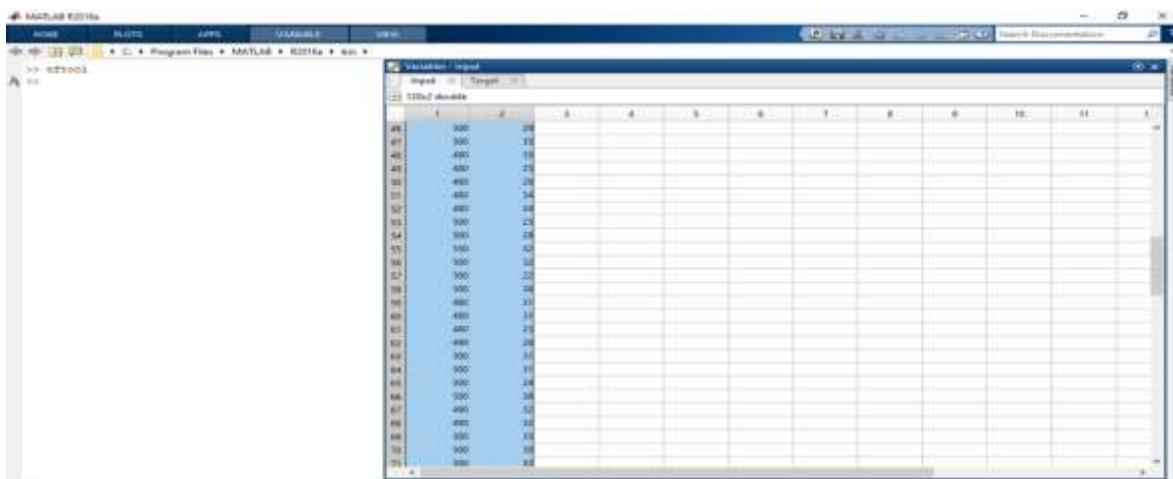
T- transformator

P- ajratilgan o‘ramlar HH;

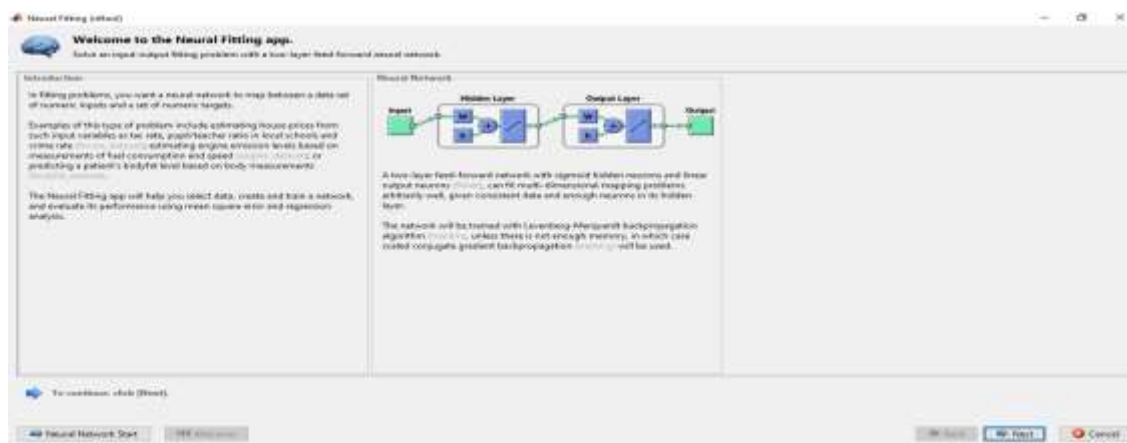
Д- tabiiy moy aylanishi va majburiy havo aylanishi (ДИ- majburiy moy va havo aylanishi bilan)

H- yuk ostida kuchlanishni tartibga solish (ППН)

Suniy neyron tarmog‘ini Matlab dasturiy ta‘minoti yordamida ishga tushirish o‘zgaruvchilarni kiritishdan boshlanadi [1]. Buning uchun Matlab dasturiy ta‘minotining ishchi oynasida “**New Variable**” yacheykasini tanlanadi. Ushbu yacheykani ustiga bosilganda 1-rasmdagidek oyna hosil bo‘ladi hamda ushbu oynalarga o‘zgaruvchilarni kiritiladi.



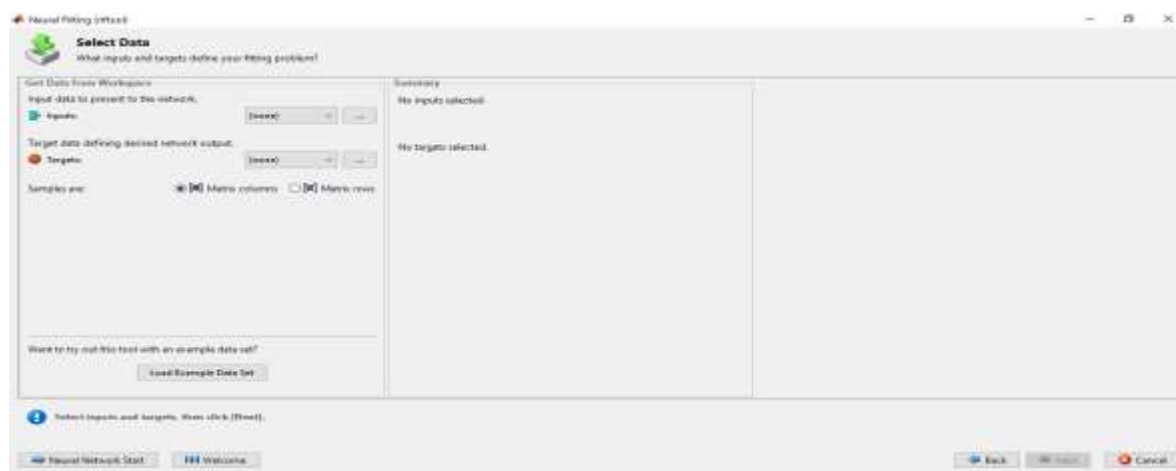
1-rasm. Matlab dasturida o‘zgaruvchilarni kiritish oynasi.



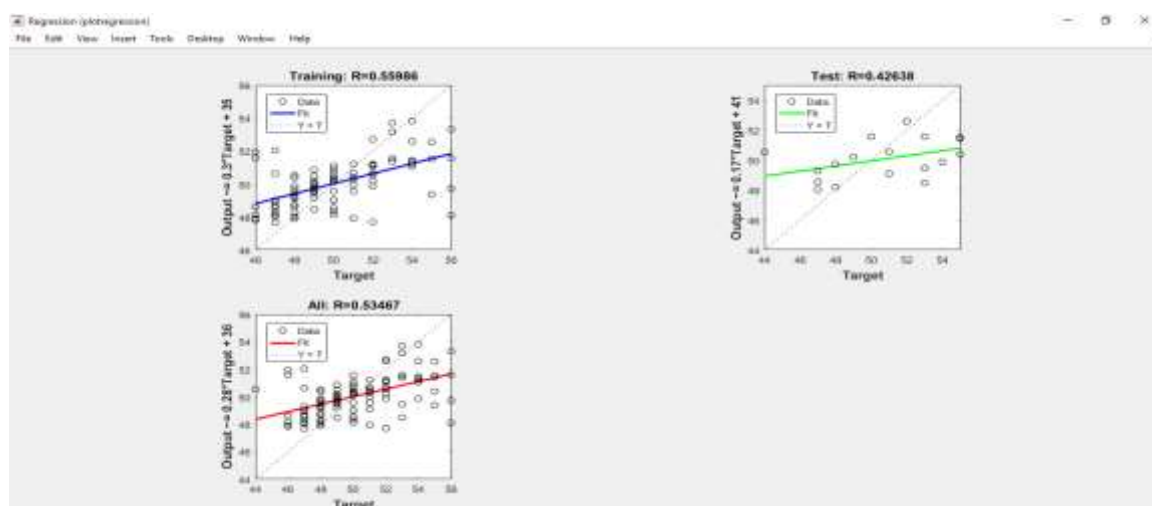
2-rasm. Matlab dasturining ishchi oynasi.

O'zgaruvchilar kiritilib bo'lingandan so'ng Matlab dasturiy ta'minotining ishchi oynasiga "nftool" buyrug'i berish orqali suniy neyron tarmog'ining oynasini hosil qilamiz (2-rasm)

Rasmdagi oyna hosil qilingandan so'ng "next" buyrug'ini bosish orqali **Input** hamda **Target** kiritgan o'zgaruvchilarimizni tanlaymiz. Ushbu buyruqlarni tanlangandan so'ng quyidagicha ko'rinish hosil bo'ladi.



3-rasm. Hisoblashlar oynasi.



4-rasm. Bog'liqliklar oynasi.

O'zgaruvchilar kiritib yuqoridagi buyruqlar kiritilgandan so'ng neyron tarmog'i ishga tushiriladi va quyidagi bog'liqlik grafigini bizga hosil qilib beradi.

Ikki o'zgaruvchi o'rtasida chiziqli munosabatlarni o'rnatadigan regressiya tenglamasi quyidagi ko'rinishda bo'ladi [2]: $y_1 = a_1 + b_1 x_1$

Bu yerda :

a -transformator yuklamasi

b -tashqi muhit harorati

Transformatorning moyining haroratiga tashqi muhit haroratining bo'g'liqlik chiziqli funksiyasi

$$y = 0,0955x + 45,359$$

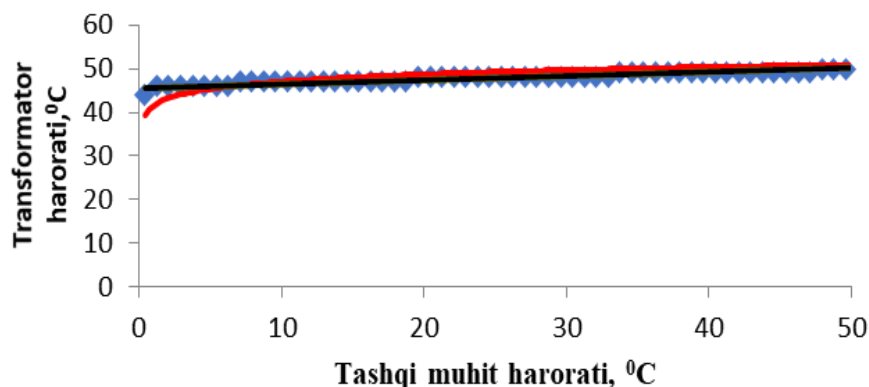
Determinatsiya koeffitsienti: $R^2 = 0,9579$

Transformatorning haroratiga tashqi muhit haroratiga bo'g'liqlik logarifmik tenglamasi:

$$y = 2,3931 \ln(x) + 41,499$$

Determinatsiya koeffitsienti: $R^2 = 0,6971$

Sun'iy neyron tarmog'i orqali ushbu bog'liqlikning grafik ko'rinishi quyidagicha bo'ladi.



5-rasm. Transformator moyining tashqi muhit haroratiga bog‘liqlik grafigi.

Hisoblashlardan kelib chiqib tashqi muhit harorati transformator moyining qizishiga sezilarli darajada ta’sir o‘tkazishini bilib olishimiz mumkin. Ushbu hisoblashlar orqali tashqi muhit harorati yuqori bo‘lgan holatlarda transformator moyining sovutish choralarini ko‘rish kerakligi haqida xizmat ko‘rsatish xodimlariga oldindan zarur choralarini ko‘rish imkonini beradi.

Adabiyotlar

- [1]. Ismoilov Muslimbek Murodjon o‘g‘li ”Quvvatni kuzatish va diagnostika qilish uchun tizimdagi mavjud transformatorlar” [Talqin va tadqiqotlar ilmiy-uslubiy jurnali, 2022 - cyberleninka.ru](#)
- [2]. Norkhojaeva Nargiza Nosirovna, Kamolov Nosir Kamolovich “Benefits of applying Internet resources in teaching process” Проблемы современной науки и ..., 2019 - cyberleninka.ru.

ОСОБЕННОСТИ УПРАВЛЕНИЯ НА ГИДРОЭЛЕКТРОСТАНЦИИ

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Annotatsiya: Ushbu maqolada gidro elektr stansiyalarini asosiy funksiyalari, rejimlarini boshqarish va rejimlarining elementlari ko‘rib chiqilib, xulosalar berilgan.

Kalit so‘zlar: gidroelektrostansiya, energiya, rejim, parametrlar, energiya tizimi.

Аннотация: В данной статье рассмотрены основные функции, элементы управления режимами и режимами работы гидроэлектростанций и даны выводы.

Ключевые слова: гидроэлектростанция, энергия, режим, параметры, энергосистема.

Annotation: in this article, the main functions, control of modes and elements of modes of hydro power plants are considered, conclusions are given.

Keywords: hydroelectric power plant, energy, regime, parameters, energy system.

Гидроэлектростанция (ГЭС) — совокупность сооружений и оборудования, концентрирующих одну энергию и преобразующих ее в электроэнергию.

Гидроэлектростанции являются важной частью энергетических систем. Одна из их основных функций — перекрытие пиков нагрузки и обеспечение резервирования нагрузки в случае возникновения аварийных ситуаций в энергосистеме. Не следует забывать, что гидроэлектростанции являются самым «чистым» и дешевым источником электроэнергии.

Сегодня КПД ГЭС может достигать 95%, что является очень высоким показателем, однако КПД ГЭС напрямую зависит от режима работы станции и выполнения требований энергосистемы[1].

В связи с этим на первый план выходит задача поиска оптимальных вариантов управления гидроэлектростанцией в процессе эксплуатации. Однако прежде чем приступить к решению этих задач, рассмотрим особенности управления режимами ГЭС.

Понятие режима энергосистемы многогранно, и соответственно его можно рассматривать с нескольких точек зрения: режим как состояние, режим как технологический процесс и режим как процесс управления. Ознакомьтесь с основными элементами режима управления.

Порядок работы ГЭС:

- Режим как состояние (набор требований и критериев)
- Режим как технологический процесс (набор параметров режима)
- Режим как процесс управления (виды и уровни управления)

Режим как технологический процесс подразумевает содержание параметров режима. В параметры режима входят характерные значения определенного рабочего состояния техники и технологий в определенный момент времени[2].

Наиболее характерные параметры для гидроэлектростанций:

- Активная мощность гидроагрегатов;
- Реактивная мощность гидроагрегатов;
- Эффективность гидроагрегатов;
- Напряжение на клеммах генератора;
- Состав подразделений станции и т.д.;

В этом отношении можно выделить два разных режима.

1. устойчивое состояние.

Этот режим характеризуется тем, что его параметры не изменяются или изменяются очень медленно и неравномерно.

2. Переходный режим.

Этот режим характеризуется быстрым изменением своих параметров во времени.

По размеру параметров режима различают следующие:

- Нормальный установившийся режим, при котором значения параметров режима близки к значениям, необходимым для корректной работы потребителей, или находятся в заданной зоне этих значений;
- Весовой режим, при котором некоторые параметры находятся на границах нормального состояния.
- Аварийный режим, при котором некоторые или все параметры режима превышают допустимые значения.
- послеаварийный установившийся режим, при котором параметры могут быть близки к параметрам нормального режима, и в этом случае исход аварии можно считать благополучным; если параметры сильно отличаются от параметров нормального режима, возникшие аварии следует считать неблагоприятными.

Режим как состояние означает ряд требований и ограничений энергосистемы электростанции и потребителей.

1. Обеспечение надежности основного энергетического оборудования;

Надежность — это способность объекта или технического устройства выполнять заданные функции и поддерживать значения заданных эксплуатационных показателей в заданных пределах в соответствии с заданными режимами и условиями использования, обслуживания и ремонта[3].

2. Обеспечение качества электроэнергии;

Под термином «качество электрической энергии» понимают степень соответствия характеристик электрической энергии, вырабатываемой на станции, совокупности нормируемых показателей электрической энергии.

3. Обеспечение эффективности энергоснабжения;

В современных условиях основными показателями эффективности работы станции зачастую являются ее технико-экономические показатели, которые могут быть связаны с техникой и технологией или иметь коммерческое содержание.

Управление энергосистемой соответствует трем ее аспектам:

1. Административно-производственный отдел;

К этому типу относится управление всеми видами потоков (сырьевых, финансовых и т.п.) как внутри системы, так и при взаимодействии системы с внешней средой. По временной иерархии этот процесс включает в себя оперативное, текущее и перспективное направления планирования. В этом случае, как правило, времени для принятия решения достаточно[4].

2. Технологическое управление (автоматическое регулирование);

Данный вид управления осуществляется как на скорости производственного процесса (регулирование параметров с автоматизацией режимов), так и на уровне планирования - определение сроков ремонта, профилактических мероприятий, модернизации на основе правил применения и контроля состояния оборудования.

3. Оперативное управление;

Оно осуществляется эксплантами энергообъектов различного уровня и сводится к управлению технологическими потоками в процессе производства, преобразования и передачи энергии. Сюда входит контроль значений параметров режима, работы средств автоматизации, а также соответствующая корректировка режима работы оборудования исходя из требований производственного процесса - как технологических ограничений, так и задач на более высоких уровнях управления.

Список литературы:

- [1]. Петровски Е.С., Кузнецов Е.Ю. «Особенности оценка эффективности инвестиционных проектов в развитии электросетевых объектов». Материал 8-ое международной научно-практической конференции «Актуальных проблем управления - 2003 ». Вып. 6, ГУУ, М.: 2003 г. (0,3 п.л.).
- [2]. Кузнецов Е.Ю. «Проблем оценка экономической эффективности электросетевых инвестиционных проектов условия либерализации рынок электроэнергии». Сборник научных статей. Экономика. Управление. Культура. Вып. 11, часть 2, ГУУ, М.: 2004 г. (0,3 п.л.).
- [3]. Кузнецов Е.Ю. «Принцип ценообразования и услуг по передаче электроэнергии». Материал 19-о Всероссийской научно конференции молодых ученых и студентов «Реформ в России и проблем управления - 2004» Вып. 1, ГУУ, М., 2004 г. (0,17 п.л.)
- [4]. Кузнецов Е.Ю. «Финансово-экономические последствия реализации инвестиции в электросетевые объекты». Материал 9-ое международное научно-практическое конференция «Актуальны проблем управления - 2004 ». Вып. 6, ГУУ, М.: 2004 г. (0,3 п.л.)

TIKUVCHILIK KORXONALARIDA ASSYST CAD DASTURIY TA'MINOTINING ROLI

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Аннотация: Поддержание конкурентоспособности в динамично развивающейся среде швейных предприятий требует использования инновационных технологий. Программное обеспечение Assyst CAD становится преобразующим инструментом, который ускоряет процессы проектирования, создания эскизов и производства. В этой статье описывается решающая роль программного обеспечения Assyst CAD в повышении эффективности, точности и креативности на швейных фабриках. Благодаря интуитивно понятному интерфейсу и расширенным функциям программное обеспечение Assyst CAD позволяет дизайнерам и производителям упростить операции, снизить затраты и добиться более высокого качества при производстве одежды.

Ключевые слова: САПР Assyst, швейные фабрики, инновации в проектировании, точность, эффективность, производство одежды.

Abstract: Maintaining competitiveness in the dynamic landscape of garment enterprises requires the use of innovative technologies. Assyst CAD software is emerging as a transformative tool that accelerates design, sketching and manufacturing processes. This article describes the critical role of Assyst CAD software in increasing efficiency, accuracy and creativity in garment factories. With its intuitive interface and advanced features, Assyst CAD software enables designers and manufacturers to simplify operations, reduce costs and achieve higher quality in apparel production.

Key words: Assyst CAD software, garment factories, design innovation, accuracy, efficiency, clothing production.

Annotatsiya: Tikuvchilik korxonalarining dinamik manzarasida raqobatbardoshlikni saqlab qolish innovatsion texnologiyalarni qo'llashni taqozo etadi. Assyst CAD dasturi dizayn, eskiz yaratish va ishlab chiqarish jarayonlarini tezlashtiradigan o'zgartiruvchi vosita sifatida paydo bo'ladi. Ushbu maqola tikuv korxonalarida samaradorlik, aniqlik va ijodkorlikni oshirishda Assyst CAD dasturining muhim rolini tavsiflaydi. Assyst CAD dasturi o'zining intuitiv interfeysi va ilg'or xususiyatlari orqali dizaynerlar va ishlab chiqaruvchilarga operatsiyalarni soddalashtirish, xarajatlarni kamaytirish va kiyim ishlab chiqarishda yuqori sifatga erishish imkonini beradi.

Kalit so'zlar: Assyst CAD dasturi, tikuvchilik korxonalari, dizayn innovatsiyasi, aniqlik, samaradorlik, kiyim-kechak ishlab chiqarish.

Ijodkorlik aniqlik va samaradorlikka mos keladigan tikuvchilik korxonalarining jadal rivojlanayotgan dunyosida texnologiyaning rolini ortiqcha baholab bo'lmaydi. Kiyim-kechak ishlab chiqarishning murakkab dizayndan beg'ubor bajarilishigacha bo'lgan har bir jihati jiddiy e'tiborni talab qiladi. Ushbu mukammallikka intilishda Assyst CAD dasturi tikuvchilik korxonalarining ishlash usullarini qayta belgilovchi vositalar to'plamini taklif qiluvchi jarayonni o'zgartiruvchi sifatida paydo bo'ladi.

Assyst CAD dasturi markazida o'zining intuitiv dizayn interfeysi yotadi, bu esa dizaynerlarga o'z ijodini cheklovlarsiz ochib berishga imkon beradi. Dizayn elementlarining keng kutubxonasi va moslashtirilgan shablonlari bilan dizaynerlar o'z tasavvurlarini osonlik bilan amalga oshirishlari mumkin. Murakkab naqshlar yoki noyob kiyim tuzilmalari bo'ladimi, Assyst CAD dasturi g'oyalarni aniq ijodga aylantirish uchun vositalarni taqdim etadi [1].



1-rasm. Assyst CAD dasturida dizayn yaratish jarayonini ko'rinishi.

Bundan tashqari, Assyst CAD dasturi an'anaviy ravishda ko'p vaqt talab qiladigan va ko'p mehnat talab qiladigan eskiz yaratish jarayonini yaxshilaydi(1-rasm). Ilg'or algoritmlar va

avtomatlashtirish xususiyatlari orqali Assyst CAD dasturi dizaynerlarga misli ko'rilmagan samaradorlik bilan aniq eskizlarni yaratishga imkon beradi. Qo'lda xatolarni bartaraf etish va materiallardan foydalanishni optimallashtirish orqali tikuv korxonalari yuqori sifat standartlarini saqlab, ishlab chiqarish xarajatlarini sezilarli darajada kamaytirishi mumkin [2].

Dizayn va eskiz yaratishdan tashqari, Assyst CAD dasturi ishlab chiqarish jarayonlari bilan uzluksiz integratsiyani osonlashtiradi. Uning ilg'or ishlab chiqarish texnologiyalari bilan muvofiqligi dizayndan ishlab chiqarishga muammosiz o'tishni, etkazib berish vaqtini minimallashtirish va ishlab chiqarishni maksimal darajada oshirishni ta'minlaydi. Assyst CAD dasturiy ta'minoti raqamli eskizlarni baholashtan virtual prototiplashgacha tikuvchilik korxonalariga ishlab chiqarish jarayonlarini optimallashtirish va bozor talablariga tezda javob berish imkoniyatini beradi.

Bundan tashqari, Assyst CAD dasturiy ta'minotining ko'p qirraliligi an'anaviy kiyim-kechak ishlab chiqarishdan tashqarida bo'lib, tikuv sanoatining turli ehtiyojlarini qondiradi. Maxsus kiyim-kechak, texnik to'qimachilik yoki maxsus kiyim bo'ladimi, Assyst CAD dasturi rivojlanayotgan bozor tendensiyalari va mijozlarning xohishlariga moslashish uchun moslashuvchanlikni ta'minlaydi [3].

Xulosa qilib aytadigan bo'lsak, Assyst CAD dasturining qabul qilinishi tikuv korxonalarining dizayn, naqsh va ishlab chiqarishga yondashish uslubidagi paradigma o'zgarishini anglatadi. Tikuvchilik korxonalari texnologiya kuchidan foydalangan holda samaradorlik, aniqlik va ijodkorlikning yangi darajalarini ochishi mumkin. Sanoat rivojlanishda davom etar ekan, Assyst CAD Dasturi birinchi o'rinda turadi va tikuvchilik korxonalariga raqobatbardosh bozorda muvaffaqiyat qozonish imkoniyatini beradi.

Adabiyotlar:

- [1]. F.U. Nigmatova M.SH. Shomansurova TIKUV BUYUMLARINI LOYIHALASHNING AVTOMATLASHTIRILGAN SISTEMASI Toshkent- 2017 «Extremum-press».
- [2]. Assyst. (n.d.). Assyst CAD Software. Retrieved from <https://www.assystbullmer.co.uk/products/cad/>
- [3]. Smith, J. (2022). The Impact of CAD Software on Sewing Enterprises. Journal of Textile Engineering and Fashion Technology, 8(2), 112-125.

QUYOSH SHAMOL KOMBINATSIYASI

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Maqolada O'zbekistonning chekka hududlarida, elektr energiyasi mummo joylarda, yozgi oshxonalarda, issiqlik ta'minotida qo'llasa bo'ladigan ko'p funktsiyali quyosh qurilmasini ishlab chiqish. Quyosh va shamol parragini kombinatsiyalash natijasida uzluksiz elektr energiya olish va yo'llardagi yoritish chiroqlarini qurilmamiz orqali ishlab chiqargan elektr energiya bilan ta'minlash hamda quyosh kollektorlari orqali suv isitish qurilmasini ishlab chiqish tavsiflangan.

Kalit so'zlar: Muqobil energiya, geotermal issiqlik, innovatsion qurilmalar, shamol parragi, quyosh paneli, kombinatsiya, ko'p funktsiyali quyosh qurilmasi, quyosh kollektorlari, shamol tezligi, quyosh nuri, elektr energiya, energiya tizimlari, sensor datchik, yoritish yo'llari.

В статье разрабатывается многофункциональное солнечное устройство, которое может быть использовано в отдаленных районах Узбекистана, в местах с дефицитом электроэнергии, в летних кухнях и для отопления. Описывается получение непрерывного электричества путем объединения солнечных и ветряных турбин и питание уличных фонарей электроэнергией, вырабатываемой нашим устройством, а также разработка устройства для нагрева воды с помощью солнечных коллекторов.

Ключевые слова: Альтернативная энергия, геотермальное тепло, инновационные устройства, лопасть ветра, солнечная панель, комбинация, многофункциональное солнечное устройство, солнечные коллекторы, скорость ветра, солнечный свет, электричество, энергетические системы, сенсорный датчик, пути освещения.

The article develops a multifunctional solar device that can be used in remote areas of Uzbekistan, in places with a shortage of electricity, in summer kitchens and for heating. It describes the generation of continuous electricity by combining solar and wind turbines and powering streetlights with electricity generated by our device, as well as the development of a device for heating water using solar collectors.

Key words: Alternative energy, geothermal heat, innovative devices, wind blade, solar panel, combination, multifunctional solar device, solar collectors, wind speed, sunlight, electricity, energy systems, touch sensor, lighting pathways.

Qayta tiklanadigan energiya vaqt o'tishi bilan tabiiy ravishda to'ldiriladigan, qayta tiklanadigan manbalardan to'plangan energiyadir. U quyosh nuri, shamol, suv harakati va geotermal issiqlik kabi manbalarni o'z ichiga oladi. Qayta tiklanadigan energiya ko'pincha elektr tarmog'i, havo va suvni isitish va sovutish hamda mustaqil ravishda ishlaydigan energiya tizimlariga elektr energiyasini ishlab chiqarish uchun energiya yaratib beradi.

Hozirgi kunda qayta tiklanadigan yoki noan'anaviy energiya manbalaridan foydalanish sohasida ko'plab texnologiyalar taklif etilganligi, ularni bimalol amalga oshirish mumkin. Ammo qayta tiklanadigan yoki noan'anaviy energiya manbalarining rad qilib bo'lmaydigan ustunliklari bilan bir qatorda u yer yuzida tarqoq ekanligi natijasida olinadigan quvvat uchun sarf-xarajat ham ortib boradi. Shu sababli, hozircha qayta tiklanadigan yoki noan'aviy energiya manbalari an'anaviy energiya manbalaridan foydalanish bilan raqobatlasha olmaydi. Ma'lumotlarga ko'ra, qayta tiklanadigan yoki noan'anaviy energiya manbalaridan foydalanish natijasida 2025 -yilga kelib 2.8 mlrd.tonna shartli yo'qilg'ini tejash mumkin. Qayta tiklanadigan energiyalarni rivojlantirishning asosiy yo'nalishlari quyidagilardan iborat:

- Bug' turbinali quyosh elektrostansiyalarini ishlab chiqarish va ishga tushirish;
- Quyosh kollektoridan foydalanish orqali turar joy binolari va davlat muassasalarini energiya bilan ta'minlash;
- Avtonom (iste'molchilar uchun fotoelektr) qurilmalarini loyihalash va ishlab chiqarish;
- Quyosh nuridan foydalanib sho'r suvlarni chuchuk suvga aylantirish;
- Quyosh energiyasidan foydalanib, qishda uylarni isitish va yoz oylarida sovitish;



1-rasm. Yangicha ko'rinishdagi shamol quyosh kombinatsiyasi.

smartlashtirilgan quyosh panelidan iborat. Quyosh paneli kunduzi quyosh nurlari orqali elektr energiya ishlab chiqaradi, havo oqimi yordamida qurilma parraklari harakatga keladi, generator

Hozirgi paytda dunyo malakatlarida yashil energetikaga oid yangi qurilmalar ishlab chiqilib, hayotga tadbqiq etilmoqda. Bularga: qo'shimcha ravishda elektr energiya olish, avtomobil o'tish yo'llarini yoritish, korxonalarni qo'shimcha elektr energiya bilan ta'minlash maqsadida quyosh qurilmalari va ularning smartlashtirilgan variantlari, shamol qurilmalari yoki shamol parraklari bilan quyosh panellarini kombinatsiyalash orqali ishlab chiqilgan qurilmalarni misol qilishimiz mumkin.

Chunki ushbu qurilmamiz shamol generatori, shamol parraklari va yuqori qismidagi

ishga tushadi. Kombinatsiyalash orqali ikkala energiyani birlashtiramiz. Qurilma kunduzi ishlab chiqargan elektr energiyani akkumulyatorlarga yig'ib olinadi va tunda yo'llarni yoritish uchun ishlatiladi.

Hozirgi paytda yo'llarni yoritishda va yo'llardagi, korxonalaridagi kuzatuv kameralarini ishga tushirishda iste'molimiz uchun mo'ljallangan energiya sarflanmoqda. Avtomobil yo'llarini va piyodalar o'tish yo'lakchalarini, yo'llardagi kuzatuv kameralarini kunning kechki qismida, ya'ni tungi paytlarda shamol generatorlari va quyosh panelimiz orqali kombinatsiyalangan qurilmamiz hosil qilingan energiya yordamida yo'llarni yoritishimiz mumkin bo'ladi, kuzatuv kameralarini ham uzluksiz ishlashini ta'minlaydi. Loyihamizning foydali tomonlari shundaki, energiyani hosil qilish yoritilishi kerak bo'lgan hududlarda amalga oshiriladi va buning natijasida yoritiladigan yo'llar asosiy energetik tizimda uzilish bo'lgan holatda ham uzluksiz ishlashda davom etadi. Muqobil energiya manbalari orqali elektr energiyaga bo'lgan talabni qisman kamaytira olamiz.

Qurilma afzalliklari: Ekologiya va atrof-muhitga turli xil zararli oqibatlar mavjud emas, qurilma ishlashi uchun hech qanday yoqilg'i turi va suv sarf qilmaydi, kunning kunduzgi va kechki paytida ham elektr energiya olish imkoniyati mavjud, qurilma quyosh paneli va shamol generatorlariga nisbatan arzonroq. Bitta 1345 wt (1.4 kwt) quvvatdagi elektr energiya ishlab chiqaradigan qurilma uchun 5 mln 226 ming sarflanmoqda.

Mahsulotimiz chet el raqobatchilaridan arzon narxdaligi bilan ustun. Chet elda huddi shunday quvvatdagi qurilmalar 5000 \$ ni tashkil etadi. Bizning qurilmamiz chet elniki bilan bimalol raqobatlasha oladi. Qurilmamizni Furqat tumani hududidagi shamol esish vaqtlari va shamol tezliklari asoslanib, hisob-kitoblarini qilib chiqdik.

1-jadval

Vahti	V(m/s)	η_T	η_e	L(m)	N(w)
Kunduzgi	9	0.3	0.85	0.8	240.9
Oqshomgi	12	0.3	0.85	0.8	571.1

$$N = \frac{\eta_T \cdot \eta_e \cdot \rho \cdot \pi L^2 \cdot V^3}{2}$$

η_T – Shamol turbinasining samaradorligi (0.25÷0.35)

η_e – Shamol generatori va konventiri samaradorligi (0.70÷0.85)

Hozirgi kunda Prezidentimiz tomonidan yashil energetika sohasiga katta e'tibor qaratilmoqda. Kombinatsiyalangan qurilmamiz orqali elektr energiyaga bo'lgan talabni kamaytirishga erishamiz. Respublikamizdagi barcha yoritish yo'laklarini qurilmamiz bilan ta'minlab, korxonalarga buyurtma asosida o'rnatib berib, energetik tizimda uzulish bo'lgan paytda uzluksiz elektr energiya bilan ta'minlashimiz mumkin.

Ushbu qurilmani ishlab chiqarsak, unga bo'lgan talab yuqori bo'lishi nazarda tutilmoqda. Agar mahsulotimiz sotilmay qolsa, bunga ham oldindan daromadli chora-tadbir ishlab chiqilgan. Chora-tadbirimiz qurilmalarimizdan foydalanib, mini elektr toki ishlab chiqaruvchi zonalarini tashkil etib, korxona yoki qo'shimcha elektr energiya talabi bor hududlarga elektr energiya ishlab chiqarib, aholiga yoki korxonalarga sotilayotgan narx miqdoriga tenglab sotib daromad olish.

Shuningdek, bu qurilmamizni aholi istiqomat qiladigan chekka hududlardagi xonadonlar uchun ham o'rnatib berishimiz mumkin. Ushbu qurilma ishlab chiqargan elektr energiyani qish mavsumida isitish uchun ham sarflash mumkin. Asosan qishki mavsumda elektr energiyada uzulishlar miqdori ortib ketadi. Bunda chekka hududlardagi aholi qishki mavsumning ko'p vaqtlarini elektr energiyasiz o'tkazishga majbur bo'ladi. Hozirgi kunda uylarimizni isitish uchun ham elektr energiyadan foydalanmoqdamiz, hamda elektr istish jihozlari orqali issiqlik ehtiyojimizni qondirishga to'g'ri kelmoqda. Bunday vaqtlarda yuklamalar ortib ketadi va elektr jihozlarimiz deyarli yaxshi ishlamaydi.

Chekka hududlardagi xonadonlarga qurilmamizni hajm va quvvat jihatdan kattaroq variantini o'rnatish orqali qishki mavsumda xonadonlarda elektr energiya uzulishi sodir bo'lgan

vaqtda qurilma ishlab chiqargan elektr energiyani xonadon tarmog'iga berish orqali elektr isitish jihozlarini ham uzluksiz elektr energiyasi bilan ta'minlashga erishamiz.

Xulosa qilib aytish mumkinki, xalqaro tajribani o'rganish va uni O'zbekiston sharoitlari bilan taqqoslash bugungi kunda barcha rivojlangan mamlakatlar va ayrim rivojlanayotgan mamlakatlar muqobil energetika sohasida strategiya va dasturlarni ishlab chiqib, joriy etayotganini ko'rsatmoqda. Ushbu mamlakatlarni muqobil energiyani joriy etishga undovchi asosiy omillar quyidagilardir: qayta tiklanmaydigan energiya resurslari etishmasligining ortishi; an'anaviy energiya manbalarini atom energiyasi bilan almashtirish xavfi yuqori; muqobil energiya manbalari uchun asbob-uskunalarining texnologik darajasini oshirish; O'zbekiston uchun quyosh elektr energetikasini rivojlantirish, shuningdek, quyosh energiyasiga boy va suv resurslariga boy mintaqada yirik to'g'onlar qurishning muqobil na'munasi sifatida ham muhim ahamiyatga ega.

Dunyo rivojlangan sari fan va texnologiya jadal ravishda o'sib boraveradi, yangiliklar, innovatsion g'oyalar shu bilan birgalikda rivojlanishdan to'xtamaydi. Yangidan-yangi g'oyalar, ma'lum bir muammolarga bo'lgan yechimlar orqali ishlab chiqarilgan qurilmalar ham to'xtab qolmaydi. Avvalo, bu ishlab chiqarilayotgan qurilmalar inson hayotidagi ma'lum bir qiyinchilikni bartaraf etishi, insonlarga manfaat keltirishi, davlatning rivojlanishiga o'zining xissasini qo'sha olishi kerak.

Adabiyotlar:

- [1]. Muxitdinov M., Ergashev S.F., Isakulov J.I. "Quyosh energiyasidan foydalanish". Toshkent, DTM. 1999.
- [2]. Jo'rayev T.D. Quyosh issiqlik qurilmalari. O'quv qo'llanma. - B.: "Dizayn-Press", 2012.
- [3]. T.Sh.Majidov. „No'anaviy va qayta tiklanuvchi energiya manbalari". Toshkent-2014.
- [4]. M.M.Mamadazimov, Sh.A.Egamberdiev Quyosh fizikasi// O'quv qo'llanma. O'zMU nashriyoti.1999.
- [5]. Kuchkarova D.T., Farg'ona mintaqasida ikkilamchi va qayta tiklanadigan energiya manbalaridan foydalanish.FarPI-Ilmiy texnik jurnal. №4, 2018 yil.

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**ИСПОЛЬЗОВАНИЕ НОВЫХ ПЕДАГОГИЧЕСКИХ ТЕХНОЛОГИЙ ДЛЯ
ПРОВЕДЕНИЯ ПРАКТИЧЕСКИХ ЗАНЯТИЙ ПО ИНФОРМАЦИОННЫМ
ТЕХНОЛОГИЯМ**

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Аннотация: Статья содержит описание современных педагогических технологий, применяемых на практических занятиях по информатике и ИКТ, таких как информационные, компьютерные, игровые технологии, учебный проект, работа в малых группах и других. Раскрывается их практическое применение и обоснованность использования данных технологий на уроках информатики и ИКТ. Предлагаемый материал адресован преподавателям ВУЗов, проводящих практические занятия по информатике и ИКТ и поможет им грамотно применять современные педагогические технологии на занятиях.

Ключевые слова: информационные технологии, новые педагогические технологии, работа в малых группах, мозговая атака, рефлексия, когнитивное мышление, ролевые игры, рефлексивный экран, рефлексивная мишень.

Аннотация: Maqolada axborot, kompyuter, o'yin texnologiyalari, o'quv loyihasi, kichik guruhlarda ishlash kabi informatika va AKT bo'yicha amaliy mashg'ulotlarda qo'llaniladigan zamonaviy pedagogik texnologiyalarning tavsifi keltirilgan. Ushbu texnologiyalarni kompyuter fanlari va AKT darslarida qo'llashning amaliy qo'llanilishi va haqiqiyliги oshkor etiladi. Tavsiya etilgan material kompyuter fanlari va AKT bo'yicha amaliy mashg'ulotlar olib boradigan universitet o'qituvchilariga qaratilgan va ularni darslarda zamonaviy pedagogik texnologiyalarni to'g'ri qo'llashga yordam beradi.

Kalit so'zlar: axborot texnologiyalari, yangi pedagogik texnologiyalar, kichik guruhlarda ishlash, aqliy hujum, aks ettirish, kognitiv fikrlash, rol o'ynash o'yinlari, aks etuvchi ekran, aks etuvchi maqsad.

Annotation: *The article contains a description of modern pedagogical technologies used in practical classes in computer science and ICT, such as information, computer, game technologies, educational project, work in small groups and others. Their practical application and the validity of the use of these technologies in computer science and ICT lessons are revealed. The proposed material is addressed to university teachers conducting practical classes in computer science and ICT and will help them competently apply modern pedagogical technologies in the classroom.*

Key words: *information technologies, new pedagogical technologies, work in small groups, brain attack, reflection, cognitive thinking, role-playing games, reflexive screen, and reflexive target.*

ВВЕДЕНИЕ

В период активных преобразований общества одной из важнейших задач является обновление системы высшего образования, создание высших учебных заведений, основанных на принципах гуманной педагогики, отвечающей запросам формирования разносторонне развитого, грамотного, творческого и инициативного специалиста, умеющего решать нестандартные задачи, возникающие в его профессиональной деятельности. Важную роль в решении этой задачи можно отвести использованию новых педагогических технологий.

Современные цели образования высших учебных заведений, различные варианты содержания образования, направленные на развитие познавательной активности студентов, привели во многом к возникновению новых организационных форм, средств и методов обучения. Активность учащихся, являющаяся следствием познавательного интереса, это серьезный показатель результативности и эффективности образовательного процесса и одновременно фактор его улучшения, потому что он мотивирует учащихся к развитию поисково-творческого подхода, самостоятельности, самообразованию. Основная задача образования заключается в улучшении его качества посредством индивидуализации, дифференциации, интенсивности процесса обучения, развития и воспитания, более полной удовлетворенности учащихся образовательными потребностями, касающимися новых технологий. Среди педагогических технологий наибольшее распространение получили следующие: здоровые берегающие технологии, информационные, игровые технологии, личностно-ориентированный подход, учебный проект [1, с. 89].

Последние годы новые информационные технологии прочно вошли в нашу педагогическую деятельность. Также наступило время активного использования новых педагогических технологий. Использование компьютеров, интерактивных досок, проекторов составляют лишь техническое обеспечение занятий, проводимых на основе новых педагогических технологий. Их применение увеличивает наглядность преподаваемого материала, способствуют эффективному запоминанию и полному пониманию темы занятий. А в преподавании информационных технологий без использования технических средств вообще невозможно обойтись [2. С.96].

Совместное использование технических средств и новых педагогических технологий актуально как при проведении лекционных, так и при проведении практических занятий по информатике. Но результаты исследования эффекта их совместного использования были мало исследованы. В этой работе авторы попытались оценить эффект использования нескольких новых педагогических технологий при изучении студентами курса информатики и информационных технологий.

Очень эффективным средством обучения явилась работа в малых группах. Преподаватель разбивал студентов на малые, числом три-четыре студента, группы и давал нестандартные задачи, например, решить в системе MS Excel задачи линейного программирования или составить программу на языке C++, имея эту программу, написанную на другом языке. Первые эксперименты с работой в малых группах были не очень удачными. Студенты не могли выдвигать идеи и реализовывать их на практике. Но через два-три занятия появлялся интерес, начинали выдвигаться идеи и предлагаться средства их реализации.

При сдаче вступительных тестов студенты, будучи абитуриентами, показывают результаты, имеющие большой разброс. Индивидуальный подход к каждому студенту является жизненной необходимостью. Этот метод обучения хорошо известен в традиционной педагогике. А в сочетании с новыми педагогическими технологиями он дает очень хорошие результаты. Так, студенты, плохо успевающие по информатике, получали задания «кластер» для определенных терминов. После двух-трех кластеров увеличивалась их наполняемость, создавались довольно неожиданные связи, следовательно, у отстающего студента начинало проявляться когнитивное мышление, развивались память, воображение и логические способности. Также хорошо работал метод мозговой атаки, заставляющий слабых студентов выдвигать идеи, порой довольно неожиданные, а иногда фантастические, для решения поставленной проблемы.

Полезными для изучения и запоминания новой информации оказалось упражнение по составлению слов, в которых буквы стоят не на своих местах. Например:

роамгарп	программа
роропета	оператор
килц	цикл
таказьуле	указатель
ловуйныс порероат	условный оператор

При изучении программирования на языках C++ или Pascal часто студенты теряются и не усваивают новый материал. Дело в том, что в этом случае недостаточно просто знать изучаемый материал, но необходимо его критически перерабатывать и нестандартно мыслить. Хорошие результаты при работе с программами давали такие технологии, как тренинговые ролевые технологии. Например, один студент исполняет роль программиста, другой – роль компьютера. «Программист» дает команды «Компьютеру» в виде операторов языка, а «Компьютер» показывает свою реакцию на поданные команды. Через некоторое время «Программист» и «Компьютер» меняются ролями.

Важнейшую роль в процессе обучения играет рефлексия. Преподаватель обязан знать, насколько полно студент освоил материал, был ли к нему проявлен интерес, были ли трудности при его осмыслении, насколько эффективна была работа самого преподавателя.

Приемов рефлексии множество. Здесь мы не будем перечислять их все и объяснять, в чем заключается тот или иной прием. Из них мы выбрали такие, как «слова», «рефлексивный экран» и «рефлексивная мишень». Эти способы рефлексии позволяют быстрее всего оценить качество проведенного занятия и его недостатки, для того, чтоб при проведении следующих занятий исправить определенные путем рефлексии недостатки.

ВЫВОДЫ

Для выбора необходимой педагогической технологии нужно сначала перестроить стереотипы традиционных методов преподавания. При проведении занятий необходимо понять обучающегося, принять обучающегося, признать обучающегося как субъекта процесса обучения и подобрать образовательные технологии, учитывая состав институтской группы, тему и подбор дидактического материала, не забывая о желаемых результатах.

Самым продуктивным и оптимальным для решения учебных, педагогических и воспитательных задач урока является использование активных методов обучения, поэтому так актуальны сегодня современные образовательные технологии, которые направлены на организацию деятельности обучающихся, на развитие через эту деятельность их умений, качеств, компетенции для активного использования в современном информационном пространстве. Преподаватель применяет больше активизирующих методов обучения вместо изложения абстрактной, «готовой» информации. Формы работы должны захватывать студентов, пробуждать в них интерес и мотивацию, обучать самостоятельному мышлению и действиям.

При проведении занятий по ИКТ повышается уровень общей информационной культуры студентов и будущего общества в целом, воспитывается стереотип мышления: “Нужно узнать – посмотри на компьютере, спроси у Яндексa”.

Таким образом, если использовать разнообразные педагогические технологии и методики на проводимых занятиях (в частности информатики), то обучающиеся будут иметь необходимые знания, умения и навыки, адаптационные, мыслительные и коммуникативные способности, а также владеть способами работы с информацией:

- ✓ собирать необходимые для решения имеющихся проблем факты,
- ✓ анализировать их, предлагать гипотезы решения проблем,
- ✓ обобщать факты, сопоставлять решения, устанавливать статистические закономерности, аргументировать свои выводы и применять их для решения новых проблем, применять современные средства получения, хранения, преобразования информации и др.

Список литературы

- [1]. Левитес Д.Г. Практика обучения: современные образовательные технологии. – Мурманск, 2017. – 215 с.
- [2]. “Новые педагогические и информационные технологии в системе образования”, Москва, АCADEMA, 2020 г.
- [3]. «Новые педагогические и информационные технологии в системе образования». Е.С.Полат. «Академия», М., 2018 г.
- [4]. Современные педагогические технологии: О.И. Мезенцева; под. ред. Е.В. Кузнецовой; Куйб. фил. Новосиб. гос. пед. ун-та. – Новосибирск: ООО «Немо Пресс», 2019 г.
- [5]. <https://multiurok.ru/blog/>

O‘RTA TOLALI G‘O‘ZA NAVINI EKISH UCHUN TUPROQ TARKIBIDAGI MIKRO VA MAKRO ELEMENTLARNI O‘RGANISH

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Annotatsiya: o‘rta tolali g‘o‘za navini ekish uchun qanday mikro va makro elementlarini o‘rganish. Makro va mikro elementlar tuproqqa qanday ijobiy ta‘sir ko‘rsatishidan iborat.

Kalit so‘zlar: o‘rta tola, mikro element, makro element, nav, tuproq, g‘o‘za .

Аннотация: исследование микро и макроэлементов для посева средневолокнистого хлопчатника. Как макро и микроэлементы положительно влияют на почву.

Ключевые слова: средневолокнистость, микроэлемент, макроэлемент, сорт, почва, хлопок.

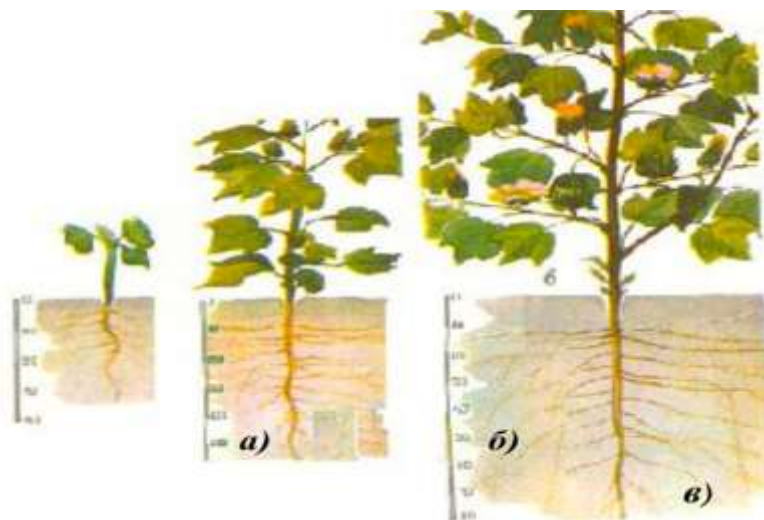
Abstract: study of micro and macro elements for planting medium fiber cotton. How macro and micro elements have a positive effect on the soil.

Key words: medium fiber, micro element, macro element, variety, soil, cotton.

G‘o‘za o‘simligining 37 turi bo‘lib juda ham ko‘p turi va navlari shakllangan. Bu turlarining hammasi GOSSIPIUM (gosypium) deyiladi. G‘o‘zaning batanik avlodi gulgayridoshlar oilasiga mansub bo‘lib kanop, bo‘ritaroq, tugmachagul, xitoy atirguli ham shu oilaga misol bo‘la oladi.

G‘o‘za navlarining yovvoyi turlari va shakllari uzoq yashashi er tanlamas- ligi, qurg‘oqchilikka chidamliligi, monopodial shoxlanganligi, hosil shoxlari sust rivojlanganligi, ko‘saklari juda mayda bo‘lishi, chigitning po‘sti «toshdek qattiq» bo‘lishi, qo‘ng‘ir rangli siyrak tuk bilan qoplanganligi tufayli hozir ekiladigan navlardan farq qiladi. Ularning deyarli hammasi

fotopermodik xususiyatiga ega bo'lib, normal gullashi va ko'sagi etilishi uchun yorug' kun qisqa bo'lishini talab qiladi. Ular orasida qator qimmatli belgilarni - kasallik va zararkunandalarga, vertisilloyoz va fuzorioz viltga, bakterioz, ildiz chirishga qarshi immunitetni, past xaroratga va turlanishga chidamlilikni o'zida mujassamlashtirgan shakllar ko'p. Ayrim turlar juda serhosil, ertapishar, ipaksimon, tolasi pishiq, yaltiroq bo'ladi (1).

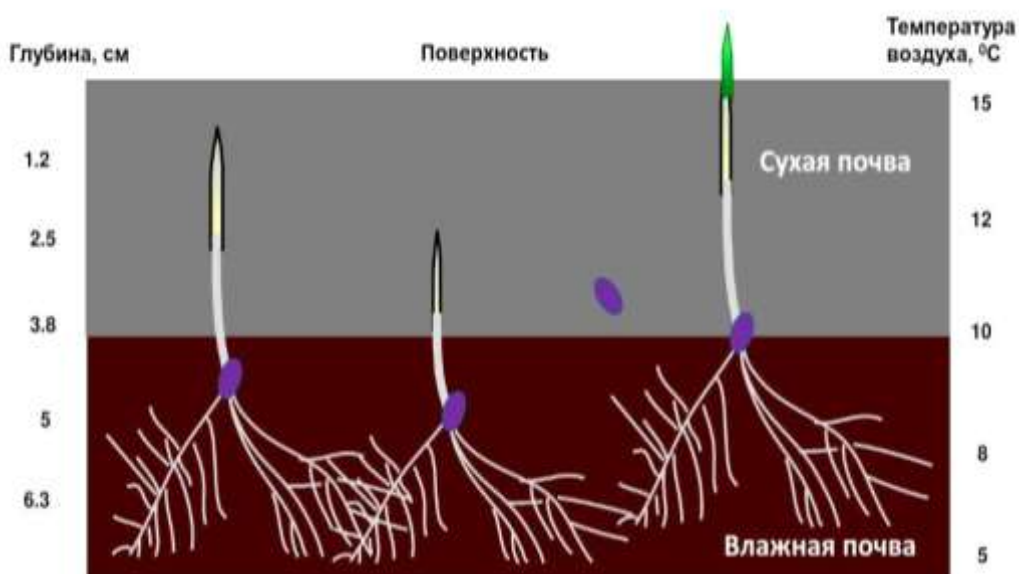


1-rasm. G'o'zaning rivojlanish davrlari a - birinchi xaqiqiy barg paydo bo'lish davri;
b - butonizasiya davri; v - gul ochilish davri.

G'o'za o'simligi ma'lumki azot, kaliy fosfor kabi oziqa moddalariga juda ham talabchan bo'ladi Tajribalar natijalariga ko'ra g'o'za o'sishi davrida turli xil vaqtda, turlicha ozuqa olishi ma'lum bo'lgan. Bunda g'o'za o'simligining moddalarga to'yinganligini aniqlab, unga o'sish davrida qulay va yetarli darajada sharoit qilinishi talab etiladi. Bunday oziqa moddalarini eng kop talab qiladigan davri gullash va ko'saklarining pisha boshlashi, ya'ni eng jadal o'sadigan paytiga to'g'ri keladi. O'rta tolali go'za navlari

paxta xosilining har bir tonnasi hisobiga tuproqdan 50-60 kilogramm azot, undan bir oz ko'proq kaliy va 12-20 kilogramm fosfor oladi. Vegetatsiya davri 110-145 kun davom etadi [2].

Mineral moddalar miqdoriga qarab 2 xil: mikro va makro elementlarga bo'linadi. Makro elementlar-o'simliklarni yashashi uchun juda ham zarur mineral moddalar, ular mikro elementga qaraganda ko'proq uchraydi. Tabiatda kamdan kam uchraydigan, o'simliklar ham kam talab qiladigan lekin ular hayotda juda muhim ahamiyatga ega bo'lgan elementlar mikro elementlar deyiladi. Mikroelementlarga B, Mn, Cu, Mo, Zn va So kabi elementlar kiradi. Tarkibida o'simliklarning oziqlanishi uchun zarur mikroelementlarni saqlaydigan o'g'itlar mikroo'g'itlar deyiladi [3].



2-rasm. Ekish chuqurligi va chigit unib chiqishi.

Ekish sxemasi

90 x 10 x 1	= 111111
90x12x1	= 92592
60x15x1	= 111 111
60x30x12x1	= 185 184

tavsiya etilgan ko'chat qalinligi

O'tloqi va o'tloqi bo'z tuproqlarga 90 000 -100 000

Tipik bo'z tuproqlarga 100 000 -120 000

Unumdorligi past bo'lgan yerlarga 120 000 -160 000

Qo'shqatorlab ekilgan maydonlarga 180 000 -220 000

Xulosa: o'simliklar o'zining rivojlanishi rivojlanishi va oziqlanishi bilan bir biridan farqlanish xususiyatiga ega. Xulosa qilib aytganda nikro va mikro elementlari tuproq uchun zarurligi hamda ularda turli xil o'simliklar uchun har xil taqsimlanishi o'simlikning yaxshi o'sib rivojlanishiga ta'sirini aniqlash mumkin. Bundan tashqari har bir o'simlik uchun har xil miqdordagi moddalar qo'shilganda ularga ozuqa bo'lishi va yaxshi o'sishi aniqlash mumkin. Yerni o'z vaqtida ekishga tayyorlash mo'l va erta hosil yetishtirilishida hamda yerdan samarali foydalanish asosiy shartlardan biri ekan. G'o'zapoyalarni yetishtirish ishlari g'o'za hosilini yeg'ib terib olish ishlari oktabr oyining oxiri va noyabr oyining boshlarida yeg'ilishi mumkin ekan. Chigit asosan tep-tekis maydonlarga ekiladi. Ayni paytda yogongarchilik kam bolgan viloyatlarda (tumanlarda) marza surib ham ekiladi buning uchun yerni koklamda tirmalash (boronalash) va malalashdan song chigit ekishga 10-12 kun qolganda balandligi 16-18 sm bolgan marza olinadi. Tuproq quruq bo'lsa, agatlar suv quyulib maarzaning uchdan ikki qismi namlanguncha oqizilar ekan. Tuproq etilganda marzaning ustki quruqqismi ekish vaqtida surib tashlanadiva chigit nam tuproqqa ekiladi.

Adabiyotlar

- [1]. Musayev.B.S. O'g'it qo'llash tizimi (o'quv qo'llanma), T:1998.
- [2]. Agrokimyo.ma'ruza matnlari. T: 1999
- [3]. Musayev.B.S. Agrokimyo.T."Sharq".2001y.
- [4]. S.A.Abdullayev,X.K.Nomozov. "Tuproq melioratsiyasi"(Darslik)
- [5]. Paxta va uning agroteknikasi (o'quv qo'llanma)(1-2-3)(9-31 betlar)
- [6]. Ubaydullaev, M. M. (2022). YANGI DEFOLIANTLAR HOSILDORLIK GAROVI. Архив научных исследований, 2(1).
- [7]. Mo'minjonovich, U. M. (2022). Effectiveness Of Defoliants. Eurasian Research Bulletin, 8, 9-12.
- [8]. Mominjonovich, U. M., & Ogli, M. I. V. (2022). STUDY AND ANALYSIS OF TECHNOLOGICAL PROCESSES OF COTTON DRYING IN A CLUSTER SYSTEM. International Journal of Advance Scientific Research, 2(11), 6-10.
- [9]. Ubaydullaev, M. M., & UT, T. (2022). DETERMINATION OF APPROPRIATE NORMS AND TERMS OF DEFOLIANTS. American Journal Of Applied Science And Technology, 2(05), 18-22.
- [10]. Ubaydullaev, M. M., & Makhmudova, G. O. (2022). MEDIUM FIBER S-8290 AND S-6775 COTTON AGROTECHNICS OF SOWING VARIETIES. European International Journal of Multidisciplinary Research and Management Studies, 2(05), 49-54.
- [11]. Ubaydullaev, M. M., & Komilov, J. N. (2022). EFFECT OF DEFOLIANTS FOR MEDIUM FIBER COTTON. International Journal of Advance Scientific Research, 2(05), 1-5.
- [12]. Ubaydullaev, M. M., & Mahmutaliyev, I. V. (2022). EFFECTIVENESS OF FOREIGN AND LOCAL DEFOLIANTS ON THE OPENING OF CUPS. International Journal of Advance Scientific Research, 2(05), 6-12.
- [13]. 12.Ubaydullaev, M. M., & Sultonov, S. T. (2022). DEFOLIATION IS AN IMPORTANT MEASURE. European International Journal of Multidisciplinary Research and Management Studies, 2(05), 44-48.
- [14]. 13.Ubaydullaev, M. M., & Nishonov, I. A. (2022). The Benefits of Defoliation. Eurasian Journal of Engineering and Technology, 6, 102-105.

TEACHING ACTIVITIES OF GENDER TERMINOLOGY IN ENGLISH FOR THE ESP STUDENTS

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Annotatsiya: Ushbu maqolada gender terminologiyasini nofilologik yo`nalish talabalariga o`qitilishda foydalaniladigan mashqlar, usullar, metodlar tahlil qilingan bo`lib, ularning ahamiyati va foydalanish usullari ko`rsatib o`tilgan.

Kalit so`zlar: interfaol muhokamalar, lug'atni rivojlantirish mashqlari, haqiqiy materiallar, sezgirlik, til registrari.

Аннотация: В данной статье анализируются упражнения, приемы и приемы, используемые при обучении гендерной терминологии студентам-нефилологам, показывается их значение и способы использования.

Ключевые слова: интерактивные обсуждения, упражнения по расширению словарного запаса, аутентичные материалы, чувствительность, языковой регистр.

Annotation: This article analyzes the exercises, techniques and techniques used in teaching gender terminology to non-philology students, showing their meaning and methods of use.

Key words: interactive discussions, vocabulary building exercises, authentic materials, sensitivity, language register

INTRODUCTION:

In today's diverse and inclusive society, it is imperative for English for Specific Purposes (ESP) instructors to equip their students with the knowledge and understanding of gender terminology. As language learners, ESP students need to be aware of the nuances and sensitivities associated with gender, especially when communicating in professional contexts. This article presents a collection of engaging teaching activities to facilitate the effective learning and application of gender terminology among ESP students.

1. Interactive Discussions:

Engage students in interactive discussions to promote critical thinking and exploration of gender-related topics. Create a safe and inclusive environment where students can openly express their opinions and share cultural perspectives. Encourage students to discuss gender roles, stereotypes, and the impact of gender on various professions. This activity will enable students to develop a deeper understanding of the complexities surrounding gender.

2. Vocabulary Building Exercises:

Introduce gender-related vocabulary through interactive exercises. Provide students with word lists and ask them to categorize terms as gender-neutral, masculine, or feminine. Encourage them to create sentences using the vocabulary, focusing on context and appropriate usage. This activity will help students expand their vocabulary and develop familiarity with gender-specific terms.

3. Role-Play Scenarios:

Organize role-play scenarios that simulate real-life professional situations. Assign students different roles and provide them with specific gender-related scenarios. For example, a job interview where gender biases might come into play. Ask students to act out the scenarios and encourage them to respond appropriately, addressing any gender-related challenges that may arise. This activity will enhance students' communication skills while promoting a nuanced understanding of gender dynamics in professional contexts.

4. Analyzing Authentic Materials:

Select authentic materials, such as newspaper articles, case studies, or reports, that explore gender-related issues in specific industries or professions. Ask students to critically analyze these materials and identify instances where gender terminology is used. Encourage them to reflect on the impact of such language choices on the overall message or perception of the content. This activity will enable students to develop a keen eye for recognizing gender terminology in real-world contexts.

5. Guest Speaker Sessions:

Invite guest speakers from diverse professional backgrounds to share their experiences and insights regarding gender in their respective fields. Encourage students to engage in open discussions and ask questions related to gender equality, inclusivity, and the use of gender terminology in the workplace. This activity will provide students with valuable perspectives and practical knowledge, enabling them to navigate gender-related challenges in their future careers.

6. Collaborative Projects:

Assign collaborative projects that require students to research and present on gender-related topics within their specific industry or field of study. This could involve creating informative brochures, designing awareness campaigns, or developing presentations on gender diversity in the workplace. Encourage students to use proper gender terminology while highlighting the importance of inclusive language. This activity will foster teamwork, research skills, and the application of gender terminology in a practical context.

Additional points to consider when teaching gender terminology to ESP students:

1. Sensitivity and Cultural Awareness: When discussing gender-related topics, it is essential to create a sensitive and culturally aware learning environment. Acknowledge and respect the diversity of perspectives and cultural norms surrounding gender in different countries and professional contexts. Encourage open dialogue while emphasizing the importance of empathy and respect for individuals' experiences and identities.

2. Language Register: Teach students about appropriate language registers when discussing gender-related topics. Help them understand the differences between formal and informal language use, as well as the importance of using inclusive and respectful language in professional settings. Provide examples of common gender-related terms and guide students on when and how to use them appropriately.

3. Pronoun Usage: Pronouns play a significant role in gender terminology. Teach students about different pronoun options, including he/him, she/her, and they/them, as well as the importance of respecting individuals' preferred pronouns. Discuss the concept of gender-neutral pronouns and their growing acceptance in various professional contexts.

4. Legal and Ethical Considerations: Familiarize students with legal and ethical considerations related to gender terminology and diversity in the workplace. Discuss anti-discrimination laws, policies, and guidelines that protect individuals from gender-based biases and prejudices. This knowledge will help students understand the importance of inclusive language and behavior within professional settings.

5. Language Evolution: Emphasize that language, including gender terminology, is continually evolving. Discuss how societal shifts and changing attitudes influence language use, and encourage students to stay updated on emerging trends and developments. This awareness will help them adapt their communication skills in an ever-changing professional landscape.

6. Reflection and Self-Assessment: Encourage students to reflect on their own biases and assumptions regarding gender. Provide reflective activities where students can critically analyze their own beliefs and attitudes towards gender-related issues. Help them recognize and challenge stereotypes or preconceived notions they may hold, fostering a more inclusive mindset.

7. Guest Experts and Field Visits: Whenever possible, arrange for guest experts or industry professionals to share their experiences and insights on gender-related issues. Field visits to organizations or businesses that prioritize diversity and inclusivity can provide students with firsthand exposure to inclusive workplace environments. These experiences can deepen their understanding of gender terminology in practical contexts.

By incorporating these additional aspects into your teaching approach, you can facilitate a comprehensive and enlightening learning experience for ESP students, equipping them with the necessary knowledge and skills to navigate gender-related challenges in their professional lives effectively.

CONCLUSION:

Teaching gender terminology to ESP students is crucial in preparing them for effective communication in professional settings. By incorporating interactive discussions, vocabulary building exercises, role-play scenarios, analysis of authentic materials, guest speaker sessions, and collaborative projects, instructors can create engaging learning experiences. These activities will empower ESP students to navigate gender-related issues confidently, promote inclusivity, and communicate effectively in their future careers while embracing diversity.

References

- [1]. "Teaching Gender Across the Curriculum" by James Davis and Elizabeth Evans
- [2]. "Gender and Education: An Encyclopedia" edited by Barbara J. Bank
- [3]. "Gender and Language: Theory and Practice" by Lia Litosseliti
- [4]. "Gender and Education: An Introduction" by David Baker
- [5]. "Gender and International Migration in Europe: Employment, Welfare, and Politics" edited by Francesca Scrinzi and Anna Amelina
- [6]. "Gender and the Language Classroom" by Sue Garton and Fiona Copland
- [7]. "Gender and Development" by Janet Momsen
- [8]. "Teaching Gender: Feminist Pedagogy and Responsibility in Times of Political Crisis" edited by Nancy Lesko and Susan Talburt
- [9]. "Gender and English Language Learners" by Bonny Norton and Kelleen Toohey
- [10]. "Teaching Gender and Sexuality at the University: A Critical Pedagogy" edited by Kristine De Welde and Andi Stepnick
- [11]. Muminova, E., Honkeldiyeva, G., Kurpayanidi, K., Akhunova, S., & Hamdamova, S. (2020). Features of Introducing Blockchain Technology in Digital Economy Developing Conditions in Uzbekistan. In *E3S Web of Conferences* (pp. 04023-04023).
- [12]. Numonjohnovna, Ergasheva Nargiza, Khamdamova Sevara Oybekovna, and Bobokhujaev Bokhodirjohn Boqirjohn Ugli. "Paralinguistic features of the written language: problems of classification." *Проблемы современной науки и образования* 12-2 (145) (2019): 116-118.
- [13]. Ergasheva N. N., Khamdamova S. O., Toshmatova N. A. DEVELOPMENT OF THE COMMUNICATIVE COMPETENCE OF STUDENTS AT THE LESSONS OF THE ENGLISH LANGUAGE IN NON-PHILOLOGICAL HIGHER EDUCATIONAL INSTITUTIONS //Вестник науки и образования. – 2019. – №. 19-2. – С. 66-68.
- [14]. Хамдамова С. О. Эффективность использования мультимедиа и гипермедиа на занятиях английского языка //Вопросы науки и образования. – 2018. – №. 8 (20). – С. 89-91.
- [15]. qizi Hamdamova S. O. et al. GENDER'S IMPACT ON THE ACHIEVEMENTS IN THE PROCESS OF LEARNING THE ENGLISH LANGUAGE AS A FOREIGN LANGUAGE //Scientific Bulletin of Namangan State University. – 2021. – Т. 2. – №. 2. – С. 415-418.
- [16]. Qizi K. S. O. Teaching Gender-Sensitive Language And Gender-Biased Terminology //The American Journal of Social Science and Education Innovations. – 2021. – Т. 3. – №. 09. – С. 28-33.
- [17]. Kasimova G. M., Hamdamova S. O. GENDER TERMINOLOGY. SUGGESTED WAYS OF TEACHING AND NEEDS OF GENDER TERMINOLOGY //PEDAGOGS jurnalı. – 2023. – Т. 35. – №. 2. – С. 123-127.
- [18]. Hamdamova S. O. Q. Gender tushunchasi va uning asosiy mohiyati //Oriental renaissance: Innovative, educational, natural and social sciences. – 2022. – Т. 2. – №. Special Issue 20. – С. 714-717.
- [19]. Hamdamova S. O., Negbaxtov S. Y. TEACHING ENGLISH THROUGH DIGITAL EDUCATION //Fergana state university conference. – 2023. – С. 29-29.
- [20]. ХАМДАМОВА С. О. ГЕНДЕР. ОБРАЗОВАНИЕ. ТРАНСФОРМАЦИЯ //ЭКОНОМИКА. – С. 999-1002.

ISLOM OLAMINING SAXOVAT GAVHARI

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Annotasiya: Maqolada xalifa Umar ibn Xattobning ijtimoiy-madaniy sohada qilgan buyuk ishlari haqida so'z boradi.

Kalit so'zlar: "ABU XAFS", "FORUQ", nafaqa, fatx, ilm, ijtimoiy ta'minot, yosh bolalarning ijtimoiy ta'minoti, Yaman, obodonchilik, pochta xizmati.

Аннотация: В статье говорится о великих делах халифа Умара ибн Хаттаба в социальной и культурной сфере.

Ключевые слова: «АБУ ХАФС», «ФОРУК», пособие, фатх, наука, социальное обеспечение, социальное обеспечение детей раннего возраста, Йемен, развитие, почтовая служба.

Abstract: The article talks about the great deeds of Caliph Umar ibn Khattab in the social and cultural sphere.

Key words: "ABU HAFS", "FOROUK", manual, fatx, science, social security, social security for young children, Yemen, development, postal service.

Islom olamida o'z saxovatpeshaligi bilan mashhur va aziz bo'lgan, shuningdek payg'ambarimiz Muhammad sollallohu alayhi vasallam tomonlaridan "Abu Xafs, "Foruq" degan laqab tariflarni olgan payg'ambarimiz tushlarida qo'llaridan sut ichish nasib etgan inson buyuk xalifa Umar ibn Xattobdir.

Biz barchamiz islom diniga e'tiqod qiluvchi mo'min musulmon bandalarimiz. Albatta dinimiz buyurgan ishlarni, farz amallarni ado etish bilan bir qatorda bir necha asrlar avval dinimiz uchun yonib kuyib harakat qilgan islom olami saxovat gavhariga aylangan inson haqida ham xotirlamog'imiz lozim. O'zining saxovatpeshaligi kuchli, dovyrakligi shu bilan bir qatorda ilm-ma'rifatga yuqori nazar qaratgan inson ekanligi bilan islom olami tarixida buyuk sanaluvchi Umar ibn Xattob raziyallohu ning to'liq ismlari Umar ibn Xattob ibn Nufayl ibn Abdul'uzzo ibn Riyox ibn Abdulloh ibni Qurt ibn Razox ibn Adiy Ibn Ka'b ibn Luay Qurashiy Adaviydir. Umar Ibn Xattob (r.a.) kuchli va shiddatli bo'lganliklari uchun payg'ambar sallohu alayhi vasallam u kishiga "ABU XAFS" "SHER" degan kunya berganlar. Otalari Xattob ibn Nufayl. Onalari Xantama Maxzumiya.

Hazrati Umar (r.a.) ning tinchlik jabhasidagi olamshumul ishlari

Hazrati Umar (r.a.) ning musulmonlar xalifasi, ularning bosh rahbari sifatida olib borgan faoliyatlari namozga o'tish, uzoqdan turib shimol tarafdin kelayotgan fatx ishlarini boshqarishdangina iborat bo'lmagan. U kishining maqsadlari qur'oni karim va rasululloh sallallohu alayhi vasallamning sunnatlari shariat ahkomlari asosida dunyodagi eng mukammal hayotning barcha sohalarida eng namunali jamiyat qurishni ta'minlash ham edi. Mana shu maqsadga erishish yo'lida u kishi har taraflama va serqirra faoliyat olib boradilar. Milodiy 20 asrning oxirlarida g'ayri musulmon mutaxassislar tomonidan insoniyat tarixida jamiyatlarga eng ko'p foyda keltirgan shaxslarning ism shariflaridan tuzilgan ro'yxatning 4- o'rnida Umar (r.a.) ning ismlari keltirilganligi ham fikrimizning yorqin dalilidir. Quyida hazrati Umar (r.a.) ning olamshumul faoliyatlaridan ba'zi namunalarni qisqacha keltirib o'tishga harakat qilamiz

Kambag'al oilalarning ijtimoiy ta'minoti

Bugungi kundagi eng xayrli ish albatta kambag'al, nochor, qiynalganlarga yordam berish sanalmoqda. Bu ishlarga ham asos solib bergan inson sifatida Umar ibn Xattob (r.a) ni ko'rsatish mumkin. Ibn Sa'd Ja'far ibn Muxammad roziallohu anhudan u zot esa o'z otalaridan rivoyat qiladi: "Umar (r.a) ga Yamandan kiyimlar keltirishdi. U kishi ularni odamlarga tarqatdi. Hamma yangi kiyim kiyib yura boshladi.

Umar (r.a) payg'ambar sallallohu alayhi vasallamning qabrlari va minbarlari orasida o'tirar, odamlar esa uning oldiga kelib salom berishar va xaqiga duo qilishar edi. Bir kuni u yerga Hasan va Husayin

keldi. Ularning egnida kecha tarqatilgan kiyimlar yo'q edi. Ularning qovoqlari osilib ikki qoshi orasida tugun paydo bo'ldi. So'ng " Allohga qasamki sizlarga bergan narsam menga tatamadi "- dedi.

Odamlar " ey mo'minlarning amiri qavmingizga kiyim kiydirib yaxshi qildingizku deyishdi.

Shunda Umar men mana bu ikki bolani aytyapman. Odamlarning orasidan o'tib ketishyapti egnilarida esa hech narsa yo'q. Kiyimlar ularga katta kelibdi yoki ular kiyimlarga kichik kelishdi dedi.

So'ng Yamanga tezda Xasan bilan Xusaynga kiyim bosh yuboringlar deb maktub yozdi. U yerdan ikkisiga kiyim yuborishdi. Umar ularni ikkovlariga berdi. Siz - u biz esa kichik ehsonni qilib qo'yib "Dargohida qabul bo'ldi endi men saxovat peshaman"deya mag'lublanib yurishdan avval saxovatini barcha egasiga yetib borishigacha nazorat qilgan inson haqida ham biroz o'ylashimiz lozim.

Yosh bolalarning ijtimoiy ta'minoti

Islom ahli poytaxti bo'lmish Madinai-Munavara shahriga savdogarlar karvoni kelib tushdi. Bir kuni tunda Umar, yosh bolaning yig'ishini eshitib o'sha tomon bordilar va uning onasiga "Allohdan qo'rq bolangga yaxshi qara " deb orqalariga qaytdilar va uch-to'rt marta bola yig'ilishidan to'xtamagandan so'ng qayta-qayta kelib Allohdan qo'rq bolanga yaxshilik qil " deya onaga uqtira ketdi. Ona esa qarshisida turgan odam rahbar ekanini bilmagan holda, xuddi qorovulga gapirayotganday "ey Allohning bandasi kechasi bilan meni tinch qo'ymading axir men uni ko'krakdan ajratmoqchiman u bo'lsa ko'nmay injiqlik qilyapti"; dedi.

" Nima uchun" deb so'radilar Umar (r.a).

"Chunki Umar faqat ko'krakdan ajratilgan bolalarga nafaqa tayin qilgan " dedi ayol.

" Bolaning yoshi qanchalik bo'ldi" dedilar.

"Falon oylik bo'ldi " dedi ayol.

Umar (r.a) uni ko'krakdan ajratishga shoshilma dedilar va orqalariga qaytib ketdilar.

So'ng xalifa borib bomdod namoziga imomlikka o'tdi. Namozdagi odamlar uning yig'isidan qiroatini ajrata olishmadi. Bo'lib o'tgan hodisadan qattiq ta'sirlangan xalifa yig'lab turib namoz o'qir edi. Salom bergandan so'ng "Umarning sho'ri qursin musulmonlarning qanchadan qancha bolalariga zulm qilibdi " dedi va jarchini chorlab " Bolalaringizni ko'krakdan ajratishga shoshilmanglar biz islomda har bir tug'ilgan bolaga nafaqa beramiz " - deb jar solishga amir etdilar bu haqida boshqa yurtlarga ham farmoni yubordilar.

Umar (r.a) ko'krakdan ajratilgan bolalarga nafaqa ajratishdek xayrli ishni qilib so'ng esa ko'krakdan ajratilmaganlariga bermagani uchun pushaymon bo'lib yig'lab namoz o'qigan inson edi. Mana shu kabilar bois ham Umar (r.a) ni islom olamining sahovat gavhari deya ta'riflab o'tdik.

Qarilik nafaqasini joriy qilish

O'zbekiston Respublikasining amaldagi konstitutsiyasi 46 moddasiga binoan "Har kim qaraganda mehnat qobiliyatini yo'qotganda ishsizlikda shuningdek boquvchisini yo'qotganda va qonunda nazarda tutilgan boshqa hollarda ijtimoiy ta'minot huquqiga ega. Qonunda belgilangan pensiyalar nafaqalar va boshqa turdagi ijtimoiy yordam miqdorlari rasman belgilangan eng kam iste'mol xarajatlaridan oz bo'lishi mumkin emas"

Ushbu turdagi ish faqatgina O'zbekiston Respublikasi hududida emas barcha demokratik davlatlar inson manfaati uchun xayrli yo'lda faoliyat yurituvchi davlatlarda bosh omil hisoblanadi va bu omilning, hayotimizning bir bo'lagining asoschisi, deya Umar (r.a) keltirib o'tish mumkin.

Imom Abu Ubaydaning " Al Amvol " kitobida quyidagilar keltirilgan.

" Mo'minlar amiri Umar ibn Xattob ko'chada tianib yurgan yahudiy cholni ko'rib qolib uni chaqirdilar agar sendan yoshligingda jiiziyani olib qaraganingda tashlab qo'ysak senga nisbatan insof qilmagan bo'libmiz " deydilar va unga baytulmoldan keragicha ta'minot joriy qildilar. O'sha paytda musulmonlar jamiyatidan boshqa biron jamiyatda qariyalarga xususan g'ayridin qariyalarga nafaqa berilgani haqida ma'lumot bormi? Bu ishni birinchi bo'lib Umar ibn Xattob joriy qildilar.

Ofatga uchraganlarga yordam uyushtirish

2002 yil 6 may mamlakatimiz uchun juda ham qayg'uli kun. Sardoba suv ombori o'pirilishi natijasida 10 minglab oilalar uysiz qold, hovli joylar vayron bo'ldi. Bu borada esa ofatga uchragan insonlarga mamlakatimiz tomonidan juda ham ulkan xayr ehson yordam ishlari amalga oshirildi.

Xususan saxovatpesha insonlar va boshqa mamlakatlar tomonidan ham yordamlar yuborildi. Bundayin ofatga uchragan insonlarga yordam berish ishlarini ham Umar ibn Xattob boshlab bergan.

Hijriy 17 yil. Islom tarixida "RAMADO" ochlik yili nomi ila mashhurdir. O'sha yili qattiq qahatchilik ochlik hukm surgan. Ana shunda hazrati Umar aholini halokatdan saqlab qolish uchun katta tadbirkorlik va fidokoblik ko'rsatganlar. Ofatga uchragan insonlarga yordamlar uyushtirganlar. Biz hozir vijdonan o'ylab ko'raylik, xalqqa yurtga ochlik kelsa avval o'z qornimizni o'ylaymiz albatta. Lekin Umar o'zi va oilasi och qolgan taqdirda ham yurtni tashlab qo'ymaydi. Ibn Sa'd Firos Daylamiydan rivoyat qilinadi.

"Umar ibn Xattob (r.a.) har kecha dasturxoni uchun yuborilgan tuyalaridan 20 tasini so'yib tarqatar edilar".

Ramadon ochlik oyidagi Umar (r.a) ning ishlarini yana ko'plab sanashlik mumkin.

Yuqorida keltirilgan misollar orqali yana bir bor islom olamining sahovat gavhariga tariflar bera oldik desak mubolag'a bo'lmaydi.

Hazrati Umar raziyollohning ijtimoiy-madaniy sohada qilgan buyuk ishlari

1. Xalifa Umar mo'minlar amiri degan nomga musharraf bo'lgan birinchi shaxsdir.
2. U kishi devonni tashkil qilgan birinchi shaxsdir, askar devoni, ato devoni, vazirlar devoni va boshqalar.
3. Shuningdek u kishi pochta xizmatini yo'lga qo'ydilar.
4. Pul zabt etishni yo'lga qo'ydilar.
5. Musulmonlar taqvimi yil hisobini yo'lga qo'ydilar buning uchun nabiy sallallohu alayhi vasallamning hijratlarini asos qilib oldilar va hisobni shu yildan boshladilar.
6. Xarami sharif masjidini kengaytirdilar va boshqa ko'plab buyuk ishlarini amalga oshirdilar.

Xulosa qilib aytganda "Roshid xalifalar"- Muhammad alayhissalomning yo'ldagi o'rinbosarlari edilar. Ularning har birlari musulmon ummatiga jonli ibrat edilar. Roshid xalifalarning asosiy qilgan ishlari-ixlos bilan insoniyatning insoniyligini ro'yobga chiqarish bo'lgan. Ularda insoniyatga ytakchilik qilish shartlari mujassam bo'lgan. Shunday xalifalardan biri Umar ibn Xattob adolat bobida peshqadam edilar va zamonaviy davlat asoschilaridan biri edilar.

Adabiyotlar

- [1]. Muxammad Sodiq Muxammad Yusuf. "Islom tarixi " 1- qism. Hilol nashri Toshkent 2023. 414-461 sahifa.
- [2]. Muxammad Sodiq Muxammad Yusuf. "Tafsiri Hilol" Sharq nashriyoti, Toshkent, 2012.
- [3]. Muxammad Sodiq Muxammad Yusuf. "Hadis va Hayot". 19,20.21.22.23.-juzlar, Sharq nashriyoti, Toshkent, 2011.
- [4]. Mahmud Shokir. "Tarixi islomiy" 1991.
- [5]. <https://islom.ziyouz.com/siyrat/xalifalar/hazrati-umar-al-foruq>
- [6]. <https://islom.ziyouz.com/siyrat/sahobalar/umar-ibn-xattob>.

RAQAMLI TA'LIMNING DIDAKTIK TAMOIYILLARI

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Raqamli ta'lim didaktik tamoyillari ochiq hisoblanib, yangiligi tufayli raqamli ta'limning nazariy va amaliy imkoniyatlari rivojlangani uchun qo'shimchalar kiritishni talab qiladi. Ta'limni raqamlashtirish natijasida individual ta'lim jarayonlari va talaba faoliyatini doimiy nazorat qilish asosida samarali mustaqil ta'lim olinadi. Raqamli ta'lim o'quv mashg'ulotlarining guruh va individual shakllaridan foydalanish imkoniyatlarini kengaytiradi, kasbiy bilim va ko'nikmalarning to'liq o'zlashtirilishini ta'minlaydi, shuningdek, inklyuziv ta'limning rivojlanishiga sifatli ta'sir ko'rsatadi.

Kalit so'zlar: Raqamli didaktika, e-Didactics, Raqamli ta'lim, raqamli ta'lim muhiti, Baholash tamoyili, Pedagogik dizayn

Дидактические принципы цифрового образования считаются открытыми и требуют дополнений в связи с развитием теоретических и практических возможностей цифрового образования в силу его новизны. В результате цифровизации образования получается эффективное самостоятельное образование, основанное на индивидуальном образовательном процессе и постоянном контроле за деятельностью учащихся. Цифровое образование расширяет возможности использования групповых и индивидуальных форм обучения, обеспечивает полное овладение профессиональными знаниями и навыками, а также оказывает качественное влияние на развитие инклюзивного образования.

Ключевые слова: Цифровая дидактика, Электронная дидактика, Цифровое образование, цифровая среда обучения, Принцип оценки, Педагогический дизайн.

The didactic principles of digital education are considered open and require additions due to the development of theoretical and practical possibilities of digital education due to its novelty. As a result of digitization of education, effective independent education is obtained based on individual educational processes and continuous monitoring of student activities. Digital education expands the possibilities of using group and individual forms of training, ensures full mastery of professional knowledge and skills, and also has a qualitative impact on the development of inclusive education.

Key words: Digital didactics, e-Didactics, Digital education, digital learning environment, Evaluation principle, Pedagogical design

Raqamli didaktika - pedagogikaning bir qismi hisoblanib, raqamli ta'lim muhitida o'quv jarayonini tashkil etish bo'yicha fan sifatida qaraladi. Raqamli didaktika an'anaviy didaktikaning asosiy tushunchalari va tamoyillarini raqamli muhit sharoitlaridan kelib chiqqan holda o'rganish, to'ldirish va o'zgartirish haqidagi fan sifatida ketma-ket foydalanadi. Dj. D'Andjelo tomonidan raqamli didaktika yoki raqamli ta'lim didaktikasi tushunchasini anglatuvchi "e-Didactics" tushunchasini kiritish taklif etilgan. Raqamli didaktika atamasiga M. Choshanov "raqamli texnologiyalar va multimedia vositalaridan keng foydalangan holda samarali o'rganish san'ati haqidagi fan" deb ta'rif bergan. V.I.Blinovning fikricha raqamli didaktikaning asosiy vositalari quyidagilardirdan iborat:

1. shaxsga yo'naltirilgan ta'lim jarayoni;
2. raqamli ta'lim texnologiyalari;
3. metaraqamli o'quv komplekslari.

Raqamli ta'lim jarayonining asosiy tamoyillariga quyidagilar kiradi: ustunlik tamoyili, shaxsiylashtirish tamoyili, maqsadlilik tamoyili, moslashuvchanlik tamoyili, muvaffaqiyatlilik tamoyili, hamkorlikda o'rganish tamoyili, amaliyotga yo'naltirganlik tamoyili, murakkablikni oshirish tamoyili, ta'lim muhitining to'yinganligi tamoyili, polimodallik (multimedia) tamoyili, baholash tamoyili.

Ustunlik tamoyili raqamli ta'lim muhitida talabani mustaqil ta'lim faoliyatiga qaratilgan. O'quv jarayonini tashkil etish, o'quv jarayonida talabani qo'llab-quvvatlash va yordam berish lozim.

Shaxsiylashtirish tamoyili talabani o'quv maqsadini mustaqil ravishda belgilash, o'quv jarayonining strategiyasini, o'quv dasturining rivojlanish sur'ati va darajasini tanlash qobiliyatini nazarda tutadi. Ushbu yondashuv o'qituvchiga shaxsiy rivojlanish ko'rsatkichlari va talabalarning ta'lim natijalarini kuzatish imkonini beradi.

Maqsadlilik tamoyili maqsadlilikning an'anaviy didaktik tamoyili bilan kesishadi: o'quv jarayonida faqat ma'lum bir talabani ta'lim jarayonida belgilangan maqsadlarga maksimal darajada erishishni ta'minlaydigan raqamli texnologiyalardan foydalanish talab etiladi. Ushbu tamoyil ta'lim maqsadlari aniq belgilanmagan holda samarasiz pedagogik texnologiya va vositalardan foydalanishni nazarda tutmaydi.

Baholash tamoyili butun o'quv jarayoni davomida talabalarning muvaffaqiyatini doimiy ravishda baholashni taqozo etadi. Raqamli texnologiyalar tezkor qayta aloqani ta'minlaydi, talabaga topshiriq natijalari bo'yicha kerakli ma'lumotlarni doimiy ravishda uzatadi. Buning yordamida o'qituvchi talabani kuchli va zaif tomonlari to'g'risida xulosalar chiqaradi, bu sizga rivojlanish stsenariylarini va o'quv jarayonida bevosita o'quv maqsadlarini to'g'rilash

imkonini beradi. Shunday qilib, raqamli texnologiyalar ma'lum bir vazifaning bajarilishini yakuniy baholashning xolisligi va shaffofligini ta'minlaydi.

Pedagogik dizayn ta'lim jarayonini yanada samarali va sifatli tashkil etishda muhim rol o'ynaydi. Bu, ayniqsa, tinglovchilar, professor- o'qituvchilar va o'quv kontenti o'rtasidagi o'zaro munosabatlarni to'g'ridan- to'g'ri emas, balki axborot va kommunikatsiya texnologiyalari orqali ta'minlanadigan onlayn ta'limda muhimdir. Kelajakda raqamli ta'lim resurslarini yaratishni rejalashtirayotgan professor-o'qituvchilar bu jarayonning moliyaviy va inson resurslari bilan bir qatorda juda ko'p vaqt talab qilishini tushunishi lozim. Faqat pedagogik dizaynning har bir bosqichida batafsil, yaxshi rejalashtirilgan mehnatorqali sifatli raqamli resurs yaratiladi.

Adabiyotlar:

- [1]. Sh.Adashboev. Oliy ta'lim tizimida raqamli ta'limning didaktik tamoyillari. UzACADEMIA. Ilmiy-uslubiy jurnali, №9 20/01/2021, 14-19 b.
- [2]. Petrova Ye. TSifrovaya didaktika: proektirovanie protsessi obucheniya i yego soprovozhdenie // Sovremennoe pedagogicheskoe obrazovanie № 4, 2018. - S. 141- 143
- [3]. Choshanov M.A. Ye-didaktika: noviy vzglyad na teoriyu obucheniya v epoxu tsifrovoy texnologiy // Obrazovatelnye tekhnologii i obshchestvo № 3, t. 16. - S.684-695.
- [4]. Blinov V.I., Dulinov M.V., Yesenina I.Yu., Sergeev M.S. Proekt didakticheskoy kontseptsii tsifrovogo professional'nogo obrazovaniya i obucheniya

1. “Фарғона политехника институти Илмий – техника журнали” (“Научно – технический журнал ФерПИ”, “Scientific – Technical Journal FerPI”) саҳифаларида фундаментал ва техника фанлари соҳасида янги илмий натижаларга эга бўлган ва 50 % дан ортиқ қисми илгари эълон қилинмаган ўзбек, рус, инглиз тилларида тайёрланган мақола ва қисқа хабарлар қуйидаги бўлимлар бўйича чоп этилади: **физика-математика фанлари; механика; қурилиш; энергетика, электротехника, электрон қурилмалар ва ахборот технологиялари; кимёвий технология ва экология; ижтимоий-иқтисодий фанлар; қисқа хабарлар.**

2. Мақола стандарт A4 ўлчамдаги оқ қоғознинг бир томонида чапдан 30 мм, ўнгдан 15 мм, юқоридан ва пастдан 20 мм кенгликда жой қолдириб, **Times New Roman** шрифтида, **12 pt** ўлчамда, қаторлар ораси **бир оралик** билан ёзилади ва икки нусхада тақдим қилинади. Мақолалар ҳажми чизмаларсиз **саккиз саҳифадан**, қисқа хабарлар эса **уч саҳифадан** ошмаслиги ва иккинчи нусхасида барча муаллифлар фамилияси, исми ва шарифларини кўрсатиб имзо чекишлари лозим.

3. Мақолага қуйидагилар илова қилинади: иш бажарилган **ташкилот йўлланмаси**; ўзбекча, русча ва инглизча **аннотациялар** (бир хил мазмунда ва 5-6 қатордан ошмаслиги зарур), **таянч сўзлар, мақола номлари; эксперт хулосаси; муаллифлар тўғрисида маълумот** (иш жойи, лавозими, телефони, e-mail). Муаллифлар орасида фан доктори бўлмаган тақдирда, шу соҳа ихтисослиги бўйича **фан докторининг тавсияси** тақдим этилади.

4. Формулалар компьютерда Word формулалар муҳаррирининг Math Type версиясида ёзилади. Чизмалар ва диаграммалар стандарт қоидаларга риоя қилинган ҳолда 10×10 см дан катта бўлмаган ўлчамда тайёрланиши, ёзувлар имкони борида сонлар ёки ҳарфлар кўринишида берилиши ва улар мақола саҳифасида ёки чизмага иловада тушунтирилиши лозим. Мақолада чизмалар сони **4 тагача**, қисқа хабарларда эса **2 тагача** рухсат этилади.

5. Мурожаат қилинган адабиётлар рўйхати мақола охирида қуйидаги тартибда келтирилади: муаллифнинг фамилияси, исми, шарифи, китоб (журнал)нинг номи, нашриёт (китоблар учун) йили, журнал номери, саҳифа (журнал учун). Мақола саҳифаларида адабиётларга илова рақам билан тартибли равишда квадрат қавс ичида (масалан [7] кўринишида) берилади.

6. Мақолани тайёрлашга ўта синчковлик ва ўткир диққат билан ёндошиш тавсия этилади. У илмий ва грамматик жиҳатдан юқори даражада талабчанлик билан илмий мақола мақомида таҳрирланган бўлиши лозим: саёз мазмундаги, ғализ ва узундан-узоқ жумлаларни ишлатмаслик; мақоланинг илмий йўналишига, шу куннинг ечилмаган ва долзарб муаммоларига баҳо берилиши; ишнинг асосий мақсади, қўйиладиган масалалар ва уларни ечиш услублари, олинган янги илмий натижалар ва уларнинг таҳлили ҳамда аниқ хулосалар катъий кетма-кетликда равон тилда баён қилиниши лозим.

7. Таҳририят зарурат бўлганда тақдим этилган мақола ва қисқа хабарларни таҳрир қилиш ҳуқуқига эга. Улар сўзсиз таҳририят аъзоларига ёки бошқа тегишли мутахассисларга тақризга берилади.

8. Агар мақола муаллифга қайта ишлаш учун қайтарилса, мақоланинг охирги кўриниши олинган кундан бошлаб мақола таҳририятга тушган ҳисобланади.

Журнални чоп этишда doc. MS Word 97 (2003) таҳририда ишловчи дастурлардан фойдаланилади.

Мақолаларини ўз вақтида чоп этилишини истаган муаллифлар таҳририятга ана шу дастурдан фойдаланган ҳолда компьютерда терилган электрон вариантини тақдим этишлари мақсадга мувофиқдир.

9. **Журналнинг электрон вариантларини ФерПИ веб-сайти <http://www.ferpi.uz> (faoliyat→ilmiy faoliyat→ilmiy jurnal) дан топиш мумкин.**

Кўрсатилган қоидалар асосида тайёрланмаган мақолалар таҳририят томонидан қабул қилинмайди.

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2. Статья представляется в двух экземплярах на белой бумаге стандартного формата А4 с полями: слева 30 мм, сверху и внизу по 20 мм, справа 1,5 мм; шрифт Times New Roman 12 pt, междустрочное расстояние один интервал. Общий объем статьи не должен превышать восьми страниц, не считая рисунков, кратких сообщений же не более трёх страниц. Второй экземпляр статьи представляется с подписями всех авторов.

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