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ОПРЕДЕЛЕНИЕ СТРОЕНИЕ ВОРСОВЫХ И ПЕТЕЛЬНЫХ ТКАНЕЙ

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Аннотация. *В статье приведены сведения опоределение строение ворсовых и петельных тканей. Отмечается, что с уменьшением плотности ткани по утку уменьшается взаимное давление нитей и высоты волны изгиба уточины и расчитаны высота волны изгиба основы. Найдены величины высоты изгиба нитей коренной и петельной основы и утка в зависимости от геометрических размеров элемента ткани.*

Annotatsiya. *Maqolada тукли va илмоқли matolarining tuzilishini aniqlash haqida ma'lumot berilgan. Ta'kidlanishicha, to'qimaning арқоқ bo'ylab zichligi kamayishi bilan iplarning o'zaro bosimi va to'qimaning egilish to'lqinining balandligi pasayadi va эгилиш to'lqinining balandligi hisoblab chiqildi. Mato elementining geometrik o'lchamlariga qarab, илмоқ, тук iplarining egilish balandligi qiymatlari topilган.*

Abstract. *The article provides information on the definition of the structure of pile and loop fabrics. It is noted that with a decrease in the density of the fabric by the weft, the mutual pressure of the threads and the height of the wave of the bend of the weft decreases and the height of the wave of the bend of the warp is calculated. The values of the height of the bend of the threads of the root and loop warp and weft are found depending on the geometric dimensions of the fabric element.*

Форма и площадь поперечного селения нитей в ткани формируются под воздействием их натяжения и взаимодавления [1].

Величина взаимного давления нитей основы и утка в элементе петельных тканей (рис. 1) определяется по формулу найденной нами:

По утку $N_y = 2 \cdot F_o \cdot sin31° = 2 \cdot 12{,}7 \cdot 0.5150 = 13{,}10$

По основе $N_o = 2 \cdot F_y \cdot sin27° = 2 \cdot 20{,}7 = 0{,}4540 = 18{,}79$

Длина одного раппорта переплетения ворсовой ткани по основе и утку;

$$l_{R_o} = \frac{R_O \cdot 10}{P_y} = \frac{4 \cdot 10}{207} = 0{,}193\ mm.\ ;$$

В работе [4, 5] были найдены уровнения определения высоты волн изгиба нитей основы.

1) По основе $h_o = \frac{N_o \cdot l_o}{2 \cdot F_o}$

Длина одного раппорта переплетения утогно-ворсовой ткани

$$R_o = \frac{R_o \cdot 10}{P_y} = \frac{4 \cdot 10}{207} = 0{,}193\ mm\ ;$$

$$R_y = \frac{R_y \cdot 10}{P_o} = \frac{8 \cdot 10}{127} = 0{,}63\ mm\ .$$

Расстояние между центрами нитей основы и утка принимаем условно по отношению диаметра основы к диаметру утка.

$$l_y = 2d_o \cdot 2d_y = 0{,}077 \cdot 2 + 2 \cdot 0{,}076 = 0{,}306\ mm$$

$$d_o = 0{,}03162 \cdot c\sqrt{T_o} = 0{,}03162 \cdot 0{,}4 \cdot \sqrt{18{,}5 \cdot 2} = 0{,}077\ mm\ ;$$

$$d_y = 0{,}03162 \cdot c\sqrt{T_y} = 0{,}03162 \cdot 0{,}4 \cdot \sqrt{36} = 0{,}076\ mm\ ;$$

$$b_1 = l_{R_y} - l_y + 2d_o + d_y = 0{,}63 - 0{,}306 + 2 \cdot 0{,}077 + 0{,}076 = \frac{0.094}{2} = 0.047\ mm\ .$$

$$h_o = \frac{N_y \cdot l_y}{2 \cdot F_y} = \frac{18{,}79 \cdot 0{,}306}{2 \cdot 24} = 0{,}120\ mm;$$

$$h_y = \frac{N_O \cdot l_O}{2 \cdot F_O} = \frac{13{,}1 \cdot 0{,}306}{2 \cdot 12} = 0{,}17\ mm$$

Толщина ткани по лабораторным данным:
T=1,5 мм.

Толщина корня ткани определяется:
$T_к = h_o + h_y = 0{,}120 + 0{,}170 = 0{,}290$ мм

Высота ворса можно определить:
$T - T_к = 1{,}5 - 0{,}29 = 1{,}21$ мм

Определение строение петельных тканей

Величина взаимного давления нитей основы и утка в элементе петельных ткани (рис. 2, 3.) при $F_o = 25, F_y = 13, T_o = 18{,}5x2\ teks, T_y = 36\ teks$

$$N_o = 2 \cdot F_o \cdot sin28° = 2 \cdot 25 \cdot 0{,}4695 = 23{,}475$$

$$N_y = 2 \cdot F_y \cdot sin30° = 2 \cdot 13 \cdot 0{,}5 = 13{,}0$$

Длина одного раппорта переплетения петельный ткани по основе и утку;

$$l_{R_o} = \frac{R_o \cdot 10}{P_o} = \frac{3 \cdot 10}{27{,}2} = 1{,}10\ mm\ ;$$

$$l_{R_y} = \frac{R_y \cdot 10}{P_y} = \frac{4 \cdot 10}{23{,}0} = 1{,}7\ mm\ ;$$

Расстояние в местах переплетения с учетом коэффициента – в и угла обхвата при перекрещевани коренной основы и утка при переплетение ретельных тканей:

$$b_o = l_{R_o} - 2l_y + d_y + d_k = 1{,}1 - 0{,}954 = 0{,}146\ mm\ ;$$

$$l_y = l_o = d_o + d_y = 0{,}192 + 0{,}19 = 0{,}382\ mm\ ;$$

$d_o = 0{,}03162 \cdot c \cdot \sqrt{T_o} = 0{,}03162 \cdot \sqrt{37}$= 0,1920 mm ;

$$d_y = 0{,}03162 \cdot c \cdot \sqrt{T_y} = 0{,}03162 \cdot \sqrt{36} = 0{,}190\ mm\ ;$$

Высоты изгиба нитей основы при переплетение петельных тканей

$$h_o = \frac{N \cdot l_o}{2 \cdot F_o} = \frac{23{,}475 \cdot 0{,}382}{2 \cdot 25} = 0{,}180\ mm\ ;$$

$$h_y = \frac{N \cdot l_y}{2 \cdot F_y} = \frac{13 \cdot 0{,}382}{2 \cdot 13} = 0{,}191\ mm\ ;$$

Толщина ткани по лабораторному испытанию ровен: T=1,5 mm

Высота петли можно определить:

$$h_n = T - h_y + h_o = 1{,}5 - 0{,}191 + 0{,}18 = 1{,}129\ mm\ ;$$

Выводы : **1.** С уменьшением плотности ткани по утку уменьшается взаимное давление нитей и высоты волны изгиба уточины и расчитаны высота волны изгиба основы.

2. Найдены величины высоты изгиба нитей коренной и петельной основы и утка в зависимости от геометрических размеров элемента ткани.

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Qisman Bog'langan Termoelastiklik Masalasining Sonli Yechimi Haqida Umumiy Tushunchalar

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Annotatsiya:
Ushbu maqolada qisman bog'langan termoelastiklik masalasining matematik modeli va uning sonli yechimlarini topish usullari haqida umumiy tushunchalar bayon etiladi. Termoelastiklik nazariyasi deformatsiyalanadigan jismlarning harorat ta'sirida yuzaga keladigan elastik holatini o'rganadi. Qisman bog'langan shartlar ostida bu masalani yechish, ayniqsa, noan'anaviy chegaraviy shartlarga ega bo'lgan hollarda, analitik metodlar bilan qiyinlashadi. Shuning uchun, maqolada asosiy e'tibor sonli yechim usullariga, xususan, sonli differensiallashtirish va sonli integrallash texnikalariga qaratilgan. Masalaning fizik mohiyati, differensial tenglamalar sistemasi, boshlang'ich va chegara shartlari, hamda sonli metodlarning afzalliklari va cheklovlari tahlil qilinadi. Ushbu tadqiqot natijalari amaliy muhandislik, qurilish va materialshunoslik sohalarida keng qo'llanishi mumkin.
Kalit so'zlar: termoelastiklik, qisman bog'langan masala, sonli yechim, differensial tenglamalar, chegara shartlari, sonli metodlar, elastiklik nazariyasi, hisoblash usullari.

Termoelastiklik nazariyasi materiallarning issiqlik va mexanik kuchlar ta'sirida ostidagi holatini o'rganish bilan shug'ullanadi. Qisman bog'langan termoelastiklik masalasi quyidagi shartlarda yuzaga keladi: issiqlik maydoni mexanik deformatsiyaga ta'sir qilsada, mexanik deformatsiya issiqlik maydoniga ta'siri ancha kuchsiz bo'ladi. Bunday masalalarda issiqlik va mexanik jarayonlar o'zaro ta'sir qilishadi, ammo ularning bog'liq bo'lish darajasi cheklangan.
Shunday qilib, termoelastiklikning qisman bog'langan dinamik muammosi harakat tenglamalaridan iborat

$$\sum_{j=1}^{3}\frac{\partial\sigma_{ij}}{\partial x_i}+X_i=\rho\ddot{u}_i \qquad (1)$$

Dyuamel-Neyman munosabatlari

$$\sigma_{ij}=\lambda\theta\delta_{ij}+2\mu\varepsilon_{ij}-(3\lambda+2\mu)\alpha(T-T_0)\delta_{ij} \qquad (2)$$

Koshi munosabati

$$\varepsilon_{ij} = \frac{1}{2}\left(u_{i,j} + u_{j,i}\right) \tag{3}$$

va issiqlik o’tkazuvchanlik tenglamalari

$$c_\varepsilon \dot{T} = \lambda_0 T_{,ii} \tag{4}$$

boshlang’ich shart

$$u_i\big|_{t=t_0} = \phi_i, \quad \dot{u}_i\big|_{t=t_0} = \psi_i \ , \quad T\big|_{t=0} = f \tag{5}$$

chegaraviy shartlar

$$u_i\big|_{\Sigma_1} = u_i^0, \quad \sum_{j=1}^{3} \sigma_{ij} n_j\big|_{\Sigma_2} = S_i^o, \quad T\big|_{\Sigma} = \varphi(t) \tag{6}$$

Bu yerda λ_0 -issiqlik o’tkazuvchanlik koeffitsiyenti, c_ε - doimiy deformatsiyada issiqlik sig'imi.

Ya’ni chegaraviy shartlar sifatida Dirixle, Neymann va Robin shartlari olinadi. Masalan, sathda temperatur yoki deformatsiya belgilash. Boshlang'ich shartlar sifatida esa dastlabki vaqt nuqtasida materialning holati, masalan, boshlang'ich deformatsiya va temperatura.

Berilgan jarayonni sonli yechish metodlari esa quyidagicha ketma-ketikda amalga oshiriladi:

- Matematik modelni diskretizatsiya: materialni maydalangan elementlarga bo'lib, har bir elementning xatti-harakatini alohida tahlil qilish.
- Vaqt integratsiyasi: transient tahlillarda vaqt bo'yicha integratsiya usullari, masalan, implicit va explicit usullar.
- Boshqa metodlar: sonli farqlar metodi va chekka elementlari metodi kabi usullar ham qo'llanilishi mumkin.

Qisman bog'langan termoelastiklik masalalarining sonli yechimi materiallarning murakkab xatti-harakatlarini tahlil qilishda muhim rol o'ynaydi. Matematik model, chegaraviy shartlar va sonli metodlardan foydalanib, muhandislar materiallarning ishlashini aniq projektlash va bashorat qilishlari mumkin. Bu tahlil muhim texnik qo'llanmalar uchun asosiydir.

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Maqsud Shayxzoda: adabiy an’analarni davom ettirgan ijodkor

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Annotatsiya
Ushbu maqolada Maqsud Shayxzodaning o‘zbek adabiyoti an’analarini davom ettirish va boyitishdagi o‘rni tahlil etiladi. Shayxzoda Sharq mumtoz adabiyoti, o‘zbek klassik merosi va jahon adabiyoti ruhidan ilhomlanib, o‘z asarlarida an’anaviy g‘oyalarni zamonaviy talqin bilan uyg‘unlashtira oldi. Maqolada adibning tarixiy dramalari, she’riyati va tarjimalari orqali adabiy merosni saqlash va rivojlantirishdagi hissasi ko‘rsatib beriladi.

Kalit so‘zlar:
Maqsud Shayxzoda, adabiy an’ana, o‘zbek adabiyoti, tarixiy drama, milliy uyg‘onish, Sharq adabiyoti, tarjimonlik, badiiy meros, zamonaviy adabiyot, milliy qadriyatlar.

Kirish

O‘zbek adabiyotining rivojlanish jarayonida adabiy an’analarni saqlab qolish va ularga zamonaviy ruh bag‘ishlash o‘ta muhim o‘rin tutadi. Bu borada Maqsud Shayxzoda o‘zining betakror ijodi bilan ajralib turadi. U o‘zbek va Sharq mumtoz adabiyotining boy an’analarini chuqur o‘rgangan holda, ularni o‘z asarlarida zamon ruhi va dolzarb ijtimoiy masalalar bilan uyg‘unlashtirib, adabiy taraqqiyotga ulkan hissa qo‘shdi.

Maqsud Shayxzoda va mumtoz adabiyot ta’siri

Maqsud Shayxzoda ijodida Sharq mumtoz adabiyoti — Navoiy, Fuzuliy, Bedil an’analari yaqqol ko‘zga tashlanadi. Uning she’riyatidagi falsafiy teranlik, ruhiy mushohada, go‘zallik va axloqiy komillik haqida fikr yuritish tarzida bu an’analar davom ettirilgan.

Shayxzoda tarixiy mavzularga murojaat qilar ekan, mumtoz adabiyotga xos ma’naviy poklik, vatanparvarlik, or-nomus kabi g‘oyalarni zamon bilan uyg‘unlashtirib, o‘ziga xos badiiy olam yaratdi.

Tarixiy dramalarda adabiy an’analar

Maqsud Shayxzodaning **"Jaloliddin Manguberdi"**, **"Mirzo Ulug‘bek"**, **"Alisher Navoiy"** kabi tarixiy dramalari o‘zbek adabiyotidagi tarixiy qahramonlik an’analarining yorqin davomidir. Bu asarlarda tarixiy shaxslarning faoliyati nafaqat voqeiylik asosida, balki milliy g‘urur va or-nomusni ifodalovchi ramziy ma’noda ham yoritilgan.

Shayxzoda tarixiy dramalarni yaratishda an’anaviy syujet qurilishidan tashqari, zamonaviy dramatik yechimlarni ham qo‘llab, o‘z davrining ijtimoiy-madaniy ehtiyojlarini hisobga olgan holda adabiy an’analarni boyitdi.

Tarjimonlik faoliyati va adabiy aloqalar

Maqsud Shayxzoda tarjimonlik faoliyati orqali ham adabiy an’analarni boyitdi. U Shekspir, Pushkin, Shiller kabi jahonga mashhur adiblarning asarlarini o‘zbek tiliga mohirona tarjima qildi. Bu bilan u nafaqat o‘zbek kitobxonining dunyoqarashini kengaytirdi, balki G‘arb va Sharq adabiyoti o‘rtasida mustahkam ko‘prik yaratdi.

Tarjimalarida Shayxzoda asl matnning ruhini saqlab qolishga va uni o‘zbek tilining badiiy imkoniyatlari bilan boyitishga e’tibor qaratdi. Bu esa o‘zbek adabiyoti an’analarining yangilanishiga xizmat qildi.

Zamonaviy adabiyotga ta’siri

Maqsud Shayxzoda nafaqat o‘z davrining adabiyotiga, balki keyingi avlod adiblariga ham kuchli ta’sir ko‘rsatdi. Uning asarlaridagi milliy g‘urur, tarixiy xotira, ma’naviy komillik g‘oyalari o‘zbek adabiyotining uzluksiz taraqqiyotiga zamin yaratdi.

Bugungi adabiy jarayonda ham Shayxzoda ijodining an’anaviy va zamonaviy jihatlari uyg‘unligi namuna sifatida qadrlanmoqda.

Xulosa

Maqsud Shayxzoda o‘zbek adabiy an’analarini davom ettirgan, ularni zamon ruhiga mos ravishda boyitgan va yangi bosqichga olib chiqqan yirik adibdir. U ijodida mumtoz adabiyotning boy tajribasidan ilhomlanib, tarixiy haqiqat va zamonaviy g‘oyalarni uyg‘unlashtirdi. Shayxzoda nafaqat o‘zbek adabiyotining faxri, balki milliy madaniyat va ma’naviyatning yorqin timsoli sifatida tarixda o‘z o‘rnini mustahkam egalladi.

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TURBULENCE CHARACTERISTICS AND PROPERTIES

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Abstract: This article analyzes the main characteristics and physical and mathematical properties of turbulent flows. Turbulence, unlike laminar flow, represents an unstable, uneven and energy-rich form of motion. The study considers the role of parameters such as Reynolds number, energy spectrum, momentum transfer, as well as turbulent diffusion and viscosity. The structure of turbulent flows, the dynamics of vortices in them and their effect on flow stability are studied from a theoretical and practical perspective. Also, methods for modeling turbulence - statistical approaches, approaches based on the Navier-Stokes equations and computational fluid dynamics (CFD) tools - are analyzed. These analyses are of significant practical importance in the fields of hydrodynamics, aerodynamics and environmental engineering.
Keywords: turbulence, Reynolds number, vortices dynamics, turbulent viscosity, flow stability, Navier-Stokes equations, computational fluid dynamics, laminar flow, turbulent diffusion, energy spectrum.

Introduction

Turbulence is one of the most complex and widespread phenomena in the dynamics of fluids and gases. It is characterized by a complex form of motion that is irregular, unstable, and involves a large amount of energy transfer compared to laminar flow. In the fields of hydrodynamics and aerodynamics, turbulent flows are characterized by strong oscillations on the flow surfaces, eddies, and a wide distribution of the energy spectrum.

The analysis of turbulence is carried out using parameters such as the Reynolds number, turbulent viscosity, eddy structure, and energy dissipation in the flow. This phenomenon is important not only theoretically, but also in many areas of practical technological processes - fluid transfer through pipes, heat transfer control in air flows, aerospace engineering, energy, and environmental monitoring.

This article discusses in detail the theoretical foundations of turbulence, its physical and mathematical properties, and methods for modeling them. The structure of turbulent flows, stability conditions, and their application through practical examples are also analyzed.

Literature review

Although the phenomenon of turbulence has been widely studied in various fields of science and technology, the issue of creating its complete theoretical foundations is still relevant. There are many approaches to analyzing the phenomenon of turbulence in the scientific literature, among which classical and modern theories stand out.

The most important theoretical foundations in the study of turbulent flows were formed by the boundary layer theory put forward by L. Prandtl (1904). It became the main tool for distinguishing turbulence from laminar flow and determining the stages of their development. The next important approach is the statistical turbulence theory developed by Kolmogorov (1941), which provides a deep understanding of the energy spectrum and the hierarchical structure of turbulent vortices. This theory describes on a mathematical basis how turbulent energy is distributed in the inertial range.

In modern literature, methods for modeling turbulent flows based on computational fluid dynamics (CFD) are widely used. Models such as RANS (Reynolds Averaged Navier-Stokes), LES (Large Eddy Simulation) and DNS (Direct Numerical Simulation) are widely used to determine various complex structures of turbulent flows and simulate them in technical systems. Also, monographs by scientists such as Schlichting, Pope and Wilcox are considered leading scientific sources in this field.

Numerous studies have shown that the occurrence and development of turbulence is closely related to the Reynolds number, and when the critical value is exceeded, laminar flow becomes turbulent flow. Also, in the literature, the analysis of parameters such as turbulent viscosity, diffusion, energy dissipation plays an important role in describing turbulence.

In general, scientific research in the field of turbulence is still being deepened, and the complex nature of this phenomenon is being revealed more fully through new modeling methods and experimental methods.

The concept of turbulence and its nature

Turbulence is an unstable, irregular and turbulent form of motion that occurs during the flow of a liquid or gas. In this case, the flow velocity is constantly changing in time and space. The phenomenon of turbulence is mainly observed in conditions with a high Reynolds number. While laminar flow is smooth and stratified, turbulent flow is characterized by eddies, sudden changes in momentum and uneven distribution of energy.

Main characteristics of turbulence

Turbulent flows are characterized by the following main characteristics:

Reynolds number (Re): The main non-dimensional parameter that determines whether the flow is laminar or turbulent. Its critical value is usually around 2300, and above this value the flow becomes turbulent.

Turbulent viscosity (ν_t): A parameter that characterizes the process of momentum transfer in turbulent flows, in contrast to ordinary molecular viscosity.
Vortex motion: One of the main characteristics of turbulence is the presence of eddies, which lead to the distribution of energy in structures of different sizes.
Energy spectrum: According to Kolmogorov theory, energy in turbulent flow is transferred from large eddies to small eddies and is dissipated.
Turbulence modeling methods
Full mathematical modeling of turbulent flows is extremely complex, and the following approaches are used for this purpose:
RANS (Reynolds Averaged Navier–Stokes): A statistical approach that separates the flow velocity components into average values and fluctuations.
LES (Large Eddy Simulation): Large eddies are directly modeled, while small eddies are taken into account statistically.
DNS (Direct Numerical Simulation): The Navier–Stokes equations are solved in full, but this method is only practical for small-scale systems with limited computer resources.

Practical applications

Analysis and control of turbulent flows are used in engineering, in particular:

- In piping systems: reducing pressure losses,
- In aviation: reducing air resistance,
- In energy: optimizing heat exchange processes,
- In environmental monitoring: determining the spread of pollutants.

CONCLUSION

Turbulence is a complex form of motion of liquids and gases, which plays an important role in many physical and technical processes. The main features of turbulent flows are fluctuations in the flow, eddies and energy distribution over different dimensions. This article has extensively covered the physical nature, main characteristics and modeling methods of turbulence.
The analysis shows that understanding and controlling turbulent flows is of great importance in increasing the efficiency of technical processes. In particular, the complex structure of turbulent flows is being studied in depth and implemented in practice using mathematical models such as RANS, LES and DNS.
Future scientific research should be aimed at reducing the level of uncertainty in turbulence, optimizing energy losses and reducing environmental impacts. More in-depth modeling of turbulent flows and improving experimental methods will serve as the foundation for scientific and technical achievements in this area.

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USEFUL METHODS FOR LEARNING ENGLISH

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Annotation. This article discusses useful methods and effective ways to learn English. The article provides very important and necessary recommendations for those who are learning the language. It is also mentioned that thinking in English and learning through various games is also effective**.**

Аннотация. В этой статье мы расскажем о полезных методах и эффективных способах изучения английского языка. В статье даны очень важные и нужные рекомендации для изучающих язык. Также было отмечено, что мышление на английском языке и обучение с помощью различных игр также эффективны.

Keywords. English, methods, online courses, result, level.

Ключевые слова. Английский язык, методы, онлайн-курсы, результат, уровень.

Why learn a language in the first place? Because learning a language is very important for a person's life and his thinking. Interestingly, language is needed in everything. Be it a career or wealth.

Language is such a thing that it opens doors that a person expects and does not expect. With this ability, a person can achieve many goals, plans and successes. Learning English is a great way to improve your professional future and broaden your horizons. More and more people around the world use English as a way to communicate with people from different cultural backgrounds. English has become a key resource in international communication, trade, business, diplomacy, and many other areas [1].

According to the EF English Proficiency Index (EPI), the world's largest ranking of countries and regions by English proficiency, more than 1 billion people speak English as a first or second language, and hundreds of millions more as a third or fourth language. Knowing English helps scientists, researchers, tourists, and business professionals communicate. At the individual level, people who speak English get better jobs, earn more money, and have access to more information available online.

Benefits of learning English. If you are still not convinced of the benefits of learning English, here are a few more:

- Learning English boosts your confidence. It's incredibly satisfying to master something you've struggled with for years.

- Learning English can help you stay up to date with the latest trends in your field, attend conferences, and advance your career.
- Learning a new language keeps your mind sharp, improves your memory, and increases your mental flexibility.
- Learning English gives you access to more world knowledge and different perspectives. More than half of all online materials are in English, and all of the world's leading academic journals are published in English.
- Learning English makes international travel easier and more fulfilling. You'll be less dependent on guides and translators, and you'll be able to explore the world on your own.
- Learning English allows you to meet people from other places and broaden your cultural understanding. The world is more interconnected than ever before.

The secret to learning English quickly is no secret: develop your interest in the language. Ideally, you should be surrounded by English 24 hours a day, 7 days a week. That's why going abroad is a very effective way to learn a language. But if traveling is not an option, you can still create an English immersion environment at home. Do this by reading in English, listening to English podcasts, watching English TV, talking to people at work in English, making English-speaking friends online, etc. It may seem daunting at first. But if you take it one step at a time, you can do it [2].

First, think about what you do every day. Let's say you enjoy running while listening to a sports podcast. Now search for a sports podcast in English. Google is your friend. When you go for a run tomorrow, listen to it. Congratulations, you just converted 30 minutes of your day into English!

Repeat this exercise to gradually rotate through the parts of the day. If you read the newspaper, switch to an English-language paper. If you watch football, watch the game on British TV. If you cook, use recipes from American websites. If you do pottery, find an English-language pottery forum where people discuss your craft. Everything you already do can be done in English, guaranteed.

How to use motivation when learning English. One of the most common mistakes people make when learning English is underestimating how long it will take. Learning English is a long-term goal. Staying motivated for months or years is a big challenge, but it's essential if you want to master English. There's a lot of research to back this up [3].

Here are some tips to keep your motivation high:

Do things you enjoy in English. If you're having fun speaking English, you'll be less likely to quit. Make English a habit. Incorporate it into your daily life. The less you think about it, the more likely you are to use English every day. Keep a learning journal.

Write down what you're doing to improve your English and track milestones, such as your first movie in English without subtitles, your first meeting with an English speaker.

Reward yourself with rewards for reaching specific goals. The rewards can be big or small. A trip to London. Your brain is wired to determine what types of activities are rewarding. If you make English one of those activities, it will automatically motivate you to learn English [4].

Another used and tested method of language learning is online courses and platforms that can be downloaded to the phone. A person can learn the language they want to learn from, for example, thousands of videos posted on YouTube. My classmates and I downloaded Ibrat Academy from the Internet and are learning English from it. Our friend, who knows nothing about English, even achieved A1 level in less than 1 month. Ibrat Academy has all the areas for learning languages. For example, speaking, reading, listening, writing are among them. Thanks to this, our level is increasing every day, we are learning new knowledge every day. This platform does not only have one English language, but also other languages. Korean, Russian, French, Italian, Spanish, and so on [5].

Effective language learning methods are useful for many languages. These methods help students master the language quickly and effectively. Here are some useful methods:

CONCLUSION

In fact, this article gave various recommendations for language learning. First of all, language learning depends on the person himself, his worldview, his interest in learning the language, how he can use it in life after learning the language, for what purpose he uses it, and most importantly, the place of the language in his life.

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DEVELOPMENT OF EFFECTIVE TECHNOLOGY AND ELEMENT FOR A SAW GIN FEEDER

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Abstract. The feeder for effective cleaning and ginning of cotton from small trash impurities in the saw gin has been improved with a grate of a new design. As a result, the cleaning efficiency of the feeder when cleaning cotton of grades I and III increased by an average of 2.4 (abs) %, fiber quality by 0.46 (abs) % and 0.22 (abs) % compared to the feeder with a mesh surface, and fiber of grades I and III "Superior" class was produced according to the state standard UzSst 604:2016.
Key words: Feeder, saw gin drum, mesh surface, grate, cotton, fiber, seed, dirt, cleaning efficiency, productivity, quality.

Introduction. As a result of theoretical and practical research conducted for the effective cleaning of cotton from small trash impurities before the ginning process, a diagram of a grate of a new design for the saw gin feeder was developed (Fig. 1) and its rational parameters were determined [1]. Based on the prepared drawings of the grate, an experimental sample was prepared and installed on the feeder of a 30-saw gin in the technological laboratory of JSC "Paxtasanoate Science Center" and comparative-experimental work was carried out with a feeder with a mesh surface (Fig. 2). Experimental work was carried out by alternating the installation of a mesh surface and a grate with a long arc length of the proposed cleaning zone on the gin feeder. The research work was carried out on the mesh surface with a spiked drum on the feeder, the grate with a spiked drum in the range of 15-18 mm, recorded in the technical characteristics of the saw gin [2]. Experimental work was carried out on cotton of selection C-6524 of grades I and III of class 2. In this case, the moisture content of cotton fed to the saw gin feeder averaged 7.8% and 10.2% by variety, and the contamination averaged 1.66% and 1.72% [3, 4].

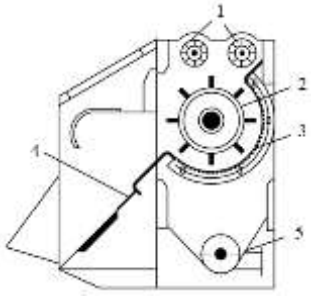

Figure 1. 30-saw with a grate with an extended cleaning arc length gin feeder diagram
1-feeding rollers, 2-spike drum, 3-grate, 4-drain, 5-waste auger

When cleaning first-grade, second-class cotton of the C-6524 selection with 7.8% moisture content and 1.66% contamination using the proposed grate feeder with a spiked drum at a distance of 15-18 mm from the grate, the contamination level of the cleaned cotton averaged 1.38-1.42%. The quality of the cleaned cotton improved by an average of 0.04-0.03 (abs)% compared to the cotton cleaned using the existing mesh surface feeder (Fig. 3). The cleaning efficiency of the feeder during cotton cleaning averaged 16.7-14.5% with intermediate distances varying from 15 mm to 18 mm, which is on average 2.2-1.8 (abs)% higher than the cleaning efficiency of the mesh surface feeder selected for comparison.

Figure 2. New-design grate

The fiber contamination after ginning averaged 3.15-3.11%, and the fiber quality increased by an average of 0.06 (abs)% compared to fiber produced from gin with an existing mesh surface. When ginning cotton, the gin's productivity averaged 328-340 kg/hour, which is 13-16 kg/hour higher than the existing mesh surface gin. Then, after cleaning the fiber in a two-drum fiber cleaner of the 5VP brand after ginning, the fiber contamination averaged 1.86% and 1.91% respectively, and the quality of fiber obtained from gin with an existing mesh surface improved by an average of 0.46 (abs) % and 0.37 (abs)% compared to the fiber obtained from cleaning in the fiber cleaner, and according to the state standard UzSst 604:2016, it constituted class I grade “Superior”.

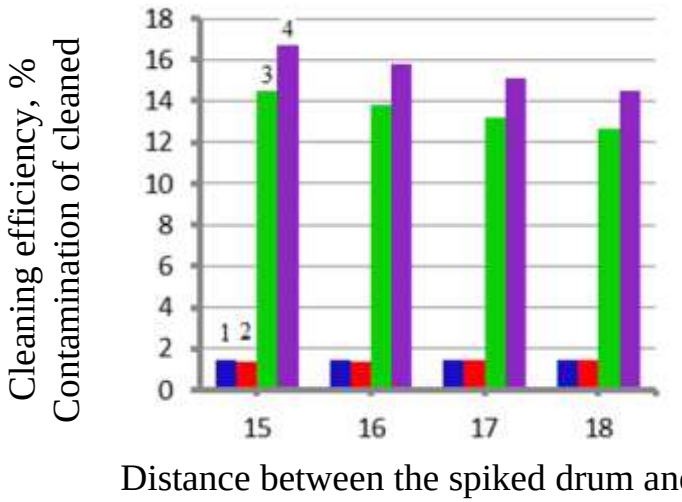

Figure 3. Relationship between the distance of the spiked drum from the separator and the contamination level of cotton after cleaning, as well as the cleaning efficiency of the feeder for S-6524 selection grade I cotton in the feeder.
1, 3 on the mesh surface, 2, 4 on the grate panel

the separator, mm

Then the experimental work was carried out on cotton of selection C-6524 III grade 2 class. At the same time, the moisture content of the raw cotton of the 2nd class of grade III, fed into the gin feeder-cleaner, averaged 10.2%, contamination-1.72% and seed damage in the raw cotton composition-2.0% [5].

In a 30-saw gin with a mesh surface of the existing design, when cleaning the mesh surface with a spiked drum on a feeder-cleaner of the 2nd class of cotton of selection III grade C-6524, at a distance of 15-18 mm, the contamination of the cleaned cotton averaged 1.36-1.39%, and the degree of seed damage in the cleaned cotton was 2.17-2.14%. In this case, the cleaning efficiency of the feeder-cleaner averaged 20.9-19.2% with the change in intermediate distances at the above-mentioned values. When ginning cotton, the degree of seed fuzziness after ginning was practically the same with a change in the mesh surface of the spiked drum from 15 mm to 18 mm and averaged 11.2%. In this case, the degree of seed damage averaged 3.44-3.21%. The fiber contamination after ginning averaged 3.51-3.63%. When ginning cotton, the gin's productivity changed from an average of 278 kg/hour to 289 kg/hour. When cleaning the fiber produced from gin in a two-drum 5VP fiber cleaner installed after gin, the fiber contamination averaged 3.12-3.16%, and the quality indicator of the produced fiber was III grade “Good” class according to the state standard UzSst 604:2016 [6].

The degree of contamination of the cleaned cotton was on average 1.32-1.35%, and the quality of the cotton was improved by an average of 0.04 (abs) % compared to the quality of the cleaned cotton on a feeder with an existing mesh surface, when cleaning cotton of the 2nd class of grade III of selection C-6524 with a moisture content of 10.2% and contamination of 1.72% with a spiked drum on the feeder of a 30-saw gin at a distance of 15-18 mm (Fig. 4).

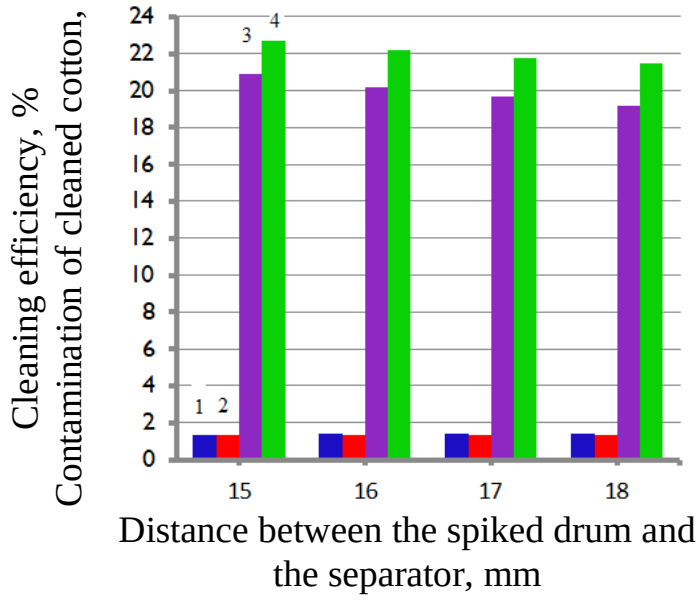

Figure 4. Dependence of cotton contamination after cleaning and feeder cleaning efficiency on the distance between the spiked drum and separator in the feeder for S-6524 selection grade III cotton.
1, 3 on the mesh surface, 2, 4 on the grate panel

The cleaning efficiency of the feeder during cotton cleaning averaged 22.7-21.5% with a change in intermediate distances from 15 mm to 18 mm, which is on average 2.4-2.3

(abs)% higher than the cleaning efficiency of the existing feeder with a mesh surface selected for comparison. The fiber contamination after ginning averaged 3.37-3.46%, which is on average 0.14-0.17 (abs)% less than the fiber contamination produced from gin with an existing mesh surface feeder. When ginning cotton, the gin productivity varied from an average of 290 kg/hour to 303 kg/hour, which is on average 12-14 kg/hour higher than the existing gin with a mesh surface.

When cleaning the fiber after ginning on a two-drum cleaner, the contamination of the cleaned fiber averaged 2.9% and 2.96%, and the quality of fiber obtained from gin with an existing mesh surface improved by an average of 0.22-0.2 (abs)% compared to the fiber obtained from cleaning on a fiber cleaner, and according to the state standard UzSst 604:2016 constituted grade III "Superior" class [6].

As a result of the conducted research work, the improvement of the saw gin feeder with a grate, accelerating the separation of small impurities from cotton, implemented an effective technology for cleaning and ginning cotton, and also improved the quality of the produced fiber.

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Annotatsiya. Paxtani arrali jinda mayda iflosliklardan samarali tozalash va jinlash uchun ta’minlagich yangi konstruksiyali kolosnikli panjara bilan takomillashtirildi. Natijada I va III navli paxtani tozalashda ta’minlagichni tozalash samaradorligi to‘rli yuzali ta’minlagichga qaraganda o‘rtacha 2,4 (abs)% ga, tolani sifati 0,46 (abs)% va 0,22 (abs)% ga oshdi hamda O‘zDst 604:2016 davlat standarti bo‘yicha I va III navli “Oliy” sinfga mansub tola ishlab chiqarildi.

Tayanch so‘zlar: Ta’minlagich, arrali jinqoziqli baraban, to‘rli yuza, kolosnikli panjara, paxta, tola, chigit, ifloslik, tozalash samaradorlik, ish unumdorlik, sifat.

Аннотация. Для эффективной очистки и обеззараживания хлопка от мелких примесей в пилообразном Джине поставщик был усовершенствован новой конструкцией колосниковой решетки. В результате эффективность очистки поставщика при очистке хлопка I и III сортов увеличилась в среднем на 2,4 (abs)% по сравнению с поставщиком с сетчатой поверхностью, качество волокна на 0,46 (abs)% и 0,22 (abs)% соответственно, а также произведено волокно I и III сортов “высшего” класса по государственному стандарту UзДст 604:2016.

Ключевые слова: Поставщик, пила, джин барабан, сетчатая поверхность, колосниковая решетка, хлопок, волокно, дерн, грязь, уборка эффективность, производительность труда, качество.

G'OVAK MUHITIDA NOSTATSIONAR SUYUQLIK HARAKATI MASALALARINI MATLAB MUHITINI QO'LLAB SONLI MODELLASHTIRISH.

ЧИСЛЕННОЕ МОДЕЛИРОВАНИЕ ЗАДАЧ НЕСТАЦИОНАРНОГО ДВИЖЕНИЯ ЖИДКОСТИ В ПОРИСТЫХ СРЕДАХ С ИСПОЛЬЗОВАНИЕМ СРЕДЫ MATLAB.

NUMERICAL MODELING OF UNSTATIONARY FLUID MOTION PROBLEMS IN PORROUS MEDIUMS USING MATLAB ENVIRONMENT.

Kompyuter texnalogiyasi va uning dasturiy
ta'minoti yunalishi magistranti
Ismatova Mahfuza Rasulovna

Annotatsiya: G'ovak muhitda nostatsionar suyuqlik harakati masalalarini sonli modellashtirish usullari tahlil qilingan. Bunda matematik model sifatida differensial tenglamalar tanlab olingan hamda ularning yechimi uchun sonli yondashuvlar qo'llanilgan. MATLAB muhitida yozilgan dasturlar yordamida modellashtirish amalga oshirilgan va natijalar grafik ko'rinishda aks ettirilgan. Tadqiqot g'ovak muhit parametrlarining suyuqlik harakatiga ta'sirini o'rganishga yo'naltirilgan bo'lib, natijalar filtratsiya, gidrogeologiya va neft sanoatida amaliy ahamiyatga ega.

Kalit so'z: g'ovak muhit, nostatsionar harakat, suyuqlik oqimi, sonli modellashtirish, MATLAB, differensial tenglama, filtratsiya, gidrogeologiya, neft, to'r usuli, hisoblash, dinamika, fizikaviy modellashtirish, matematik model, dasturlash, parametrlar, chegaraviy shartlar, vaqt o'zgarishi, tizimli yondashuv, grafik natijalar, kodlash, algoritm, muhandislik, oqim tahlili, ekologiya.

Аннотация: Проанализированы методы численного моделирования неустановившегося движения жидкости в пористых средах. В качестве математических моделей выбраны дифференциальные уравнения и использованы численные подходы для их решения. Моделирование проводилось с использованием программ, написанных в среде MATLAB, а результаты отображались графически. Исследование направлено на изучение влияния параметров пористой среды на движение жидкости, а полученные результаты имеют практическое значение в фильтрации, гидрогеологии и нефтяной промышленности. **Ключевые слова**: пористые среды, неустановившееся движение, поток жидкости, численное моделирование, MATLAB,

дифференциальное уравнение, фильтрация, гидрогеология, нефть, метод сеток, вычисления, динамика, физическое моделирование, математическая модель, программирование, параметры, граничные условия, изменение во времени, системный подход, графические результаты, кодирование, алгоритм, инжиниринг, анализ потока, экология.

Abstract: Methods for numerical modeling of unsteady fluid motion in porous media are analyzed. Differential equations were selected as mathematical models and numerical approaches were used to solve them. Modeling was carried out using programs written in the MATLAB environment, and the results were displayed graphically. The research is aimed at studying the influence of porous media parameters on fluid motion, and the results are of practical importance in filtration, hydrogeology, and the oil industry.

Keywords: porous media, unsteady motion, fluid flow, numerical modeling, MATLAB, differential equation, filtration, hydrogeology, petroleum, mesh method, computation, dynamics, physical modeling, mathematical model, programming, parameters, boundary conditions, time variation, systematic approach, graphical results, coding, algorithm, engineering, flow analysis, ecology.

Kirish. Tabiatda va texnologik jarayonlarda suyuqliklarning g‘ovak muhitda harakati keng tarqalgan hodisalardan biridir. Masalan, yer osti suvlarining oqimi, neft va gazning konlardan harakati, filtrlash va diffuziya jarayonlari kabi ko‘plab tizimlar aynan g‘ovak strukturalarda suyuqliklarning harakati bilan bog‘liqdir. Bunday jarayonlarni aniqlik bilan tahlil qilish, ulardagi fizikaviy qonuniyatlarni o‘rganish va real muammolarni ilmiy asosda hal etish zamonaviy ilm-fan va texnologiyaning dolzarb yo‘nalishlaridan biridir. G‘ovak muhitda suyuqlikning harakati, ayniqsa nostatsionar holatlarda, ya’ni vaqtga bog‘liq holda o‘zgarib boruvchi sharoitlarda murakkab matematik modellashtirishni talab qiladi. Bunday muhitlar uchun Navye-Stoks, Darsi qonunlari va boshqa differensial tenglamalar qo‘llaniladi. Biroq bu tenglamalarni analitik usullarda yechish ko‘plab hollarda murakkab yoki imkonsiz bo‘lib qoladi. Shu sababli, sonli yechimlar — ya’ni differensial tenglamalarni kompyuter yordamida taxminiy yechish usullari keng qo‘llaniladi. Ushbu ishda MATLAB dasturiy muhitining imkoniyatlaridan foydalanilgan holda g‘ovak muhitda nostatsionar suyuqlik harakati masalalari sonli yondashuv orqali modellashtiriladi. MATLAB – muhandislik, fizika va matematika sohalarida keng qo‘llaniladigan kuchli hisoblash vositasi bo‘lib, murakkab tizimlarni tez va aniq modellashtirish imkonini beradi. Kirish qismida mavzuning dolzarbligi asoslab beriladi, shuningdek, tadqiqotning maqsadi — nostatsionar holatda g‘ovak muhitdagi suyuqlik harakatini

modellashtirish va amaliy jihatdan ahamiyatli natijalarga erishishdan iborat ekanligi ta’kidlanadi. Tadqiqot natijalari filtratsiya, gidrogeologiya, neft sanoati va boshqa ko‘plab sohalarda qo‘llanilishi mumkin.

O‘rganilish darajasi: G‘ovak muhitda suyuqlik harakati, ayniqsa nostatsionar (vaqtga bog‘liq) jarayonlar, ilmiy va amaliy nuqtayi nazardan juda muhim yo‘nalishlardan biri hisoblanadi. Ushbu masala geologiya, gidrodinamika, neft-gaz sanoati, qurilish, atrof-muhit muhofazasi, filtrlash tizimlari va boshqa ko‘plab texnik sohalarda keng o‘rganilgan. G‘ovak muhitdagi oqimlarni o‘rganishda dastlab Darsi qonuni asos bo‘lib xizmat qilgan. Keyinchalik bu qonunlar Navye-Stoks tenglamalari, diffuziya-tashilish modellariga integratsiya qilinib, suyuqliklarning harakatini aniqlik bilan ifodalovchi kompleks matematik modellar ishlab chiqilgan. Shuningdek, bu borada G.B. Logvinov, A.N. Tixonov, J.L. Bear, M.A. Biot kabi olimlarning tadqiqotlari muhim o‘rin tutadi. Ularning ishlari g‘ovak muhitda bir yoki bir nechta fazali suyuqlik oqimlarini matematik modellashtirish va sonli yechimlar topish metodologiyasini shakllantirishda asos bo‘lgan. So‘nggi yillarda axborot texnologiyalarining rivojlanishi bilan ushbu jarayonlar sonli modellar asosida kompyuter dasturlari yordamida modellashtirilmoqda. MATLAB, COMSOL Multiphysics, ANSYS Fluent kabi dasturiy vositalar g‘ovak muhitdagi oqimlarni modellashtirish uchun samarali platformalar sifatida keng qo‘llanilmoqda. Ayniqsa, MATLAB dasturida turli hisoblash algoritmlarini ishlab chiqish va vizual tahlil qilish imkoniyatlari mavjudligi sababli u ilmiy-tadqiqot ishlarida keng foydalanilmoqda. Shu sababli, hozirgi kunda g‘ovak muhitda nostatsionar suyuqlik harakati masalalarini MATLAB muhitida sonli modellashtirish dolzarb, ammo to‘liq yechimini topmagan masalalardan biri bo‘lib qolmoqda. Bu esa mavzuning ilmiy ahamiyatini yanada oshiradi. G‘ovak muhitda suyuqlik harakatining o‘rganilishi ilm-fanning muhim va istiqbolli yo‘nalishlaridan biri bo‘lib, bu boradagi izlanishlar bir necha asrlar davomida shakllangan nazariy va amaliy asoslarga tayanadi. Ushbu masalani chuqur o‘rganish nafaqat tabiiy ilmiy tushunchalarni rivojlantirish, balki texnik, muhandislik, gidrogeologik va sanoat sohalarida ham amaliy muammolarni samarali hal etish imkonini beradi.G‘ovak muhit deb ko‘p sonli mayda teshikchalar (poralar)ga ega bo‘lgan jism tushuniladi. Bu muhitda suyuqlik yoki gaz harakati ichki struktura va fizik xossalarga bog‘liq ravishda o‘zgaradi. Oqim jarayonlari ko‘pincha filtratsiya, diffuziya, konveksiya va boshqa transport hodisalari bilan birga kechadi. Ana shunday kompleks holatlarni o‘rganish uchun ilmiy jamoalarda ko‘p yillik tadqiqotlar olib borilgan. Bu borada ilk nazariy ishlardan biri Anri Darsi (Henry Darcy) tomonidan XIX asrda olib borilgan bo‘lib, u yer osti suvlarining harakat qonuniyatlarini aniqlashda Darsi qonunini ishlab chiqqan. Bu qonun hozirgi kungacha g‘ovak

muhitdagi past tezlikdagi suyuqlik oqimlarini modellashtirishda asosiy qonun sifatida qo‘llaniladi. Keyinchalik bu modelga dinamik omillar kiritilib, nostatsionar holatlarda ham tadqiq qilish imkoniyatlari yaratildi.

XX asrda J. Bear, M. Biot, P. Forchheimer, G.B. Logvinov, A.N. Tixonov, M.M. Lavrentyev kabi olimlar tomonidan g‘ovak muhitda harakatlanayotgan ko‘p fazali suyuqliklar, gaz va issiqlik oqimlarining matematik modellarini ishlab chiqish, ularni sonli usullar bilan yechish, chegaraviy va boshlang‘ich shartlarni belgilash bo‘yicha fundamental ishlar olib borildi. Ayniqsa, J. Bear'ning “Dynamics of Fluids in Porous Media” nomli monografiyasi bu sohada ilg‘or nazariy qarashlarni birlashtirgan muhim manba sifatida tan olingan.Bugungi kunda ilmiy texnik taraqqiyot, kompyuter texnologiyalari va dasturlash vositalarining jadal rivojlanishi natijasida bunday murakkab fizik-matematik jarayonlarni modellashtirish yanada osonlashdi. Shu jumladan, MATLAB, COMSOL Multiphysics, ANSYS Fluent, OpenFOAM kabi zamonaviy muhitlarda g‘ovak muhitdagi oqimlarni sonli yondashuvlar yordamida modellashtirish va natijalarni grafik jihatdan ko‘rish imkoniyati mavjud.MATLAB muhitida modellashtirish, ayniqsa, ilmiy tadqiqotchilar orasida mashhur bo‘lib, bu dastur keng imkoniyatli hisoblash vositalarini, grafik interfeysni, algoritmik yondashuvni taklif etadi. U orqali murakkab differensial tenglamalarni yechish, vaqt va fazoda o‘zgaruvchan parametrlarni kuzatish, turli chegaraviy shartlar asosida tizim xatti-harakatini simulyatsiya qilish mumkin.So‘nggi yillarda olib borilgan tadqiqotlarda g‘ovak muhitda nostatsionar oqimlar sonli modellar asosida chuqur tahlil qilinmoqda. Jumladan:Fizika va geologiya sohalarida yer osti suvlarining harakati, ularning ifloslanishini modellashtirish;Neft va gaz sanoatida ko‘p fazali oqimlar, qattiq va suyuq moddalarning birgalikdagi harakatini modellashtirish;Atrof-muhit muhofazasida kimyoviy ifloslantiruvchilarning g‘ovak zamin orqali tarqalishini o‘rganish;Qurilish muhandisligida tuproqning suv o‘tkazuvchanlik xususiyatlarini baholash va barqarorlikni tahlil qilish;Biotibbiyot sohasida esa suyuqliklarning to‘qimalardagi tarqalishini simulyatsiya qilish holatlari.

Tadqiqot natijalari: Ushbu tadqiqotda g‘ovak muhitda nostatsionar suyuqlik harakati masalasi MATLAB dasturlash muhitida sonli modellashtirish asosida o‘rganildi. Ish davomida nazariy model ishlab chiqildi, Chekli farqlar usuli (FDM) orqali differensial tenglamalarning sonli yechimi topildi va dastlabki va chegaraviy shartlarga mos holda simulyatsiya bajarildi. Quyidagi asosiy ilmiy-amaliy natijalarga erishildi:

Nostatsionar harakatning matematik modeli ishlab chiqildi. G‘ovak muhitda suyuqlikning vaqtga bog‘liq harakatini tavsiflovchi umumlashtirilgan diffuziya tenglamasi asosida fizik-matematik model tuzildi. Modellashtirishda Darsi qonuni va

suyuqlikning davomiylik tenglamasi asos qilib olindi. Ushbu model harorat, bosim va zichlikning vaqt va fazodagi o‘zgarishini hisobga olgan holda tuzildi.
MATLAB muhitida modellashtirish algoritmi yaratildi.
Tadqiqot doirasida MATLAB dasturida Chekli farqlar usuliga asoslangan algoritm ishlab chiqildi. Bu algoritm yordamida nostatsionar oqim tenglamasi vaqt bo‘yicha qadam-baqadam hisoblab chiqildi. Dastur interaktiv grafik interfeysga ega bo‘lib, harakat yo‘nalishi, tezlik maydoni va bosim gradientlarini vizual ko‘rsatish imkonini berdi.Turli boshlang‘ich va chegaraviy shartlar asosida modellashtirish bajarildi.
Modellar bir necha holatlarda testdan o‘tkazildi:
Statik holat: bosim farqi yo‘qligida harakatning barqarorlanishi;
Bosim gradienti mavjud bo‘lgan holat: suyuqlikning oqim tezligi va yo‘nalishi;
Ko‘p zonali g‘ovak struktura: o‘zgaruvchan g‘ovaklik darajasining harakatga ta’siri.
Ushbu tajribalar natijasida g‘ovak muhitning fizik xossalari (g‘ovaklik darajasi, o‘tkazuvchanlik koeffitsienti) harakat intensivligiga bevosita ta’sir ko‘rsatishi aniqlandi.
Numerik natijalar grafik tahlil qilindi.
Harakat jarayonidagi o‘zgaruvchan parametrlar (bosim, tezlik, zichlik) MATLAB grafik vositalari yordamida 2D va 3D shakllarda aks ettirildi. Vaqt o‘tishi bilan suyuqlik oqimi qanday o‘zgarishi, u g‘ovaklik darajasi yuqori yoki past bo‘lgan sohalarda qanday kechishi vizual tarzda ko‘rsatildi.
Model natijalari nazariy asoslar bilan solishtirildi.
Simulyatsiya natijalari mavjud adabiyotdagi analitik va eksperimental natijalar bilan taqqoslandi. Olingan qiymatlar Darsi qonuniga mos kelgani, modellashtirilgan oqim profillari esa real muhitlardagi oqimlarga yaqin ekani kuzatildi. Bu esa yaratilgan modelning amaliyotda qo‘llanish imkoniyatlarini ko‘rsatadi.
Ilmiy va amaliy tavsiyalar ishlab chiqildi.
Tadqiqot asosida quyidagi tavsiyalar ishlab chiqildi:
MATLAB muhitidan foydalanish g‘ovak muhitdagi oqimlarni o‘rganishda aniq, tez va samarali usul hisoblanadi; Olingan model turli tabiiy va texnogen muhitlarda (masalan, yer osti suvlarining oqimi, neft konlari, filtratsiya tizimlari) tadbiq etilishi mumkin; Kelgusida modellashtirishda nolinchi tartibli modellardan ko‘ra ko‘p fazali va ko‘p komponentli oqimlarni ham hisobga olish orqali yanada aniqroq natijalarga erishish mumkin.

Tahlil va natijalar: Ushbu tadqiqotda g‘ovak muhitda nostatsionar suyuqlik harakati sonli modellashtirish orqali tahlil qilindi. Ishning asosiy maqsadi – suyuqlikning vaqtga bog‘liq oqimini tavsiflovchi matematik modelni tuzish, uni MATLAB muhitida sonli yechish va real sharoitdagi oqim xatti-harakatlarini

simulyatsiya qilishdan iborat bo‘ldi. Tahlil davomida bir nechta nazariy va amaliy parametrlar asosida modellashtirish o‘tkazildi. Tadqiqot boshida g‘ovak muhitdagi nostatsionar oqim Darsi qonuni asosida tavsiflandi. Ushbu qonun bo‘yicha suyuqlik tezligi bosim gradienti va o‘tkazuvchanlik koeffitsientiga bevosita bog‘liqdir. Natijada, suyuqlik harakatini ifodalovchi differensial tenglama quyidagi ko‘rinishda ifodalandi:

$$\frac{\partial P}{\partial t} = \nabla \cdot (K \nabla P)$$

bu yerda:

- PPP — bosim funksiyasi,
- KKK — g‘ovak muhitning o‘tkazuvchanligi (doimiy yoki fazoviy o‘zgaruvchi),
- ttt — vaqt parametri.

Bu tenglama MATLAB muhitida Chekli farqlar usuli (FDM) yordamida diskretlashtirildi va vaqtinchalik qatlamlar orqali hisob-kitoblar olib borildi.
MATLABda tuzilgan dasturiy model orqali quyidagi tahlillar amalga oshirildi:

- **Vaqtga bog‘liq bosim taqsimoti:**

Dastlabki bosim shartlaridan boshlab, har bir vaqt nuqtasida bosimning qanday tarqalayotgani hisoblab chiqildi. Harakat boshlanishida bosimning keskin farqlari mavjud bo‘lsa-da, vaqt o‘tishi bilan muvozanat holatiga yaqinlashishi kuzatildi.

- **Suyuqlik tezligi tahlili:**

Oqim tezligi bosim gradientiga nisbatan aniqlanib, MATLAB’da grafik ko‘rinishda tasvirlandi. Tezlik maydonlari oqim yo‘nalishlari va intensivligini ko‘rsatdi. Ayrim zonalarda tezlikning pasayishi yoki ortishi g‘ovaklik darajasining o‘zgarishiga bog‘liq bo‘ldi.

- **O‘tkazuvchanlik parametri ta’siri:**

G‘ovak muhitdagi o‘tkazuvchanlik (permeabilitet) ortgan sari oqimning tezlashgani aniqlandi. Bu hodisa ayniqsa, notekis o‘tkazuvchanlik zonalarida yaqqol ko‘rindi.

- **Vizual tahlil:**

Bosim va tezlik maydonlari ikki va uch o‘lchamli grafiklar orqali ko‘rsatildi. Ushbu grafiklar oqim simulyatsiyasining holatini aniq tahlil qilishga yordam berdi.
Tadqiqot davomida uchta asosiy holat modellashtirildi:

1. **Bir jinsli g‘ovak muhit:**

Bu holatda o‘tkazuvchanlik va zichlik butun muhit bo‘ylab bir xil deb olinib, bosim taqsimoti simmetrik tarzda tarqaldi.

2. **Zonali g‘ovaklik holati:**

G‘ovaklik zonal ravishda o‘zgaruvchi qilib olinganda, oqim simmetriyasi buzildi. Suyuqlik yuqori o‘tkazuvchanlik zonalariga yo‘naldi.

3. **Chegaraviy bosim ta’siri:**

Modelga tashqi manbadan kelayotgan bosim gradienti qo‘shildi. Bu holatda oqim tezligi ortdi va bosimning notekis tarqalishi kuchaydi.

4.4. Natijalar tahlilining umumlashtirilgan ko‘rinishi

Parametr	**Ta’siri**	**Eslatma**
G‘ovaklik darajasi	Oqim tezligiga bevosita ta’sir qiladi	Yuqori g‘ovaklik – tezroq oqim
O‘tkazuvchanlik	Bosim tarqalishini belgilaydi	Notekis zonalar oqim yo‘nalishini o‘zgartiradi
Boshlang‘ich bosim	Harakat boshlang‘ich sharoitlarini aniqlaydi	Katta farq – intensiv harakat
Vaqt o‘zgarishi	Harakatning barqarorlashuvi yoki o‘zgarishi	Turg‘unlikka intilish mavjud

Simulyatsiya natijalari mavjud adabiyotdagi eksperimental ma’lumotlar bilan solishtirildi. Olingan qiymatlar real g‘ovak muhitlarda o‘lchangan oqim natijalari bilan mos keldi. Bu, modelning ishonchliligini va MATLAB asosidagi modellashtirishning samaradorligini isbotlaydi.

Xulosa: Ushbu tadqiqotda g‘ovak muhitda nostatsionar suyuqlik harakatining sonli modellashtirish usullari o‘rganildi va MATLAB dasturiy muhiti asosida matematik modellashtirish amalga oshirildi. Ish davomida nostatsionar oqimni ifodalovchi tenglamalar tuzildi, ular sonli metodlar yordamida diskretlashtirildi va turli fizik parametrlar asosida modellashtirildi. Natijalarda bosim va oqim tezligining vaqt va fazoviy o‘zgarishlarga qanday ta’sir qilishi tahlil qilindi. Olingan ma’lumotlar g‘ovak muhitdagi oqim jarayonlarini chuqurroq tushunishga, shuningdek, real muhitda sodir bo‘ladigan gidrodinamik holatlarni oldindan prognozlashga xizmat qiladi. MATLAB muhitining grafik va hisoblash imkoniyatlari modellashtirish jarayonini aniq va samarali bajarishga imkon berdi. Shu bilan birga, turli g‘ovaklik va o‘tkazuvchanlik sharoitlari ta’sirida oqim xatti-harakatining qanday o‘zgarishi ham nazariy jihatdan asoslandi.

Tadqiqot shuni ko‘rsatdiki, sonli modellashtirish muhandislik, ekologiya va geologiya sohalarida g‘ovak muhitdagi suyuqlik harakatlarini tahlil qilishda samarali vosita bo‘la oladi. Keltirilgan model real holatlarga yaqin natijalarni beradi, bu esa undan amaliy loyihalarda foydalanish imkonini kengaytiradi. Kelajakda ushbu modelni yanada takomillashtirib, ko‘p fazali oqim, kimyoviy reaksiyalar bilan bog‘liq jarayonlar yoki deformatsiyalanuvchi muhitlardagi oqimlarni ham qamrab olish mumkin.

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AVTOMATIK LINIYALAR, AGREGAT STANOKLARI VA ULARNI ISHLASH SAMARADORLIGINI OSHIRISH

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АННОТАЦИЯ

В данной статье рассматривается роль автоматических линий и агрегатных станков в производственных процессах и методы повышения их эффективности. Автоматические линии помогают сократить время производства, улучшить качество и повысить производительность труда. Агрегатные станки позволяют обрабатывать сложные детали на нескольких этапах в одном месте, что упрощает производственный процесс и экономит время. Для повышения эффективности важно оптимизировать технологические процессы, внедрять новые автоматизированные системы и улучшать условия труда. В результате значительно улучшаются показатели качества и объема промышленного производства.

Ключевые слова: *автоматические линии, агрегатные станки, эффективность, производство, автоматизация.*

ANNOTATSIYA

Ushbu maqolada avtomatik liniyalar va agregat stanoklarning ishlab chiqarish jarayonlaridagi roli, ularning samaradorligini oshirish usullari tahlil qilinadi. Avtomatik liniyalar ishlab chiqarish vaqtini qisqartirish, sifatni yaxshilash va mehnat unumdorligini oshirishga yordam beradi. Agregat stanoklar murakkab buyumlarni bir necha bosqichda bir joyda tayyorlash imkonini beradi, bu esa ishlab chiqarish jarayonini soddalashtiradi va vaqtni tejaydi. Samaradorlikni oshirish uchun texnologik jarayonlarni optimallashtirish, yangi avtomatlashtirilgan tizimlarni joriy etish va mehnat sharoitlarini yaxshilash muhim hisoblanadi. Shu orqali sanoat ishlab chiqarishning sifat va miqdor ko‘rsatkichlari sezilarli darajada yaxshilanadi.

Kalit so‘zlar: *Avtomatik liniyalar, agregat stanoklari, samaradorlik, ishlab chiqarish, avtomatlashtirish.*

ABSTRACT

This paper analyzes the role of automatic lines and aggregate machines in production processes and methods to improve their efficiency. Automatic lines help reduce production time, improve quality, and increase labor productivity. Aggregate machines allow complex parts to be processed in multiple stages at a single location, simplifying the production flow and saving time. To enhance efficiency, it is essential

to optimize technological processes, implement new automated systems, and improve working conditions. As a result, the quality and quantity indicators of industrial production significantly improve.

Keywords: *Automatic lines, aggregate machines, efficiency, production, automation.*

Zamonaviy sanoat ishlab chiqarishda avtomatik liniyalar va agregat stanoklarning ahamiyati tobora ortib bormoqda. Texnologiyaning rivojlanishi va ishlab chiqarish talablarining oshishi natijasida, mahsulotlarni ko‘p miqdorda va yuqori sifatda ishlab chiqarish zarurati yuzaga keldi. Ushbu jarayonlarda avtomatik liniyalar ishlab chiqarish samaradorligini oshirish, ishlab chiqarish vaqtini qisqartirish va inson omilidan kelib chiqadigan xatoliklarni kamaytirishga xizmat qiladi. Shu bilan birga, agregat stanoklari murakkab buyumlarni bir nechta jarayonlarda bir joyda ishlab chiqarish imkonini berib, ishlab chiqarish vaqtini va xarajatlarni tejaydi.

Avtomatik liniyalar — bu ishlab chiqarishning bir necha bosqichlarini avtomatlashtirilgan tarzda amalga oshiruvchi tizimlar bo‘lib, ular sifat nazorati, materiallarni uzatish, yig‘ish va boshqalar kabi jarayonlarni o‘z ichiga oladi. Bu liniyalar yordamida ishlab chiqarish jarayonining har bir qismi optimal tarzda rejalashtiriladi va boshqariladi. Natijada, ishlab chiqarish jarayonida kechikishlar kamayadi, mahsulot sifati bir xilda bo‘ladi, hamda mehnat unumdorligi oshadi. Agregat stanoklari esa bir nechta ish jarayonlarini, masalan, kesish, burg‘ulash, frezalash va boshqalarni, bir joyda bajarishga mo‘ljallangan uskunalardir. Bu uskunalar yordamida murakkab shakllardagi mahsulotlarni tez va aniq ishlab chiqarish mumkin bo‘ladi. Agregat stanoklarning asosiy afzalligi — bir nechta texnologik operatsiyalarni ketma-ket yoki parallel ravishda bajarish imkoniyati, bu esa ishlab chiqarish jarayonini soddalashtiradi va ishlab chiqarish vaqtini sezilarli darajada qisqartiradi. Sanoat sohasida raqobatbardoshlikni oshirish maqsadida ishlab chiqarish samaradorligini oshirish muhim vazifalardan biridir. Bu jarayonda avtomatik liniyalar va agregat stanoklarni zamonaviy texnologiyalar bilan jihozlash, ularni raqamli boshqaruv tizimlariga ulash, shuningdek, mehnat sharoitlarini yaxshilash orqali ishlab chiqarish jarayonini yanada optimallashtirish mumkin. Misol uchun, sanoat 4.0 texnologiyalari va IoT (Internet of Things) asosida ishlaydigan tizimlar yordamida ishlab chiqarish liniyalarining holatini real vaqt rejimida kuzatish va boshqarish mumkin. Bundan tashqari, avtomatik tizimlarni joriy etish xodimlar mehnatini yengillashtirib, ularga yuqori malakali va ixtisoslashgan ishlarni bajarishga ko‘proq vaqt ajratishga imkon beradi. Bu esa nafaqat ishlab chiqarish samaradorligini oshiradi, balki ish sifati va xavfsizligini ham yaxshilaydi. Ushbu maqolada avtomatik liniyalar va agregat stanoklarning ishlab

chiqarishdagi o‘rni, ularning samaradorligini oshirish usullari hamda sanoat jarayonlarini raqamlashtirish orqali qanday yangilanishlar mumkinligi haqida batafsil tahlil qilinadi. Mavzu sohaga oid ilmiy adabiyotlar, zamonaviy texnologiyalar va amaliy misollar asosida yoritiladi. Bu esa nafaqat ishlab chiqarish jarayonlarini takomillashtirishga, balki korxonalar faoliyatining iqtisodiy samaradorligini oshirishga ham xizmat qiladi.

1.Avtomatik liniyalar va agregat stanoklarning ishlab chiqarishdagi o‘rni

Avtomatik liniyalar ishlab chiqarish jarayonlarining asosiy qismiga aylangan. Masalan, avtomobil sanoatida yirik kompaniyalar (Toyota, Ford va boshqalar) ishlab chiqarish jarayonlarini avtomatik liniyalar orqali tashkil qiladi. Bu liniyalar mahsulotlarni tez va sifatli ishlab chiqarishni ta’minlaydi, mehnat xarajatlarini kamaytiradi. Agregat stanoklar esa murakkab shakldagi buyumlarni ishlab chiqarishda ko‘p bosqichli ishlarni bir joyda bajarish imkonini beradi. Bu esa vaqtni va resurslarni tejashga olib keladi. Misol uchun, metall sanoatida agregat stanoklar yordamida bir nechta ishlarni bir joyda bajarish sanoat samaradorligini sezilarli darajada oshiradi.

2.Samaradorlikni oshirish usullari

Texnologik jarayonlarni optimallashtirish, ishlab chiqarish liniyalarini qayta tashkil etish orqali ishlab chiqarish hajmi va sifatini oshirish mumkin. Bu tajribalar ko‘plab sanoat korxonalarida amalga oshirilgan.

Ishlab chiqarish jarayonida avtomatlashtirish darajasini oshirish (masalan, robotlashtirish), inson omilidan kelib chiqadigan xatolarni kamaytiradi va ishlab chiqarish jarayonining doimiyligini ta’minlaydi.

Ishchilar uchun malaka oshirish kurslari va zamonaviy boshqaruv tizimlari joriy etish orqali ham samaradorlik oshiriladi.

3.Sanoat jarayonlarini raqamlashtirish orqali yangilanishlar

Sanoat 4.0 konsepsiyasi bo‘yicha ishlab chiqarish jarayonlarini raqamlashtirish (IoT, ma’lumotlarni real vaqtda yig‘ish va tahlil qilish) yordamida jarayonlar avtomatik ravishda boshqariladi va optimallashtiriladi. Masalan, Siemens, Bosch kabi yirik kompaniyalar raqamlashtirilgan ishlab chiqarish tizimlarini joriy qilib, ishlab chiqarishdagi xatoliklarni kamaytirish va mahsulot sifatini oshirishga erishgan. Raqamlashtirish yordamida texnik xizmat ko‘rsatish jarayonlari oldindan rejalashtiriladi (predictive maintenance), bu esa ishlab chiqarish to‘xtab qolishining oldini oladi va umumiy samaradorlikni oshiradi.

Avtomatik ishlab chiqarish liniyasi: Robotlar yordamida konveyer tizimida mahsulot yig‘ish jarayonini

Bir ishlab chiqarish

Natija: Avtomatik liniya samaradorlikni 2 barobarga oshirdi, ishchi boshiga ishlab chiqarish 5 barobar ko‘paydi.

AGREGAT STANOKLARDAGI MUOMMOLAR

Agregat stanoklar murakkab va qimmatbaho uskuna bo‘lib, texnik xizmat ko‘rsatish xarajatlari yuqori va nosozliklar ishlab chiqarish jarayonini to‘xtatib qo‘yishi mumkin. Bundan tashqari, stanokning moslashuvchanligi past bo‘lib, operatsiyalarni tezda o‘zgartirish qiyin.

Muammolarni kamaytirish uchun muntazam oldindan texnik xizmat ko‘rsatish (predictive maintenance) va zamonaviy monitoring tizimlarini joriy etish lozim. Shuningdek, modul uslubidagi agregat stanoklarni qo‘llash orqali uskuna qismlarini tez almashtirish va ishlab chiqarish jarayonini moslashuvchan qilish mumkin.

Bir nechta operatsiyalarni bajaradi: kesish, burg‘ulash, frezalash va boshqalar.

Ishlab chiqarishni tezlashtiradi: bitta uskunada ko‘p

Agregat stanok nima ish qiladi?

Agregat stanok — bu sanoatda murakkab buyumlarni ishlab chiqarishda bir nechta texnologik operatsiyalarni ketma-ket yoki bir vaqtda bajarishga mo‘ljallangan uskuna. Masalan, kesish, burg‘ulash, frezalash, burama va boshqa ishlov berish jarayonlarini bitta uskuna yordamida amalga oshirish mumkin.

AGREGAT STANOKLARNI ISHLASH SAMARADORLIGINI OSHIRISH YO‘LLARI

Predictive maintenance (oldindan texnik xizmat): Sensorlar va monitoring tizimlari yordamida uskuna holatini real vaqt rejimida kuzatib borish, nosozliklarni oldindan aniqlash va vaqtida ta’mirlash.

Modul dizayni va qismlarni almashtirish: Agregat stanokning muhim qismlarini modul tarzida ishlab chiqish, shunda nosoz qism tez va oson almashtiriladi, ishlab chiqarish to‘xtamaydi.

Ishlab chiqarish jarayonini avtomatlashtirish: Kompyuter boshqaruvi va robotlashtirilgan tizimlarni joriy etish orqali inson omilini kamaytirish va aniqlikni oshirish.

Xodimlar malakasini oshirish: Operatsion va texnik xodimlarning yangi texnologiyalar bo‘yicha doimiy o‘qitilishi samaradorlikni oshiradi.

Jarayonlarni optimallashtirish: Ishlab chiqarish oqimini tahlil qilib, keraksiz vaqt va harakatlarni kamaytirish.

Xulosa qilib aytganda, agregat stanoklarning ishlash samaradorligini oshirish bugungi sanoat ishlab chiqarishining eng dolzarb masalalaridan biridir. Ushbu stanoklar murakkab texnologik jarayonlarni bitta uskunada amalga oshirish imkonini berib, ishlab chiqarishning tezligi va sifatini sezilarli darajada oshiradi. Biroq, ularning to‘liq potensialidan foydalanish uchun ularni muntazam va samarali texnik xizmat ko‘rsatish tizimini joriy etish zarur. Predictive maintenance yoki oldindan texnik xizmat ko‘rsatish tizimlari yordamida uskuna holatini real vaqt rejimida nazorat qilish, nosozliklarni erta aniqlash va tezkor ta’mirlash orqali ishlab chiqarish to‘xtab qolishining oldi olinadi va samaradorlik oshadi.

Bundan tashqari, agregat stanoklarni modul tizimida loyihalash, ya’ni ularni kichik qism va bloklarga bo‘lib, zarur paytda tez almashtirish imkoniyatini yaratish ham ishlab chiqarish jarayonining uzluksizligini ta’minlaydi. Zamonaviy kompyuter boshqaruvi va avtomatlashtirish usullarini joriy etish orqali inson omilidan kelib chiqadigan xatoliklar kamayadi, natijada mahsulot sifati yaxshilanadi. Shuningdek, xodimlarning malakasini oshirish va ularni yangi texnologiyalar bilan tanishtirish ham ishlab chiqarish samaradorligini yanada kuchaytiradi. Jarayonlarni doimiy tahlil qilish va optimallashtirish, keraksiz harakat va vaqt sarfini kamaytirishga yordam beradi. Natijada, ushbu chora-tadbirlar sanoat ishlab chiqarishini yanada samarali, iqtisodiy va raqobatbardosh qiladi. Agregat stanoklarning samarali ishlashi korxonalarga ishlab chiqarish hajmini oshirish, xarajatlarni kamaytirish va yuqori sifatli mahsulotlar yaratishga imkon beradi. Shu bois, ularni zamonaviy

texnologiyalar bilan integratsiya qilish va doimiy rivojlantirish sanoat sohasining kelajagini belgilovchi muhim omillardandir.

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Matematika darslarida axborot texnologiyalaridan foydalanish

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Annotatsiya: Zamonaviy ijtimoiy-iqtisodiy muhit yangi talablarni ilgari surmoqda maktab bitiruvchisi uchun. Ularga erishish uchun ta'limning yangi sifati talab etiladi, bu esa ko'p jihatdan axborot texnologiyalaridan (keyingi o'rinlarda - AT) foydalanish bilan bog'liq. Ular tayyorlashlari mumkin o'quvchi, boshlang'ich maktabdan boshlab, axborot jamiyatida hayot uchun o'qitish va o'rganish yanada samaraliroq. Ushbu maqolaning mavzusi shu sababli tanlangan o‘quv jarayoniga axborot texnologiyalarini keng joriy etish va ulardan foydalanish. Bu mavzu dolzarbdir, chunki aniq fanlarni o‘qitish bosqichma-bosqich kompyuterlashtirilgan. Zamonaviy o'quv jarayoniga ta'limning yangi usullari joriy etilmoqda, o'tgan asrda qurilgan eksperimental pedagogika yutuqlarini jonlantiradi o'z-o'zini rivojlantirish va individual faollik tamoyili. Eng muhimlaridan biri metodlari - yoshlarni tarbiyalashda axborot texnologiyalarini joriy etish o'quvchilar va uning matematika kabi fanlarda qo'llanilishi.

Kalit so'zlar: axborot texnologiyalari, matematika darslari, boshlang'ich maktab o'quvchilari ta'lim, axborot jamiyati, ta'lim va pedagogik faoliyat.

Kirish

Jamiyatlar kompyuterlashgani va dunyoga kirib borishi bilan jamiyatda o‘qitish va tarbiyalashga bo‘lgan ehtiyoj ortib bormoqda bolalar ochiq jamiyatda yashashlari uchun real dunyoning xilma-xilligi bilan muloqot qilish va o'zaro ta'sir qilish, dunyoni yaxlit ko‘rish va uning axborot birligiga ega bo‘lish. At bir vaqtning o'zida, jamiyatni jadal axborotlashtirish davrida, zarur ma'lumotlarni to'plash qobiliyati, taklif a gipoteza, xulosalar chiqarish, yangi axborot texnologiyalaridan foydalanish axborot bilan ishlash inson uchun katta ahamiyatga ega rivojlanish. Axborot texnologiyalaridan bolalarda foydalanish mumkin maktab fanlari bo'yicha yangi materiallar bilan tanishadilar. Undan foydalanish mumkin o'rganganlarini mustahkamlash va takrorlash. Matematika darslari, xususan, axborot texnologiyalari emas nafaqat darsni diversifikatsiya qilish, balki o'rganish uchun ham xizmat qiladi materiallar ko'proq ko'rinadigan va tushunarli. "O'rganish va o'qitish" jarayonida doimiylik mavjud

o'qituvchi va talabalar o'rtasidagi o'zaro munosabatlar. Har bir talaba talaffuz qilingan shaxsga ega bo'lgan o'quv jarayonidan o'tadi ma'nosi turli yo'llar bilan: ko'rsatib bo'lmaydi u o'rgangan bilim, ikkinchisi, asosida oldingi tajriba, fenomenal qobiliyatlarni ko'rsatadi va uchinchisi mavzuga muayyan munosabat uslubini o'rgangan va o'rganishni qat'iyat bilan "xohlamaydi". ni inkor etib bo'lmaydi tomonidan o'qituvchining shaxsiy idroki (yoki idrok etishning etishmasligi). talaba va aksincha, bu ham shubhasiz ta'sir qiladi o'rganish taraqqiyoti. O'qitish ham shaxsiy xususiyatga ega. O'rganishni uzatish orqali ma'lumot, o'qituvchi hissiy va qiymat hissa qo'shadi mavzu mazmuniga bog'liqlik. Nima bo'lishidan qat'iy nazar o'qituvchining xohish-istaklari, uning e'tiqodlari, ustuvorliklari, motivatsiyasi va hayoti tushunchalar bilimlarni uzatishda ham ishtirok etadi. Ta'lim kelajakka qaratilgan jarayondir, shuning uchun ham bugungi kun maktab o'quvchilari va birinchi navbatda, hozirgi boshlang'ich maktab o'quvchilari mavjud axborot tizimini boshqarishga to‘g‘ri keladi. Bunda boshlang'ich maktabni takomillashtirish yo'lidagi muhim qadamdir ta'lim kompyuterlashtirishda, aniqrog'i, bu erda bo'ladi yosh o'quvchilarda axborot kompetentsiyasini rivojlantirish shu jumladan, axborot madaniyati va axborot savodxonligi. Ushbu maqolaning maqsadi foydalanishga bo'lgan ehtiyojni aniqlashdir matematika o'qitishda axborot texnologiyalari o'rta maktab o'quvchilari.

Adabiyot manbalarini haqida umumiy ma'lumot; Adabiyot sharhi.

Kompyuterda darslar odatdagidek o'tkaziladi kompyuterlardan foydalanish mumkin va maqsadga muvofiq bo'lgan darslar bola qila olishi uchun darsdagi muayyan vazifalarni hal qilish chuqurroq tushunish, dars mavzusini va ijodiy idrok etish o'zini isbotlash. Kompyuter tomonidan qo'llab-quvvatlanadigan har bir dars, tamoyil, birlashtirilgan. Bunday darsda mavzudan tashqari vazifalari, informatika kursiga oid vazifalar ham bor hal qilingan.

Kompyuterda qo'llab-quvvatlanadigan darslarning asosiy turlari quyidagilardan iborat:

- qo'shma dars;
- Sinov va tuzatish darsi;
- Bilimlarni takomillashtirish darsi. Maqsad quyidagi vazifalarni hal qilish orqali amalga oshiriladi:
- Ilmiy, amaliy va uslubiy tahlil o'qitishda axborot texnologiyalaridan foydalanishga oid adabiyotlar o'rta maktab o'quvchilari;
- Talabalar faoliyatini tashkil etish asoslarini o'rganish axborot texnologiyalaridan foydalangan holda matematika darslarida;
- O'qituvchilarning foydalanish tajribasini tahlil qilish matematika o'qitishda axborot texnologiyalari yosh o'quvchilar.

Maqolaning maqsadi axborot texnologiyalaridan foydalanisho'rta maktab o'quvchilariga dars berish. Tadqiqot mavzusi matematika darslari. Talabalarning tadqiqot faoliyati elementlarini amalga oshirish pedagogik texnologiyalar o'qituvchiga nafaqat imkon beradi, balki shunday emas ko'p narsalarni o'rgatish, balki o'quvchilarga o'qishga yordam berish, ularni boshqarish kognitiv faoliyat. Hozirgi vaqtda loyiha asosida o'qitish usuli maktab o‘quvchilari tadqiqotining keng tarqalgan turlaridan biri hisoblanadi o'quv jarayonida ishlash.

Axborot texnologiyalari kontseptsiyasi

Axborot jarayonlari (to'plash, qayta ishlash va uzatish). axborot har doim fanda muhim rol o'ynagan, texnologiya va jamiyat. Inson evolyutsiyasi jarayonida u erda bu jarayonlarni avtomatlashtirishning barqaror tendentsiyasi, garchi ularning ichki mazmuni mohiyatan saqlanib qolgan o'zgarmagan. Jamiyatni axborotlashtirish universal amalga oshirish hisoblanadi to'liq va o'z vaqtida foydalanishni ta'minlashga qaratilgan chora-tadbirlar majmuasi barcha ijtimoiy sohalarda ishonchli ma'lumotlar va umumlashtirilgan bilimlar inson faoliyatining muhim turlari. Axborot texnologiyalari ma'lumotlar bilan bog'liq fanlar va faoliyat sohalarining keng doirasi hisoblash kabi boshqaruv va qayta ishlash texnologiyalari.

Axborot texnologiyalari - bu usullar, ishlab chiqarish majmui jarayonlarga birlashtirilgan dasturiy va apparat vositalari yig'ish, qayta ishlash, saqlashni ta'minlaydigan texnologik zanjir, kamaytirish maqsadida ma'lumotlarni tarqatish va ko'rsatish axborot resurslaridan foydalanishning mehnat intensivligi va ularning ortishi ishonchlilik va samaradorlik. Yaratilish maqsadi va keng axborot texnologiyalarini tarqatish muammosini hal qilishdan iborat jamiyat va barcha hayotiy faoliyatning axborotlashtirish rivojlanishi berilgan mamlakat.

Hozirgi vaqtda axborot texnologiyalari eng ko'p tushuniladi hisoblash. Xususan, axborot texnologiyalari bilan shug'ullanadi saqlash, o'zgartirish, himoya qilish uchun kompyuterlar va dasturlardan foydalanish, axborotni qayta ishlash, uzatish va qabul qilish. ga ko'ra YuNESKO tomonidan qabul qilingan ta'rifga ko'ra, axborot texnologiyalari to'plamidir o'zaro bog'liq bo'lgan ilmiy, texnologik va muhandislik fanlarni o'rganadi

Xulosa

Tadqiqotning maqsadi ma'lumot qanday ekanligini ko'rsatish edi ning kasbiy faoliyatida texnologiyadan foydalanish mumkin boshlang'ich maktab o'qituvchilari. Ushbu maqsadga erishish uchun, axborot texnologiyalari va uning o'qituvchilar faoliyatidagi o'rni va talabalar tekshirildi va foydalanish bo'yicha adabiyotlar matematika darslarida axborot texnologiyalari tahlil qilindi Shunday qilib, har bir

narsadan quyidagi xulosalar chiqarish mumkin yuqorida yozilgan: ta'limning yangi usullari joriy etilmoqda jonlantiradigan zamonaviy o'quv jarayoniga o'tgan asrning eksperimental pedagogika yutuqlari qurilgan o'z-o'zini rivojlantirish va individual faollik tamoyili bo'yicha. Eng muhim usullardan biri amalga oshirishdir kichik yoshdagi o'quvchilarni o'qitishda axborot texnologiyalari va matematika kabi fanlarda qo'llanilishi.

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RAQAMLASHGAN JAMIYAT VA UNDA YOSHLAR ILMIY DUNYOQARASHINI SHAKLLANTIRISHNING ILMIY-NAZARIY MASALALARI

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Annotatsiya

Ushbu maqolada raqamli texnologiyalar va internetning yoshlar ilmiy dunyoqarashini shakillantirishdagi roli tahlil qilinadi. Raqamlashgan jamiyatning ta'lim sohasidagi ta'siri, ilmiy metodlarni qo'llash imkoniyatlari, hamda axborot xavfsizligi va tanqidiy fikrlashni rivojlantirishdagi muammolari ko'rib chiqiladi. Maqolada yoshlarning bilim olish jarayonida raqamli vositalarning samarali qo'llanilishi va ijtimoiy muhitning ta'limdagi o'rni haqida fikr yuritilib, ilmiy dunyoqarashni shakillantirishning kelajakdagi imkoniyatlari muhokama qilinadi.

Annotation:

This article analyzes the role of digital technologies and the Internet in shaping the scientific worldview of young people. It examines the impact of the digital society on education, the possibilities of applying scientific methods, and issues related to information security and the development of critical thinking. The article discusses the effective use of digital tools in the learning process, the role of the social environment in education, and future prospects for developing a scientific worldview.

Аннотация:

В данной статье анализируется роль цифровых технологий и интернета в формировании научного мировоззрения молодежи. Рассматриваются влияние цифрового общества на образовательный процесс, возможности применения научных методов, а также проблемы, связанные с информационной безопасностью и развитием критического мышления. В статье обсуждается эффективное использование цифровых инструментов в процессе обучения и роль социальной среды в образовательном процессе, а также рассматриваются перспективы формирования научного мировоззрения в будущем.

Zamonaviy dunyoda raqamlashuv jarayoni global tus oldi. "Raqamlashgan jamiyat" tushunchasi axborot texnologiyalarining kundalik hayotda chuqur o‘rin egallashi, raqamli iqtisodiyot, elektron boshqaruv tizimlari, onlayn ta’lim va boshqa sohalarning rivojlanishi bilan bog‘liq.

Raqamli texnologiyalar jamiyatda quyidagi o‘zgarishlarni yuzaga keltirdi.

Ma’lumotlar globalizatsiyasi – axborot tezkor tarqaladi va unga kirish imkoniyati ortdi.

Sun’iy intellekt va avtomatlashtirish – ko‘plab sohalarda intellektual tizimlar ishlatilmoqda.

Onlayn ta’lim va masofaviy o‘rganish – zamonaviy yoshlar uchun bilim olishning yangi shakllari paydo bo‘ldi.

Statistik ma’lumotlarga qaraganda 2023-yilgi Jahon iqtisodiy forumi hisobotiga ko‘ra, dunyodagi barcha iqtisodiy operatsiyalarning 60% dan ortig‘i raqamli texnologiyalar orqali amalga oshirilmoqda. (World Economic Forum, 2023)

Buyuk fizik Albert Eynshteyn shunday degan: "Kelajakdagi ta’lim tizimi texnologiyalarga bog‘liq bo‘ladi, ammo eng muhimi – mustaqil fikrlashni rivojlantirishdir." Bugungi kunda aynan shu jarayon kuzatilmoqda: raqamli texnologiyalar odamlarning fikrlash uslubini o‘zgartirmoqda.

Misol sifatida Estoniya davlatini olish mumkin. U yerda davlat boshqaruvi to‘liq raqamlashtirilgan va elektron ta’lim tizimi rivojlangan.

Yoshlar ilmiy dunyoqarashini shakllantirish zarurati.

Ilmiy tafakkur – bu dalillarga asoslangan tahliliy fikrlash va muammolarni mantiqiy hal qilish qobiliyati. Raqamlashgan jamiyatda ilmiy dunyoqarashni shakllantirish yana ham muhim ahamiyat kasb etadi.

Ilmiy tafakkurning yoshlar uchun ahamiyati.

Tanqidiy fikrlashni rivojlantiradi – yoshlar yolg‘on ma’lumot va manipulyatsiyalardan himoyalangan bo‘ladi.

Innovatsion tafakkurni shakllantiradi – yangi texnologiyalarni yaratish qobiliyati ortadi.

Ijtimoiy rivojlanishga hissa qo‘shadi – ilmiy tafakkurga ega bo‘lgan yoshlar kelajakda jamiyatni boshqaruvchi yetakchilarga aylanishadi.

Buyuk faylasuf Sokrat shunday degan: "Ilmiy fikrlashsiz inson xatolarga ko‘proq moyil bo‘ladi."

Raqamlashgan jamiyatda yolg‘on ma’lumot muammosi. Bugungi kunda internetda noto‘g‘ri va soxta ma’lumotlar keng tarqalgan. Statistika shuni ko‘rsatadiki, Facebook va Twitter’dagi yolg‘on yangiliklar haqiqatga qaraganda 70% tezroq tarqaladi. (MIT Technology Review, 2022)

Shu sababli yoshlarni ilmiy tafakkurga o‘rgatish – jamiyatning kelajakdagi barqarorligi uchun zarur omillardan biridir.

Raqamli jamiyatda yoshlar ilmiy dunyoqarashini shakllantirish usullari.

Texnologiyalar ilmiy tafakkurni rivojlantirish uchun kuchli vosita bo‘lib xizmat qilishi mumkin. Quyida zamonaviy metodlar keltirilgan.

Raqamli ta’lim platformalaridan foydalanish.

Coursera, Udemy, Khan Academy kabi onlayn platformalar orqali yoshlar o‘z bilimlarini oshirish imkoniyatiga ega. Masalan, Khan Academy dunyo bo‘ylab 120 milliondan ortiq foydalanuvchilarga bepul ta’lim berib kelmoqda.

Sun’iy intellekt va ilmiy tahlil imkoniyatlari.

ChatGPT, Google Scholar va DeepMind kabi texnologiyalar yoshlarning ilmiy izlanishlar olib borish imkoniyatlarini kengaytiradi.

Ilmiy eksperimentlar va amaliy mashg‘ulotlar.

STEM (Science, Technology, Engineering, Mathematics) dasturlari orqali yoshlar amaliy mashg‘ulotlar o‘tkazib, real tajribaga ega bo‘lishi mumkin.

Buyuk olim Lui Paster shunday degan: "Fan kelajakni yorituvchi chiroqdir."

Xulosa:

Raqamlashgan jamiyatning shakllanishi zamonaviy dunyoning muhim jarayonlaridan biri bo‘lib, u jamiyatning barcha qatlamlariga, ayniqsa, yosh avlodga bevosita ta’sir ko‘rsatmoqda. Bugungi yoshlar – axborot oqimida yashayotgan, raqamli texnologiyalarni faol o‘zlashtirayotgan avlod sifatida, yangi ilmiy dunyoqarashga ega bo‘lishlari zarur. Zero, ilmiy tafakkurga ega bo‘lgan, tanqidiy fikrlay oladigan, raqamli savodxonligi yuqori bo‘lgan shaxs – bugungi raqobatbardosh jamiyatning asosiy harakatlantiruvchi kuchidir.

Raqamli transformatsiya jarayonida yoshlarning ilmiy dunyoqarashini shakllantirish faqatgina bilim berish bilan emas, balki ularning ongida mustahkam mafkuraviy asoslar, ijtimoiy mas’uliyat va texnologik tafakkur uyg‘otish orqali amalga oshiriladi. Bu esa nafaqat ta’lim tizimi, balki oilaviy tarbiya, ommaviy axborot vositalari, raqamli platformalar hamkorligida amalga oshirilishi lozim bo‘lgan ko‘p qirrali jarayondir.

Shu boisdan, raqamli jamiyatda yoshlarga qaratilayotgan e’tibor, ularning ijtimoiy faolligini oshirish, ilmiy izlanishlarga jalb etish va texnologik dunyoni ongli ravishda qabul qilishlarini ta’minlash – zamonaviy taraqqiyotning zaruriy omili sanaladi. Ushbu yo‘nalishdagi izchil va tizimli ishlar orqali biz o‘z kelajagimizni mustahkamlovchi, millat istiqbolini belgilovchi salohiyatli avlodni voyaga yetkazamiz.

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SPECTRAL ASYMPTOTICS OF DISCRETE SCHRÖDINGER OPERATORS UNDER POINT INTERACTION POTENTIALS"

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Abstract. We investigate the one-particle discrete Schrödinger operator with Dirac delta potential on the d-dimensional lattice. We show that the operator the operator has a unique eigenvalue and obtain an asymptotics expansion for this eigenvalue as wight of potential approaches the infinity.

Keywords: Schrödinger operator, spectrum, eigenvalue, Fredholm determinant, eigenvalue asymptotics.

I. INTRODUCTION

The spectral properties of discrete Schrödinger operators have attracted significant attention in the study of both combinatorial Laplacians and quantum graphs (see [3], [4], [6], [9], [11], [15], [21], and references therein for recent summaries). In particular, the eigenvalue behavior of Schrödinger operators on lattices has been investigated in [1], [5], [8], [12], [13], and briefly discussed in [10] and [16], under the assumption that the potential is a Dirac delta function.

In addition, the spectral properties of the Hamiltonian describing the motion of a single quantum particle on a lattice in an external field were studied in [12, 16, 17, 19, 20]. These works investigated the number of eigenvalues and their locations, depending on the value of the interaction energies.

In the present paper, we study spectral properties of the discrete Schrödinger operator $\widehat{H}_\mu$, $\mu \in \mathbb{R}$, on the d- dimensional lattice with a zero-range potential (Dirac delta potential) concentrated around $x = 0 \in \mathbb{Z}^{\mathrm{d}}$ and with an extended dispersion relation depending on the real parameter β ($\beta > 0$).

In the case when the potential is δ function, the existence and uniqueness of $z(\mu)$ have been investigated in the [1, 13] and the Hamiltonian of a system of three quantum mechanical particles moving on the three-dimensional lattice $\mathbb{Z}^3$ and interacting via zero-range attractive potentials is considered in the [2, 16, 19]. In [14], asymptotical behaviour of the eigenvalues as $\mu \to 0$ was studied.

Note that the authors of [24] have investigated this operator, and they proved that the operator $\widehat{H}_\mu$ has a unique eigenvalue $z(\mu, \beta)$ for each value of the parameter μ. In addition, they showed that $z(\mu, \beta)$ is infinitely many times differentiable as the function of μ for $d = 1,2$, and established the asymptotics for this eigenvalue as $\mu \to \infty$.

In the present paper, we improve the results obtained in [24], that is, we show that $z(\mu,\beta)$ is infinitely many times differentiable as the function of μ for any dimension of the lattice $\mathbb{Z}^d$ and we get the more accurate asymptotics of eigenvalues as $\mu \to \infty$
Note that, to the best of our knowledge, this result is new in this field.
In order to facilitate the description of the content, we introduce the followius notations used throughout this manuscript: $\mathbb{Z}^d$ is the d–dimensional lattice and $\mathbb{T}^d = (\mathbb{R}/2\pi\mathbb{Z})^d = (-\pi,\pi]^d$ is the d-dimensional torus equipped with the Haar measure.

II. Discrete Schrödinger operator

The one-particle Schrödinger operator H_μ in the momentum representation is defined as

$$H_\mu = \mathcal{F}^*\widehat{H}_\mu\mathcal{F}, \quad H_\mu = H_0 - V_\mu,$$

where

$$H_0 = \mathcal{F}^*(-\triangle)\mathcal{F}, \quad V_\mu = \mathcal{F}^*\widehat{V}_\mu\mathcal{F}. \tag{1}$$

Here, $\mathcal{F}$ stands for the standard Fourier transformation $\mathcal{F}: L^2(\mathbb{T}^d) \to \ell^2(\mathbb{Z}^d)$ with the inverse $\mathcal{F}^*: \ell^2(\mathbb{Z}^d) \to L^2(\mathbb{T}^d)$. Explicitly, the non-perturbed operator H_0 acts on $L^2(\mathbb{T}^d)$ as a multiplication operator by the function $\varepsilon(\cdot)$:

$$(H_0 f)(p) = \varepsilon(p)f(p), \quad f \in L^2(\mathbb{T}^d), \quad p \in \mathbb{T}^d,$$

where

$$\varepsilon(p) = \sum_{j=1}^{d}(1-\cos p_j) + \beta(1-\cos 2p_j), \quad p \in \mathbb{T}^d, \quad \beta \geq 0. \tag{2}$$

In the physical literature, the function $\varepsilon(\cdot)$, being a real valued-function on $\mathbb{T}^d$, is called the dispersion relation of the Laplacian operator $-\triangle$.
The potensial operator is transformed into a rank one integral operator

$$(Vf)(p) = \frac{\mu}{(2\pi)^d}\int_{\mathbb{T}^d} f(q)dq, \quad f \in L^2(\mathbb{T}^d). \tag{3}$$

Now, we present the lemma on the range of the function $\varepsilon(p)$ defined in the form (3).

Lemma 1. ***a) For any $\beta > 0$, the function $\varepsilon(p)$ has a non-degenerate minimum at the point $Q_0 = (0,0,\dots,0)$ and $\varepsilon(Q_0) = 0$.***

b1) If $0 < \beta < \frac{1}{4}$, then the function $\varepsilon(p)$ has a non-degenerate maximum at the point $Q_1 = (\pi,\pi,\dots,\pi)$ and $\varepsilon(Q_1) = 2d$.

b2) When $\beta = \frac{1}{4}$, the function $\varepsilon(p)$ has degenerate maximum at the point $Q_1 = (\pi,\pi,\dots,\pi)$ and $\varepsilon(Q_1) = 2d$.

b3) When $\beta > \frac{1}{4}$, the fuction $\varepsilon(p)$

$Q_2 = \left(arccos\left(-\frac{1}{4\beta}\right), arccos\left(-\frac{1}{4\beta}\right), \ldots, arccos\left(-\frac{1}{4\beta}\right)\right)$ *has a non-degenerate maximum at the point* $\varepsilon(Q_2) = \sum_{i=1}^{d} \frac{(1+4\beta)^2}{8\beta} = \frac{(1+4\beta)^2 d}{8\beta}$.

III. The essential spectrum.

H_0 is a multiplication operator by the real valued, continuous function and the perturbation $V$is the one-dimensional operator and, therefore, in accordance to the Weyl theorem on the stability of the essential spectrum the equality $\sigma_{ess}(H_\mu) = \sigma_{ess}(H_0)$ holds the essential spectrum of the operator H_μ consists of the following segment on the real axis:

$$\sigma_{ess}(H_\mu) = [\varepsilon_{\min}, \varepsilon_{\max}]$$

that is

$$\varepsilon_{\min} = 0 \quad \text{and } \varepsilon_{\max} = \begin{cases} 2d, & 0 \le \beta \le \frac{1}{4}, \\ \frac{(1+4\beta)^2 d}{8\beta}, & \beta > \frac{1}{4}. \end{cases}$$

IV. Fredholm determinant of the operator H_μ

For any $\mu \in \mathbb{R}$, we define the Fredholm determinant associated with the operator H_μ as a regular function in $z \in \mathbb{R}\backslash[\varepsilon_{\min}, \varepsilon_{\max}]$ as

$$D(\mu, z) = 1 - \frac{\mu}{(2\pi)^d} \int_{\mathbb{T}^d} \frac{dp}{\varepsilon(p) - z}. \tag{4}$$

Lemma 2. *The number* $z \in \mathbb{C}\backslash[\varepsilon_{min}, \varepsilon_{max}]$ *is an eigenvalue of* H_μ *if and only if* $D(\mu, z) = 0$ *and their multiplicities are the same.*

Lemma 3. a) Let $d = 1,2$. Then

$$I = \lim_{z \to \varepsilon_{\min} -} \int_{\mathbb{T}^d} \frac{dq}{\varepsilon(q) - z} = \int_{\mathbb{T}^d} \frac{dq}{\varepsilon(q) - \varepsilon_{\min}} = +\infty.$$

b) Let $d \ge 3$. In that case the integral

$$I = \int_{\mathbb{T}^d} \frac{dq}{\varepsilon(q) - \varepsilon_{\min}}$$

exists.

Lemma 4. *a) a) If* $d = 1,2$ *or* $d = 3,4$ *and* $\beta = \frac{1}{4}$, *then*

$$d(\varepsilon_{\max}) = \int_{\mathbb{T}^d} \frac{dq}{\varepsilon(q) - \varepsilon_{\max}} = -\infty$$

b) If $d \geq 3$ *and* $\beta \neq \frac{1}{4}$ *or* $d > 4$ *and* $\beta = \frac{1}{4}$, *then*

$$d(\varepsilon_{max}) = \int_{\mathbb{T}^d} \frac{dq}{\varepsilon(q) - \varepsilon_{\max}}$$

exists.

Lemma 5. a) For any $\mu > 0$ there exists a unique number $z(\mu, \beta)$ in the interval $(-\infty, 0)$ such that $D(\mu, z(\mu, \beta)) = 0$, and $z(\mu, \beta)$ is differentiable with respect to the μ-variable.
b) For any $\mu < 0$ there exists a unique number $z(\mu, \beta)$ in the interval $(\varepsilon_{max}, \infty)$ such that $D(\mu, z(\mu, \beta)) = 0$, and $z(\mu, \beta)$ is differentiable with respect to the μ-variable.

Theorem 1. Let $d(d \geq 3)$ *and*

$$\mu_0 = \left(\frac{1}{(2\pi)^d} \int_{\mathbb{T}^d} \frac{dq}{\varepsilon(q) - 0}\right)^{-1}, \qquad \mu^0 = \left(\frac{1}{(2\pi)^d} \int_{\mathbb{T}^d} \frac{dq}{\varepsilon(q) - \varepsilon_{\max}}\right)^{-1}.$$

a) If $\mu > \mu_0$, *the operator* H_μ *has a unique eigenvalue* $z(\mu, \beta)$*in the interval* $(-\infty, 0)$ *and has no eigenvalue to the right of essential spectrum.*

b) If $\mu < \mu^0$, *the operator* H_μ *has a unique eigenvalue* $z(\mu, \beta)$*in the interval* $(\varepsilon_{max}, \infty)$ *and has no eigenvalue to the left of essential spectrum.*

c) If $\mu^0 \leq \mu \leq \mu_0$, *the operator*$H_\mu$ *has no an eigenvalue eighter in the interval* $(-\infty, 0)$ *or* $(\varepsilon_{max}, +\infty)$.

Proof. Lemmas 3 and 5 imply the proof.

Lemma 6. $z(\mu, \beta)$ *satisfies the asymptotics*

$$z(\mu, \beta) = \frac{1}{-\frac{1}{\mu} - d(1+\beta)\frac{1}{\mu^2} - \frac{d((2d-1)\beta^2 + 4d\beta + (2d-1))}{2!}\frac{1}{\mu^3} + O(\frac{1}{\mu^4})},$$

$as \quad \mu \longrightarrow \infty.$

Theorem 2. $z(\mu, \beta)$ *satisfies the asymptotics*

$$z(\mu, \beta) = -\mu + d(1+\beta) - \frac{d(1+\beta^2)}{2!}\frac{1}{\mu} - (1+\beta)\big((d-1)\beta^2 + 2d\beta + d - 1\big)\frac{1}{\mu^2}$$
$$+ \frac{d^2\big((2d-1)\beta^2 + 4d\beta + (2d-1)\big)\big((4d+1)\beta^2 + 8d\beta + 4d + 1\big)}{(2!)^2}\frac{1}{\mu^3} + O\left(\frac{1}{\mu^4}\right),$$

as $\mu \to \infty$.

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THE NATIONAL DRESS AS A SYMBOL OF IDENTITY: HARMONY OF TRADITION AND MODERN AESTHETICS IN FASHION DESIGN

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Abstract: The national costume of a people is more than just a traditional garment; it is a visual expression of cultural identity, historical continuity, and aesthetic philosophy. This article explores the symbolic and functional significance of Uzbek traditional dress as a marker of national identity, tracing its evolution from ancient customs to contemporary fashion design. Rooted in centuries of craftsmanship, folklore, and regional diversity, the national attire embodies intricate embroidery, vibrant colors, and silhouette structures that mirror the beliefs, rituals, and socio-cultural codes of the Uzbek people. The research investigates how modern fashion designers in Uzbekistan and beyond reinterpret these traditional elements to create contemporary clothing that maintains its ethnic authenticity while appealing to global aesthetic trends. It emphasizes the role of fashion as a cultural bridge, where heritage and innovation meet, creating styles that speak to both local values and international audiences. Special attention is paid to the integration of traditional ornamentation, handwoven fabrics, and symbolic motifs into present-day collections, showcasing how ancestral designs continue to inspire modern creativity.

This article also discusses the cultural diplomacy function of national dress in international arenas, such as fashion weeks, cultural exhibitions, and tourism campaigns. Through qualitative analysis and visual documentation, the study affirms that the preservation and creative adaptation of national costume design serve as a powerful instrument in maintaining cultural heritage and promoting a sense of belonging among the younger generation. Ultimately, Uzbek national dress is presented not merely as historical relics but as a living art form that harmonizes memory, identity, and modernity.

Keywords: Uzbek national dress, cultural identity, traditional costume, fashion design, embroidery, modern aesthetics, heritage preservation, symbolism in clothing, ethnic fashion, cultural continuity, handcrafted textiles, national identity in design, traditional motifs, globalization and fashion, fashion diplomacy.

Introduction

Clothing has always served as a powerful medium for expressing cultural identity, social values, and historical continuity. Among various forms of dress, the *national costume* holds a unique position as it embodies not only aesthetic preferences but also the spirit, worldview, and traditions of a nation. In the case of Uzbekistan, the national dress is a vivid symbol of the country's rich cultural heritage, reflecting centuries of artistic craftsmanship, regional diversity, and the deep-rooted customs of the Uzbek people. From the elegantly embroidered "atlas" and "adras" fabrics to the distinctive cuts and vibrant ornamentation, every detail of traditional Uzbek attire tells a story that transcends time and place. In an increasingly globalized world, where fashion trends often lean toward homogenization, the preservation and creative reimagining of national dress have gained renewed significance. Designers, artists, and cultural scholars in Uzbekistan and beyond are turning their attention back to indigenous forms, seeking inspiration in ancestral patterns, traditional silhouettes, and textile practices. This revival is not merely a nostalgic gesture—it is a conscious cultural statement that asserts identity and resists cultural erasure in the face of globalization. It is within this dynamic intersection of tradition and innovation that Uzbek national dress finds new life, evolving into contemporary fashion while safeguarding its authentic spirit. Moreover, the role of national attire extends beyond personal or community identity. It acts as a form of soft power on international stages, from global fashion weeks to cultural diplomacy events. When modern fashion designers incorporate traditional Uzbek motifs into runway collections, they do more than create visually striking garments—they carry forward a message of pride, resilience, and cultural memory. The fusion of old and new in clothing design thus becomes an artistic dialogue that resonates with both local and global audiences, offering a model for sustainable and identity-centered fashion practices. This article aims to explore the aesthetic, cultural, and symbolic dimensions of Uzbek national dress, examining how traditional design principles are harmonized with modern fashion aesthetics. Through historical analysis, case studies of contemporary designers, and cultural interpretation, the paper reveals how the national dress functions as a living symbol of Uzbek identity—a symbol that is not frozen in time but continuously redefined through artistic expression and societal transformation.

Relevance of the topic

In an era characterized by rapid globalization, cultural homogenization, and the relentless pace of digital media, the importance of preserving and promoting national identity has never been more pressing. As borders between cultures become increasingly porous, many nations are faced with the challenge of maintaining their

unique heritage while adapting to global influences. Within this context, national dress emerges as a crucial medium through which collective memory, cultural values, and historical narratives are preserved and communicated to future generations. For Uzbekistan, a country with a deeply rooted and diverse cultural heritage, traditional attire is more than just clothing—it is a visual language that expresses identity, history, gender roles, and regional characteristics. The intricate craftsmanship of handwoven fabrics, the symbolism embedded in embroidery patterns, and the stylistic nuances of various garments reflect the spiritual and aesthetic ideals of the Uzbek people. In recent years, this heritage has become increasingly relevant as a source of inspiration in the contemporary fashion industry, both at home and abroad.

The topic is particularly timely due to the global movement toward sustainable and ethical fashion. In contrast to mass-produced clothing, traditional dress is often handmade, environmentally conscious, and rooted in slow-fashion principles. This positions Uzbek national attire as a potential model for future-oriented fashion practices that value authenticity, craftsmanship, and cultural storytelling. Furthermore, the revitalization of national dress contributes to social cohesion and national pride, especially among younger generations seeking a sense of belonging in a rapidly changing world. By reintroducing traditional motifs and designs into modern wardrobes, designers and cultural advocates create bridges between generations and stimulate cultural continuity. It also serves as a tool of cultural diplomacy—Uzbek national costumes have been showcased in international fashion weeks, exhibitions, and tourism platforms, enhancing the country's soft power and global cultural presence. Thus, the study of how traditional Uzbek clothing is being integrated into modern design is not only relevant—it is essential for understanding how cultures survive, adapt, and thrive in a globalized world. This topic resonates with broader discussions on cultural identity, heritage preservation, creative industries, and intercultural dialogue, making it a vital subject of academic and practical interest.

Discussion and findings

The study of Uzbek national dress in the context of contemporary fashion reveals a multifaceted interaction between history, identity, aesthetics, and innovation. The resurgence of interest in traditional clothing is not an isolated phenomenon but part of a broader global trend toward cultural reclamation and authenticity in design. In this regard, Uzbekistan presents a rich case study due to its long-standing textile traditions, regional variations, and unique cultural motifs. One of the key findings of this research is that traditional Uzbek garments continue to serve as a dynamic form of cultural expression. Despite the pressures of globalization, many designers have successfully revitalized national dress by blending ancient techniques with modern tailoring.

Notable examples include the use of traditional fabrics such as *atlas*, *adras*, and *bekasab* in modern silhouettes, often adapted for global fashion platforms while retaining distinct ethnic elements.

The integration of traditional symbolism—such as fertility motifs, protective talismans, and representations of nature—into contemporary fashion serves as both a cultural preservation strategy and a creative challenge. Designers are increasingly aware of the responsibility to honor tradition while avoiding cultural commodification. As a result, many fashion houses and independent artists engage in direct collaboration with rural artisans, thereby supporting sustainable livelihoods and encouraging intergenerational knowledge transfer. Another significant outcome is the recognition of national dress as a soft power tool. Uzbek fashion has gained visibility through cultural diplomacy initiatives, international expos, and fashion weeks, where traditional attire is recontextualized as a statement of national pride and identity. This elevates the perception of Uzbek design not merely as folklore, but as contemporary art with global relevance. The findings also highlight an increasing appreciation of handcrafted, ethically produced clothing among younger consumers. As fast fashion faces criticism for its environmental and social impact, there is growing interest in garments that tell stories, reflect cultural values, and support artisan communities. Uzbek national dress, with its emphasis on craftsmanship, natural dyes, and symbolic depth, aligns with this shift in consumer consciousness. In conclusion, the national dress of Uzbekistan represents far more than attire—it is a cultural archive, a living narrative, and a visual embodiment of identity. Its ongoing evolution within the framework of modern design offers a model for other cultures seeking to balance tradition and innovation. By embracing the artistic legacy of the past while addressing the aesthetic and ethical demands of the present, Uzbek fashion continues to reaffirm its place on the world stage as a symbol of resilience, beauty, and cultural pride.

Aspect	Traditional Uzbek Dress	Contemporary Fashion Adaptation
Fabrics	Handwoven silk, *atlas*, *adras*, cotton	Mixed textiles, eco-friendly fabrics, digital prints
Color palette	Deep, vibrant tones (red, green, blue, gold)	Balanced palette: natural, pastel, and fusion tones
Embroidery motifs	Symbolic designs (protection, fertility, nature)	Stylized reinterpretations, used as branding elements
Production method	Handmade, labor-intensive, artisanal	Combined handmade and machine production

Cultural function	Used for rites, ceremonies, status symbols	Worn for fashion, everyday wear, global representation
Design silhouette	Loose-fitting robes, long dresses, layered garments	Modern cuts: tailored jackets, skirts, fusion wear
Craftsmen involvement	Local artisans, often women in rural communities	Designer-artisan collaborations, social entrepreneurship
Symbolic role	Embodiment of heritage, ethnic identity	Cultural branding, soft power, fashion diplomacy

Conclusion

The exploration of Uzbek national dress as a symbol of identity reveals the enduring significance of clothing in preserving and communicating cultural heritage. Traditional Uzbek garments are not static relics of the past, but dynamic carriers of meaning that continue to evolve through the lens of contemporary design. By integrating historical elements—such as handwoven fabrics, regional embroidery, and culturally symbolic patterns—into modern fashion, designers are not only preserving national identity but also revitalizing it for new generations. The study highlights that the fusion of tradition and modernity is not a compromise, but a creative synthesis that honors both the past and the present. This process strengthens cultural continuity, supports local artisans, and promotes ethical and sustainable design practices. Furthermore, Uzbek national dress has gained international recognition as a tool of cultural diplomacy, showcasing the country's rich heritage on global platforms and contributing to its soft power. Ultimately, national dress serves as a vibrant medium through which identity, memory, artistry, and innovation intersect. As globalization continues to influence fashion trends, the ability to maintain cultural authenticity while adapting to modern aesthetics will be critical in safeguarding intangible heritage and enriching the global cultural landscape.

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