



SCIENTIFIC AND TECHNICAL JOURNAL  
Namangan Institute of Engineering and Technology

«SIMULATION OF HEAT TRANSFER PROCESS IN ABSORBER  
CHANNELS»

Nigmatov Ulugbek

Senior Lecturer

Fergana Polytechnic Institute

<https://doi.org/10.5281/zenodo.7950954>



ISSN 2181-8622

**Manufacturing technology problems**



**Scientific and Technical Journal  
Namangan Institute of  
Engineering and Technology**

**Volume 8  
Issue 1  
2023**



of adsorption capacity of imported adsorbents is economically effective by saving foreign currency based on the use of local adsorbents instead, and secondly, it is ecologically effective due to the characteristics of industrial wastewater treatment.

### References

1. Muminov S.Z., Aripov E.A., Research in the field of thermodynamics and thermochemistry of adsorption on clay minerals. Tashkent Fan 1987.144p
2. Muminov., Khandamov D.A., Rakimov G.B. Equilibrium adsorption of benzene vapor on alkylammonium montmorillonite // Colloid. legal. - 2015. - Volume 77. - No. 5. - P. 675-680.
3. Tikhomirova E.I., Zamatyrina V.A., Boichenko E.A., Koshelev A.V. Ecological justification for obtaining and using biologically active organobentonites // Fundamental research. - 2013. - No. 4-3. - S. 660-662.
4. Zamatyrina V. A. Method of purification of wastewater from heavy metals and oil products using modified organobentonite: Abstract of the thesis. dis. ... cand. Tech. Sciences. - Penza. SGTU, 2015. - 19 p.
5. Nuriddinova F.M. Adsorption of active dyes from the composition of wastewater from cosmetic factories // Uchenyy XXI veka. International scientific journal. – 2016. – No. 2-1. - S. 11-15.
6. G'.M. Ochilov, I.M. Boymatov, K.K. Isakov, N. G'aniyeva, O.K. Ergashev Adsorption of various substances on activated adsorbents based on natural raw materials

UDC 662.997÷621.47

## SIMULATION OF HEAT TRANSFER PROCESS IN ABSORBER CHANNELS

**NIGMATOV ULUGBEK**

Senior Lecturer of Fergana Polytechnic Institute  
E-mail: [ulugbeknigmatov488@gmail.com](mailto:ulugbeknigmatov488@gmail.com), phone: (+99891) 113-59-40

### Abstract:

**Objective.** At present, the issues of systematization of the energy balance, the development of thermal and mathematical models, as well as the generalization of methods and computer programs for calculating photovoltaic thermal modules are relevant.

**Methods.** The program "Comsol Multiphysics 5.6." was used to simulate the process occurring inside the absorber. To describe the laminar motion of a liquid (water), a non-stationary system based on the Navier-Stokes equation and the [1] heat distribution equation was used.

**Results.** This article describes a mathematical model of heat transfer in absorber channels developed using the «Comsol Multiphysics 5.6. program». The results are presented for determining the longitudinal flow velocity at various sections of the flow channel, heat distribution over time, as well as the heat distribution isoline and isotherm.

**Conclusion.** Developed on the basis of the program «Comsol Multiphysics 5.6.» a simulation model of heat transfer from a photovoltaic battery to a heat absorber can be used to calculate heat and power supply systems. The use of a simulation model in the design of a heat and power supply system makes it possible to reduce the consumption of heat and electricity.

**Keywords:** absorber, flow, temperature, hydrostatic pressure, viscosity coefficient, flow channel.

**Introduction.** Design of solar power plants, allowing to generate electrical and thermal power on an energetically tangible scale without negative impact on the environment; experimental research and practical application of solar power plants

[2, 3, 4]; research to improve the efficiency of photoelectric conversion; development and improvement of existing structures for air, water heat supply, cooling and heat removal with forced cooling [5, 6, 7]; the widespread use of automated control systems in solar power plants [8, 9] are priority areas for the Central Asian region.

A comprehensive study of heat exchange processes makes it possible to reduce the dimensions of heat exchangers in the manufacturing sector by increasing their efficiency.

Actual problems of the theory of heat transfer at present are issues related to the intensification of convective heat transfer. It should be noted here that the problems associated with heat transfer in laminar flow are not widely considered and studied due to the limited number of research works. As is known, according to the theory of the boundary layer, in the laminar regime, the movement of fluid in the near-wall surface transfers heat more efficiently than in the case of flow turbulence.

Although a number of developed and researched methods of heat transfer intensification are known, they are classified into two main categories.

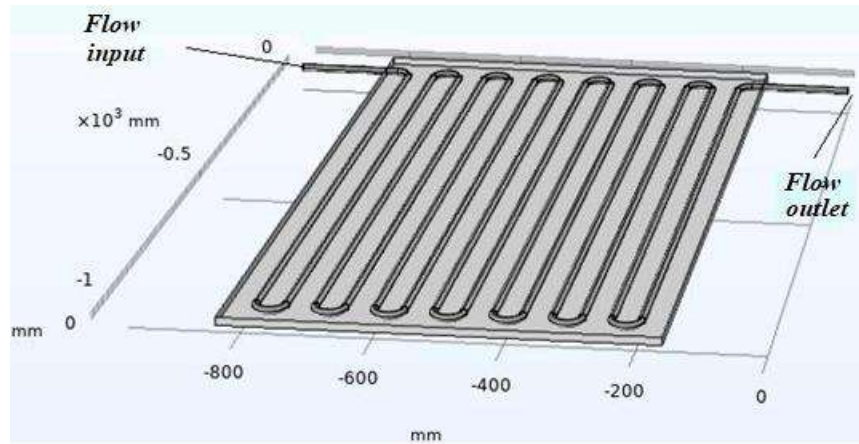
There are many recommendations of researchers on the issues of heat transfer in pipes with various types of intensifiers, the constructive solution of which depends on changes in loads, physical properties of the medium, and process features.

At present, the issues of systematization of the energy balance, the development of thermal and mathematical models, as well as the generalization of methods and computer programs for calculating photovoltaic thermal modules are relevant.

**Methods.** The physical picture of the analyzed flow of a liquid (water) thermal agent and the configuration of the computational domain are [1] shown in (Fig. 1, 2). The program “Comsol Multiphysics 5.6.” was used to simulate the process occurring inside the absorber.



Figure 1. General view of the studied thermal absorber: lower (a) and upper (b) sides



**Figure 2. General view of the thermal absorber**

To describe the laminar motion of a liquid (water), a non-stationary system based on the Navier-Stokes equation and the [1] heat distribution equation was used. These equations in cylindrical coordinates  $(z, r, \varepsilon)$  have the following form [10]:

$$\left\{ \begin{array}{l} \frac{\partial r V_z}{\partial z} + \frac{\partial r V_r}{\partial r} + \frac{\partial V_\varepsilon}{\partial \varepsilon} = 0, \\ \rho \left( \frac{\partial V_z}{\partial \tau} + V_z \frac{\partial V_z}{\partial z} + V_r \frac{\partial V_z}{\partial r} + V_\varepsilon \frac{\partial V_z}{\partial \varepsilon} \right) = -\frac{\partial p}{\partial x} + \mu \left( \frac{\partial^2 V_z}{\partial z^2} + \frac{\partial^2 V_z}{\partial r^2} + \frac{1}{r^2} \frac{\partial^2 V_z}{\partial \varepsilon^2} + \frac{1}{r} \frac{\partial V_z}{\partial r} \right), \\ \rho \left( \frac{\partial V_r}{\partial \tau} + V_z \frac{\partial V_r}{\partial z} + V_r \frac{\partial V_r}{\partial r} + V_\varepsilon \frac{\partial V_r}{\partial \varepsilon} - \frac{V_\varepsilon^2}{r} \right) = -\frac{\partial p}{\partial r} + \mu \left( \frac{\partial^2 V_r}{\partial z^2} + \frac{\partial^2 V_r}{\partial r^2} + \frac{1}{r^2} \frac{\partial^2 V_r}{\partial \varepsilon^2} + \frac{1}{r} \frac{\partial V_r}{\partial r} \right), \\ \rho \left( \frac{\partial V_\varepsilon}{\partial \tau} + V_z \frac{\partial V_\varepsilon}{\partial z} + V_r \frac{\partial V_\varepsilon}{\partial r} + V_\varepsilon \frac{\partial V_\varepsilon}{\partial \varepsilon} - \frac{V_\varepsilon V_r}{r} \right) = -\frac{\partial p}{\partial \varepsilon} + \mu \left( \frac{\partial^2 V_\varepsilon}{\partial z^2} + \frac{\partial^2 V_\varepsilon}{\partial r^2} + \frac{1}{r^2} \frac{\partial^2 V_\varepsilon}{\partial \varepsilon^2} + \frac{1}{r} \frac{\partial V_\varepsilon}{\partial r} \right), \\ \rho c_p \left( \frac{\partial T}{\partial \tau} + V_z \frac{\partial T}{\partial z} + V_r \frac{\partial T}{\partial r} + \frac{V_\varepsilon}{r} \frac{\partial T}{\partial \varepsilon} \right) = \frac{\partial}{\partial z} \left( \lambda \frac{\partial T}{\partial z} \right) + \frac{\partial}{\partial r} \left( r \lambda \frac{\partial T}{\partial r} \right) + \frac{1}{r} \frac{\partial}{\partial \varepsilon} \left( \lambda \frac{\partial T}{\partial \varepsilon} \right). \end{array} \right. \quad (1)$$

In the above equations,  $V_z, V_r, V_\varepsilon$  are the axial, radial, and tangential components of the flow velocity vector, respectively, and  $T$  is the temperature.  $p$  is the hydrostatic pressure,  $\mu$  is the dynamic coefficient of viscosity,  $c_p$  is the heat capacity,  $\lambda$  is the thermal conductivity.

When dimensionless values are introduced, the pipe diameter,  $D$ , is taken as the length scale, and the average flow rate,  $U_0$  at the pipe inlet, is taken as the velocity scale.

Dimensionless parameters are introduced:

$$U = \frac{V_z}{U_0}, V = \frac{V_r}{U_0}, W = \frac{V_\varepsilon}{U_0}, \text{Re} = \frac{\rho D U_0}{\mu}, \text{Pr} = \frac{\lambda}{\mu c_p}.$$

After the introduction of dimensionless quantities, the system equation (1) takes the following form.

$$\left\{ \begin{aligned}
 & \frac{\partial rU}{\partial z} + \frac{\partial rV}{\partial r} + \frac{\partial W}{\partial \varepsilon} = 0, \\
 & \frac{\partial U}{\partial \tau} + U \frac{\partial U}{\partial z} + V \frac{\partial U}{\partial r} + \frac{W}{r} \frac{\partial U}{\partial \varepsilon} = -\frac{\partial p}{\rho \partial x} + \frac{1}{\text{Re}} \left( \frac{\partial^2 U}{\partial z^2} + \frac{\partial^2 U}{\partial r^2} + \frac{1}{r^2} \frac{\partial^2 U}{\partial \varepsilon^2} + \frac{1}{r} \frac{\partial U}{\partial r} \right), \\
 & \frac{\partial V}{\partial \tau} + U \frac{\partial V}{\partial z} + V \frac{\partial V}{\partial r} + W \frac{\partial V}{\partial \varepsilon} - \frac{W^2}{r} = -\frac{\partial p}{\rho \partial r} + \frac{1}{\text{Re}} \left( \frac{\partial^2 V}{\partial z^2} + \frac{\partial^2 V}{\partial r^2} + \frac{1}{r^2} \frac{\partial^2 V}{\partial \varepsilon^2} + \frac{1}{r} \frac{\partial V}{\partial r} \right), \\
 & \frac{\partial W}{\partial \tau} + U \frac{\partial W}{\partial z} + V \frac{\partial W}{\partial r} + W \frac{\partial W}{\partial \varepsilon} - \frac{WV}{r} = -\frac{\partial p}{\rho \partial \varepsilon} + \frac{1}{\text{Re}} \left( \frac{\partial^2 W}{\partial z^2} + \frac{\partial^2 W}{\partial r^2} + \frac{1}{r^2} \frac{\partial^2 W}{\partial \varepsilon^2} + \frac{1}{r} \frac{\partial W}{\partial r} \right), \\
 & \frac{\partial T}{\partial \tau} + U \frac{\partial T}{\partial z} + V \frac{\partial T}{\partial r} + \frac{W}{r} \frac{\partial T}{\partial \varepsilon} = \frac{1}{\text{RePr}} \frac{\partial}{\partial z} \left( \frac{\partial T}{\partial z} \right) + \frac{1}{\text{RePr}} \frac{\partial}{\partial r} \left( r \frac{\partial T}{\partial r} \right) + \frac{1}{\text{RePr}} \frac{1}{r} \frac{\partial}{\partial \varepsilon} \left( \frac{1}{r} \frac{\partial T}{\partial \varepsilon} \right).
 \end{aligned} \right. \quad (2)$$

Obvious no-slip boundary conditions are set on all fixed solid walls  $U|_{hb} = 0$ ,  $V|_{hb} = 0$  and  $W|_{hb} = 0$ , where  $hb$  – hard border. At the channel outlet in the section for horizontal and vertical velocities, the standard extrapolation conditions are accepted.

$$\frac{\partial^2 U}{\partial z^2} = \frac{\partial^2 V}{\partial z^2} = \frac{\partial^2 W}{\partial z^2} = 0.$$

**Numerical scheme.** The dimensionless Navier-Stokes equation in vector form will have the following form:

$$\frac{\partial \Phi}{\partial t} + U \frac{\partial \Phi}{\partial x} + V \frac{\partial \Phi}{\partial y} = \frac{\partial}{\partial z} \left( A \frac{\partial \Phi}{\partial z} \right) + \frac{\partial}{\partial r} \left( A \frac{\partial \Phi}{\partial r} \right) + \frac{\partial}{\partial \varepsilon} \left( A \frac{\partial \Phi}{\partial \varepsilon} \right) + \Pi^\Phi. \quad (3)$$

$$\text{Here: } \Phi = \begin{pmatrix} U \\ V \\ W \\ T \end{pmatrix}, A^\Phi = \begin{pmatrix} \frac{1}{\text{Re}} \\ \frac{r}{\text{Re}} \\ \frac{r}{\text{Re}} \\ \frac{r}{\text{RePr}} \end{pmatrix}, \Pi^\Phi = \begin{pmatrix} \frac{\partial p}{\rho \partial z} \\ \frac{\partial p}{\rho \partial r} \\ \frac{\partial p}{\rho \partial \varepsilon} \\ 0 \end{pmatrix}.$$

**McCormack's scheme.** As is known, the McCormack method [11] is widely used to solve the equations of gas dynamics. McCormack's method is especially useful for solving non-linear partial differential equations.

Applying the explicit «predictor-corrector» method to the nonlinear Navier-Stokes equation, we obtain the following difference scheme:

**Predictor:**

$$\begin{aligned}
 \bar{\Phi}_{i,j,k} = & \Phi_{i,j,k}^n - \Delta t \left( U_{i,j,k}^n \frac{\Phi_{i+1,j,k}^n - \Phi_{i,j,k}^n}{\Delta z} + V_{i,j,k}^n \frac{\Phi_{i,j+1,k}^n - \Phi_{i,j,k}^n}{\Delta r} + W_{i,j,k}^n \frac{\Phi_{i,j,k+1}^n - \Phi_{i,j,k}^n}{\Delta \varepsilon} \right) + \\
 & + \Delta t \left( \frac{\Phi_{i,j+1,k}^n - 2\Phi_{i,j,k}^n + \Phi_{i,j-1,k}^n}{\text{Re} \Delta r^2} + \frac{\Phi_{i+1,j,k}^n - 2\Phi_{i,j,k}^n + \Phi_{i-1,j,k}^n}{\text{Re} \Delta z^2} + \frac{\Phi_{i,j,k+1}^n - 2\Phi_{i,j,k}^n + \Phi_{i,j,k-1}^n}{\text{Re} \Delta \varepsilon^2} + \Pi^\Phi \right).
 \end{aligned} \quad (4)$$

**Corrector:**

$$\Phi_{i,j,k}^{n+1} = \frac{1}{2} \left( \begin{aligned} & \bar{\Phi}_{i,j,k} + \Phi_{i,j,k}^n - \Delta t \left( U_{i,j,k}^n \frac{\Phi_{i,j,k}^n - \Phi_{i-1,j,k}^n}{\Delta z} + V_{i,j,k}^n \frac{\Phi_{i,j,k}^n - \Phi_{i,j-1,k}^n}{\Delta r} + W_{i,j,k}^n \frac{\Phi_{i,j,k}^n - \Phi_{i,j,k-1}^n}{\Delta \varepsilon} \right) + \\ & + \Delta t \left( \frac{\bar{\Phi}_{i,j+1,k} - 2\bar{\Phi}_{i,j,k} + \bar{\Phi}_{i,j-1,k}}{\text{Re} \Delta r^2} + \frac{\bar{\Phi}_{i+1,j,k} - 2\bar{\Phi}_{i,j,k} + \bar{\Phi}_{i-1,j,k}}{\text{Re} \Delta z^2} + \frac{\bar{\Phi}_{i,j,k+1} - 2\bar{\Phi}_{i,j,k} + \bar{\Phi}_{i,j,k-1}}{\text{Re} \Delta \varepsilon^2} + \Pi^\Phi \right) \end{aligned} \right). \quad (5)$$

This explicit scheme of the second order of accuracy with the approximation error  $O((\Delta t)^2, (\Delta z)^2, (\Delta r)^2, (\Delta \varepsilon)^2)$  is stable for  $U_{\max} \Delta t \left( \frac{1}{\Delta z} + \frac{1}{\Delta r} + \frac{1}{\Delta \varepsilon} \right) < 1$ , which corresponds to the Courant conditions [12].

Initially, the (predictor) is found with the  $\bar{\Phi}_i^{n+1}$  value and at the  $n + 1$ -th time step, and then the (corrector) is determined by the final value of  $\Phi_i^{n+1}$  at the  $n + 1$ -th time step. Note that the predictor is approximated by forward

differences, and the corrector is approximated backward by differences.

A similar scheme was used for transverse speed. A feature of discretization is that the finite difference approximation is centered according to the chosen pattern. In this case, the grid indices for the dependent variables turn out to be shifted.

The velocities obtained according to schemes (5) do not satisfy the continuity equation. Therefore, following the SIMPLE procedure [13], we introduce a pressure correction  $\delta p_{i,j}$  that satisfies the condition

$$\left\{ \begin{aligned} U_{i,j}^{n+1} &= U_{i,j}^n - \Delta t \frac{\partial \delta p_{i,j}}{\partial x}, \\ V_{i,j}^{n+1} &= V_{i,j}^n - \Delta t \frac{\partial \delta p_{i,j}}{\partial y} \end{aligned} \right. \quad (6)$$

Now, substituting the velocities  $\tilde{U}_{i,j}^{n+1}, \tilde{V}_{i,j}^{n+1}$  into the continuity equation, it is easy to obtain the following equation

$$\left( \frac{\delta p_{i+1,j} - 2\delta p_{i,j} + \delta p_{i-1,j}}{\Delta x^2} \right) + \left( \frac{\delta p_{i,j+1} - 2\delta p_{i,j} + \delta p_{i,j-1}}{\Delta y^2} \right) = \frac{1}{\Delta t} \left( \frac{U_{i+1,j}^{n+1} - U_{i-1,j}^{n+1}}{2\Delta x} + \frac{V_{i,j+1}^{n+1} - V_{i,j-1}^{n+1}}{2\Delta y} \right). \quad (7)$$

To solve equation (7), we used the iterative method of upper relaxation. Thus, according to (5), intermediate values of the parameters are determined, then, according to equation (7), the correction pressure is

determined. Therefore, the pressure on time layer  $n + 1$  will be equal to  $p^{n+1} = p^n + \delta p$ .

Figure 3 shows a difference grid in which 973128 cells are used.

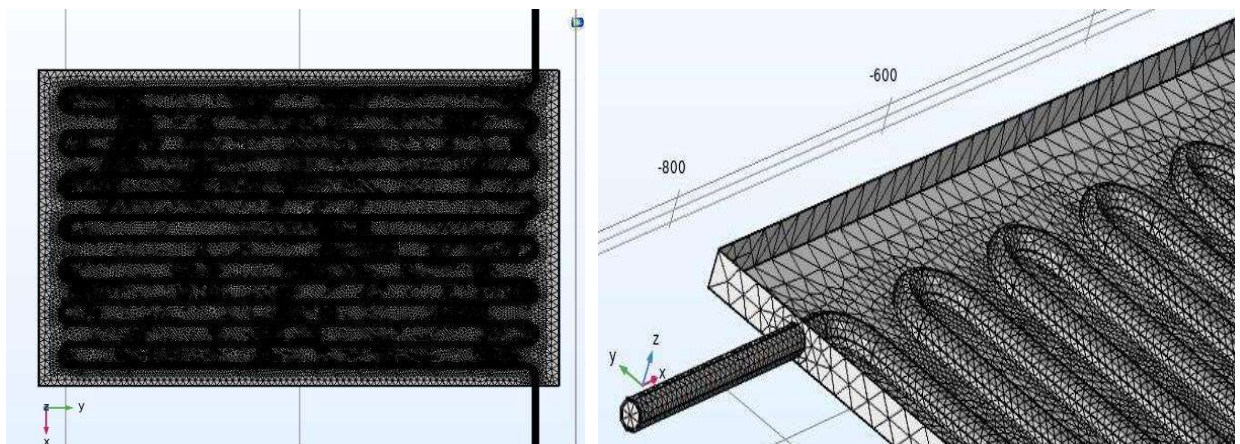
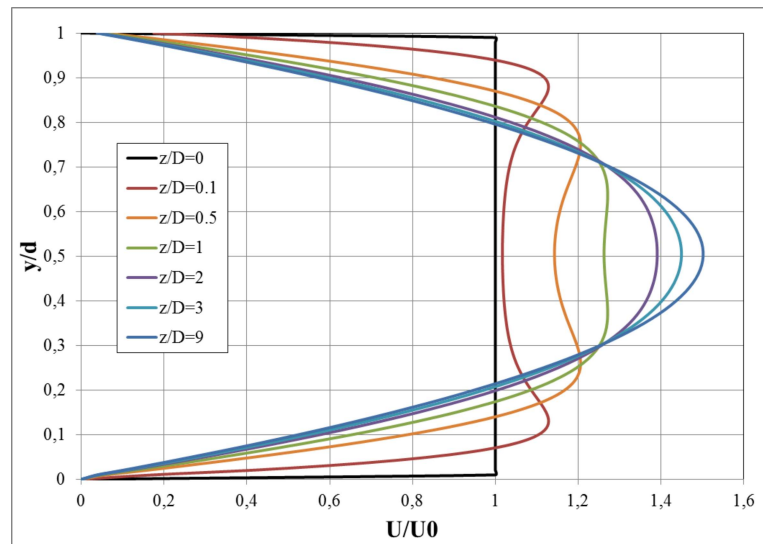


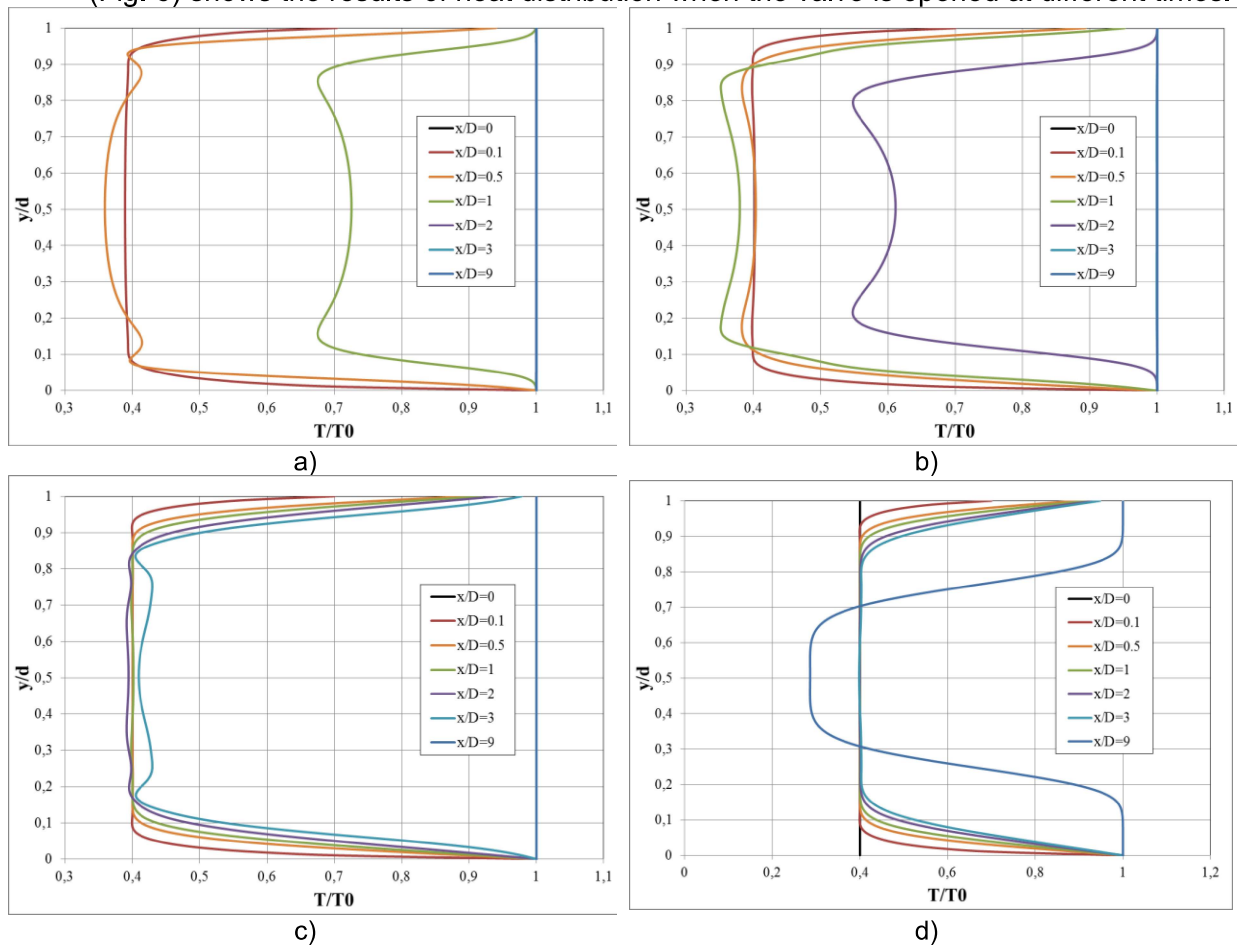
Figure 3. General view of the difference grid

Figure 4 shows the results of determining the longitudinal flow velocity at various sections of the flow channel, with the Reynolds number  $Re = 500$ .

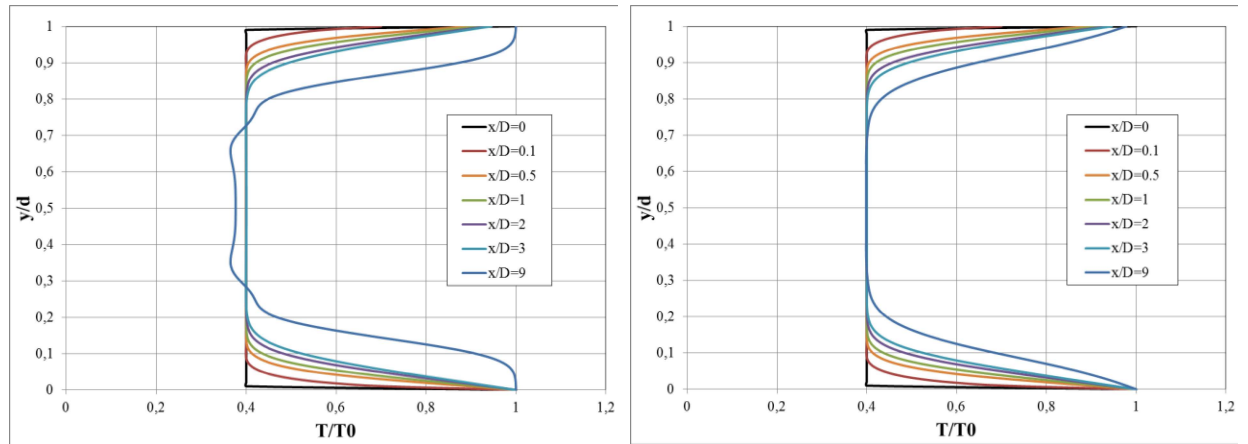


**Figure 4. The results of determining the longitudinal flow velocity at various sections of the flow channel**

It can be seen from (Fig. 4) that the flow in sections  $z / D = 9$  has a laminar profile. (Fig. 5) shows the results of heat distribution when the valve is opened at different times.



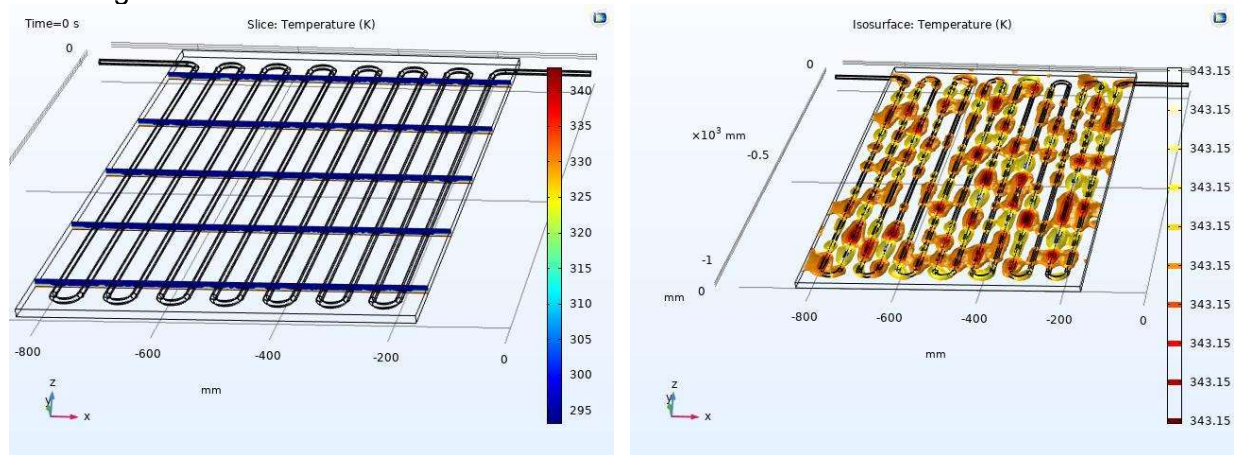




e) f)  
**Figure 5. The results of heat distribution over time:**

a)  $T = 1$  s; b)  $T = 2$  s; c)  $T = 5$  s; d)  $T = 8$  s; e)  $T = 10$  s; f)  $T = 15$  s

Figure 6 shows the heat distribution isoline and isotherm



**Figure 6. Isolines of heat distribution and isotherms**

**Conclusion.** In engineering practice, when calculating the heat and power indicators of thermal absorbers, the use of the Comsol Multiphysics 5.6. allows you to speed up the process of calculating their heat transfer and hydrodynamics, to create a difference grid for introducing initial and boundary conditions for the calculation. The number of cells in the difference grids depends on the tolerances provided by the standards for the calculation of heat exchange processes. Depending on the Reynolds number and the diameter of the channel of the thermal absorber, it is possible

to determine the stabilization section, the laminar flow section, as well as the fluid velocity and heat transfer, respectively.

Developed on the basis of the program "Comsol Multiphysics 5.6." a simulation model of heat transfer from a photovoltaic battery to a heat absorber can be used to calculate heat and power supply systems.

The use of a simulation model in the design of heat and power supply systems makes it possible to reduce the consumption of heat and electricity.

**References**

1. <https://thescipub.com/PDF/ajassp.2014.1927.1937>
2. Нигматов, У. Ж., & Наимов, Ш. Б. (2020). Анализ потенциала использования энергии солнечного излучения на территории Республики Таджикистан. In *International scientific review of the technical sciences, mathematics and computer science* (pp. 59-71).
3. Эргашев, С. Ф., Нигматов, У. Ж., Абдуганиев, Н. Н., & Юнусов, Б. С. А. (2018). Солнечные параболоцилиндрические электростанции-современное состояние работ и

перспективы использования их в народном хозяйстве Узбекистана. *Достижения науки и образования*, (5 (27)).

4. Эргашев, С. Ф., & Нигматов, У. Ж. (2020). Солнечные параболоцилиндрические установки, конструктивные особенности и расчёт отдельных параметров. *Universum: технические науки*, (11-5 (80)).

5. Эргашев, С. Ф., Нигматов, У. Ж., & Пулатов, Э. У. У. (2018). Анализ перепадов температур, возникающих в тепловых трубах солнечных параболоцилиндрических установок. *Проблемы науки*, (5 (29)).

6. Эргашев, С. Ф., Нигматов, У. Ж., Орипов, А., & Ощепкова, Э. А. (2019). Энергоэффективный трекер без использования светозависимых датчиков (Фоторезисторов, фотодиодов И ТД). *Известия Ошского технологического университета*, (3), 234-236.

7. Нигматов, У. Ж. (2020). Анализ конструктивных элементов охлаждения гибридных солнечных коллекторов. *Вестник науки и образования*, (2-3 (80)).

8. Рахимов, Р. Х., Эргашев, С. Ф., Абдурахмонов, С. М., & Нигматов, У. Ж. (2017). Автоматизированная компьютерная система измерения производительности солнечных водонагревателей с порционной подготовкой горячей воды. *Computational nanotechnology*, (1).

9. Rakhimov, R. K., Irgashev, S. F., Abdurakhmanov, S. M., & Nigmatov, U. J. (2017). The automated computer system of measurement of productivity of solar water heaters from portion preparation of hot water. *Computational nanotechnology*, (1), 23-26.

10. Loitsyansky L. G. The mechanics of fluid and gas, Moscow, Science. p. 840, *Mexanika jidkosti i gaza*, Moscow, Nauka, (1987).

11. Robert S. Bernard, A MacCormack scheme for incompressible flow, *Computers & Mathematics with Applications*, Volume 24, Issues 5–6, 1992, Pages 151-168, ISSN 0898-1221, [https://doi.org/10.1016/0898-1221\(92\)90046-K](https://doi.org/10.1016/0898-1221(92)90046-K).

12. Jim Douglas Jr., On the errors in analogue solutions of heat conduction problems, *Quart. Appl. Math.* 14 (1956), P.333–335. MR 88805. DOI <https://doi.org/10.1090/S0033-569X-1956-88805-1>

13. Patankar, S.V. (1980). *Numerical Heat Transfer and Fluid Flow* (1st ed.). CRC Press, P. 200. <https://doi.org/10.1201/9781482234213>

## PROCUREMENT OF LOCAL RAW MATERIALS COMPLEX FERTILIZERS WITH NITROGEN-PHOSPHATE-POTASSIUM CONTAINING MOISTURE

**ABDUXAKIMOV TAL'ATJON**

Doctoral student of Namangan Institute of Engineering and Technology  
E-mail: [talatbek1995@mail.ru](mailto:talatbek1995@mail.ru), phone: (+99893) 484-62-29

**SHERKUZIEV DONIYOR**

Professor of Namangan Institute of Engineering and Technology

### Abstract:

**Objective.** In the article, a study on obtaining complex fertilizers with a gel composition that preserves mineral components by introducing local raw materials FarPAN, organic and inorganic acids and MAP (monoammonium phosphate), MPP (monopotassium phosphate) as fertilizers, N:P:K fertilizers with different ratios work has been done. The optimal parameters for the synthesis of the obtained moisture-retaining complex fertilizers have been determined.

## C O N T E N T S

### PRIMARY PROCESSING OF COTTON, TEXTILE AND LIGHT INDUSTRY

<b>A.Shodmonkulov, R.Jamolov, X.Yuldashev</b>	
Analysis of load changes in the chain drive during the drying process of cotton falling from the longitudinal shelves of the drum.....	3
<b>A.Xomidjonov</b>	
Influence and characteristics of drying mechanisms in leather production on the derma layer.....	8
<b>J.Monnopov, J.Kayumov, N.Maksudov</b>	
Analysis of elastic fabrics for compression sportswear in the new assortment	13
<b>S.Matismailov, K.Matmuratova, Sh.Korabayev, A.Yuldashev</b>	
Investigation of the influence of speed modes of the combined drum on the quality indicators of the tape.....	18
<b>A.Shodmonkulov, K.Jumaniyazov, R.Jamolov, X.Yuldashev</b>	
Determination of the geometric and kinematic parameters of the developed chain gear for the 2SB-10 dryer.....	23
<b>R.Jamolov, A.Shodmonkulov, X.Yuldashev</b>	
Determination of dryer drum moisture extraction depending on its operating modes.....	27
<b>A.Djuraev, K.Yuldashev, O.Teshaboyev</b>	
Theoretical studies on screw conveyor for transportation and cleaning of linter and design of constructive parameters of transmissions.....	29
<b>S.Khashimov, Kh.Isakhanov, R.Muradov</b>	
Creation of technology and equipment for improved cleaning of cotton from small impurities.....	36
<b>G.Juraeva, R.Muradov</b>	
The process of technical grades of medium staple cotton at gin factories and its analysis.....	40
<b>I.Xakimjonov</b>	
Literature analysis on the research and development of the method of designing special clothes for workers of metal casting and metal processing enterprises.....	44
<b>GROWING, STORAGE, PROCESSING AND AGRICULTURAL PRODUCTS AND FOOD TECHNOLOGIES</b>	
<b>A.Khodjiev, A.Choriev, U.Raximov</b>	
Improving the technology of production of functional nutrition juices.....	49
<b>U.Nishonov</b>	
Research in beverage technology intended to support the functions of the cardiovascular system.....	53
<b>Z.Vokkosov, S.Hakimov</b>	

Development of new types of vegetable juices and beverages technology...	59
<b>CHEMICAL TECHNOLOGIES</b>	
<b>M.Latipova</b>	
Analysis of the current status of thermoelectric materials and technology for obtaining and manufacturing half-elements.....	66
<b>G.Ochilov, I.Boymatov, N.Ganiyeva</b>	
Physico-chemical properties of activated adsorbents based on logan bentonite.....	72
<b>U.Nigmatov</b>	
Simulation of heat transfer process in absorber channels.....	77
<b>T.Abduxakimov, D.Sherkuziev</b>	
Procurement of local raw materials complex fertilizers with nitrogen-phosphate-potassium containing moisture.....	84
<b>P.Tojiyev, X.Turaev, G.Nuraliyev, A.Djalilov</b>	
Study of the structure and properties of polyvinyl chloride filled with bazalt mineral.....	89
<b>M.Yusupov</b>	
Investigation of phthalocyanine diamidophosphate- copper by thermal analysis.....	95
<b>L.Oripova, P.Xayitov, A.Xudayberdiyev</b>	
Testing new activated coals AU-T and AU-K from local raw materials when filtration of the waste mdea at gazlin gas processing plant.....	101
<b>N.Kurbanov, D.Rozikova</b>	
Based on energy efficient parameters of fruit drying chamber devices for small enterprises.....	107
<b>MECHANICS AND ENGINEERING</b>	
<b>U.Erkaboev, N.Sayidov</b>	
Dependence of the two-dimensional combined density of states on the absorbing photon energy in GaAs/AlGaAs at quantizing magnetic field.....	113
<b>I.Siddikov, A.Denmuxammadiyev, S.A'zamov</b>	
Investigation of electromagnetic current transformer performance characteristics for measuring and controlling the reactive power dissipation of a short-circuited rotor synchronous motor.....	125
<b>Sh.Kudratov</b>	
Evaluation and development of diagnostics of the crankshaft of diesel locomotives.....	130
<b>Z.Khudoykulov, I.Rakhmatullaev</b>	
A new key stream encryption algorithm and its cryptanalysis.....	135
<b>T.Mominov, D.Yuldoshev</b>	
Coordination of the movement of transport types in areas with high passenger flow.....	146
<b>R.Abdullayev, M.Azambayev, S.Baxritdinov</b>	

Analysis of research results according to international standards.....	152
<b>R.Abdullayev, M.Azambayev</b>	
Cotton fiber rating, innovation current developments, prospects for cooperation of farms and clusters.....	157
<b>F.Dustova, S.Babadzhanov.</b>	
Calculation of the load on the friction clutch of the sewing machine.....	163
<b>Z.Vafayeva, J.Matyakubova, M.Mansurova</b>	
Improvement of the design of the shuttle drum in the sewing machine.....	168
<b>A.Obidov, M.Vokhidov</b>	
Preparation of a new structure created for sorting of ginning seeds.....	174
<b>Sh.Mamajanov</b>	
Carrying out theoretical studies of the cotton regenerator.....	181
<b>ADVANCED PEDAGOGICAL TECHNOLOGIES IN EDUCATION</b>	
<b>A.Khojaev</b>	
Methodological issues of organizing internal audits and control of off-budget funds in higher education institutions.....	188
<b>I.Nosirov</b>	
Theoretical foundations of establishing new technologies on personal management system.....	192
<b>Z.Mamakhanova, D.Ormonova</b>	
Specific characteristics of uzbek national art of embroidery.....	198
<b>A.Raximov, M.Khusainov, M.Turgunpulatov, S.Khusainov, A.Gaybullayev</b>	
Energy-saving modes of the heat treatment of concrete.....	202
<b>ECONOMICAL SCIENCES</b>	
<b>M.Bekmirzayev, J.Xolikov</b>	
Prospects for the development of service industries.....	211
<b>A.Ilyosov</b>	
Organizational and economic mechanisms to support the export of industrial products: a comparative analysis of foreign experience and proposals.....	216
<b>I.Foziljonov</b>	
The importance of multiplier indicators in assessing the effectiveness of the cash flow of the enterprise.....	221
<b>K.Kurpayanidi</b>	
Innovative activity of business entities in the conditions of transformation: a retrospective analysis.....	227
<b>Sh.Muxitdinov</b>	
Main characteristics of the risk management mechanism in manufacturing enterprises.....	237
<b>Y.Najmiddinov</b>	
Green economy and green growth. initial efforts of sustainable development in Uzbekistan.....	241

---

<b>E.Narzullayev</b>	
The methods for measuring the effectiveness of social entrepreneurship activity.....	<b>248</b>
<b>E.Narzullayev</b>	
Analysis of the management and development of environmental social entrepreneurship in Uzbekistan.....	<b>254</b>
<b>F.Bayboboeva</b>	
Legal regulation of entrepreneurial activity.....	<b>259</b>
<b>Z.Boltaeva</b>	
Foundations of neuromarketing strategy in industry.....	<b>265</b>
<b>R.Rashidov</b>	
Issues of regional development of small business.....	<b>270</b>
<b>Sh.Abdumurotov</b>	
Methodology for forecasting the competitiveness of an enterprise based on the Elliott wave principle.....	<b>277</b>
<b>S.Goyipnazarov</b>	
Assessment of impact of artificial intelligence on labor market and human capital.....	<b>288</b>
<b>A.Norov</b>	
Evolution of management science.....	<b>296</b>
<b>K.Narzullayev</b>	
Investment process in the republic of Uzbekistan.....	<b>306</b>
<b>Kh.Irismatov</b>	
Statistical analysis of assessment of the volume of the hidden economy in the republic of Uzbekistan.....	<b>311</b>

---



**“SCIENTIFIC AND TECHNICAL JOURNAL OF  
NAMANGAN INSTITUTE OF ENGINEERING AND  
TECHNOLOGY”**



**The editorial was typed and paginated in the computer center  
Paper format A4. Size 20 conditional printing plate**

**The copy must be taken from the "Scientific and Technical Journal of the  
Namangan Institute of Engineering and Technology"**