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ABSTRACTS

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Session 2. APPLIED MATHEMATICS. APPLIED STATISTICS. ENGINEERING MATHEMATICS AND TECHNOLOGIES. FUZZY ANALYSIS	75
Akhmedov O., Sotvoldiyev A., Tilavov A. <i>On Prove an Existence of "Bendixson's Bag" for Non-Linear Dynamical System</i>	75
Durdiev D., Boltaev A. <i>Inverse problem for anisotropic viscoelasticity</i>	78
Durdiev D., Jumaev J., Atoev D. <i>Inverse problem for nonlocal initial-boundary conditions of integro-differential heat equation</i>	79
Iskandar Shah Mohd Zawawi, Zarina Bibi Ibrahim <i>Convergence of the block backward differentiation formula with independent parameter for solving damped mass-spring problems</i>	80
Jumanov I., Safarov R. <i>Optimization of recognition of microorganisms based on histological information structures of images</i>	82
Najah Ghazali, Dzati Athiar Ramli, Abdul Aziz Nurul Huda, Deraman Fatanah, Mohd Asi Salina, Mat Safar Anuar, Zakaria Hasneeza Liza <i>A Strategy using Deterministic Annealing on EM Algorithm for Microembolus Detection</i>	83
Vincent Daniel David, Arifah Bahar, Zainal Abdul Aziz <i>Approximate Analytic Solution for forced Korteweg-de Vries Equation with wavy forcing function</i>	83
Бекиев А.Б. <i>Разрешимость одной краевой задачи для уравнения четвертого порядка</i>	84
Бозоров З.Р. <i>Обратная коэффициентная задача для уравнения вязкоупругости с переменным коэффициентом</i>	85
Жалолов И.Ф. <i>Некоторые свойства топологического пространства, компактное и локально компактное пространство</i>	85
Кадиркулов Б.Ж., Жалилов М.А. <i>Об одной обратной задаче для нелокального уравнения смешанного типа с дробной производной</i>	86
Маматкабиллов А.Х. <i>Об устойчивости криволинейного движения автомобиля с учетом упругости и деформируемости шин</i>	88
Рахмонов А.А. <i>Обратная коэффициентная задача для дробного-диффузионного уравнения с оператором Бесселя</i>	90
Сафаров Ж.Ш., Хасанов К.Х. <i>О разрешимости одного интегро-дифференциального уравнения гиперболического типа</i>	91
Суяров Т.Р. <i>О спектре смешанной задачи для системы интегро-дифференциальных уравнений</i>	92
Турдиев Х.Х. <i>Начально-краевая задача для системы интегро-дифференциальных уравнений гиперболического типа первого порядка</i>	93
Хашимов А.Р. <i>Энергетические оценки специального вида для решений уравнения третьего порядка типа псевдоэллиптических</i>	95
Abdujalilova G. <i>The importance of statistical criteria in assessing the reliability of socio-economic research results</i>	96
Muhamedov A. <i>Invariance principle for kernel estimates of a density function from stationary sequence of strongly linearly positive quadrant dependent random variables</i>	97
Normurodov D.G. <i>Implementing a binomial option pricing model in python</i>	98
Nurmukhamedova N.S. <i>Local asymptotic normality of statistical experiments in an inhomogeneous competing risks model</i>	100
Che Mohd Ruzaidi Bin Ghazali <i>The upcycling of carbon based wastes to graphitic compound via furnace pyrolysis</i>	101
Mohd Zamri Ibrahim <i>Marine Renewable Energy: The Potential in Southeast Asia and Device Technologies</i> .	101
Moorthy V., Nawawi N.M., Anuar M.S., Junita M.N., Zakaria H. L., Mohd Asi S., Deraman F., Abdul Aziz Nurul Huda <i>Simulation Modeling of Hybrid Optical Fiber and Radio -Frequency transmission towards user-end VLC System</i>	102
Ahmad Shamudin Nurul Atiqah, Kamis Nor Hanimah, Mohamad Daud, A Kadir Norhidayah <i>Interdependent Relationship of Criteria in Similarity Social Influence Network Group Decision Making Model</i> ..	102
Session 3. MATHEMATICAL MODELING. HYDRODYNAMICS	104
Bakhromov S.A. <i>Construction of A Two-Dimensional Local Interpolation Spline Model For Geophysical Signals And Comparative Analysis</i>	104
Dalabaev U., Xasanova D. <i>Moving node method for solving problems of a viscous fluid in pipes with different cross sections</i>	105
Elov B.B., Axmedova X.I. <i>Determining homonymy using statistical methods.</i>	105
Ganiev J., Nuritdinov S., Omonov A. <i>Models of small-scale structures in disk-like self-gravitating objects</i> .	106
Guan Xuelin <i>Numerical calculation of potential and space charge in nonstationary EHD flows of incompressible polymer fluid</i>	107
Ikramov A., Juraev G. <i>Finding proper linear transformation in a new SPONGE structured stream cipher</i> ..	108
Ikramov A., Polatov A., Pulatov S. <i>Computational model of non-stationary process of heat distribution in fibrous composites</i>	112

Moving node method for solving problems of a viscous fluid in pipes with different cross sections

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This article investigates the flow of fluid with different configurations along the pipe section. Obtaining an approximately analytical solution based on the finite-difference method is described. In this case, obtaining an analytical solution method is achieved through the use of the moving node method. With certain configurations of the pipe section, an exact solution is obtained

The problem is to determine the velocity field for a one-dimensional flow of a viscous fluid through pipes with different cross sections. The problem is set like this:

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -\frac{\Delta p}{\mu}, \quad (1)$$

in the area of

$$\frac{x^n}{a^n} + \frac{yx^n}{b^n} = 1, \quad (2)$$

with zero boundary conditions (no-slip conditions, $\frac{\Delta p}{\mu}$ is pressure drop, μ is fluid viscosity). Using the method of moving nodes [1,2], the solution is obtained

$$u = \frac{a^2 b^2 \left(S_1 - \frac{x^2}{a^2} \right) \left(S_2 - \frac{x^2}{a^2} \right)}{a^2 \left(S_2 - \frac{x^2}{a^2} \right) + b^2 \left(S_1 - \frac{x^2}{a^2} \right)} \frac{A}{2}. \quad (3)$$

Where $A = \frac{\Delta p}{l}$, $S_1 = \sqrt[n]{1 - \frac{y^n}{b^n}}$, $S_2 = \sqrt[n]{1 - \frac{x^n}{a^n}}$. From the obtained solution for $n = 2$, $a = b$, we get the exact solution in a round pipe, for $n = 2$, $a \neq b$ the solution is the solution for an ellipsoidal pipe, for $n \rightarrow \infty$ and $a \rightarrow \infty$, we get the exact solution for a flat pipe.

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Determining homonymy using statistical methods.

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The problem of automatic processing of natural language remains relevant for more than half a century. One of the important problems in the field of NLP is the creation of a semantic analyzer, which in turn goes through a series of steps. Determining homonymy is important in the semantic analysis of sentences. Statistical methods are also used to determine homonymy. The frequency method is used to determine homonymy between grammatically similar word groups. This method involves extracting homonym classification parameters.

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Models of small-scale structures in disk-like self-gravitating objects

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Mathematical modeling of the structure and evolution of disk-like self-gravitating systems requires an analysis of the stability of various small-scale perturbations. However, nobody studied the role of small-scale modes in the evolution problems against the background of non-stationary disks. A detailed and thorough analysis of the problems of their origin in various non-stationary flat formations has also not been performed, and there is also no corresponding nonlinear theory of their formation. In particular, it is not clear under what criteria the observed small-scale formations could be formed in disk-like systems, what of the primary mechanism of this phenomenon. This implies the relevance of the problem of constructing a mathematical model for studying small-scale instabilities in non-stationary disk-shaped self-gravitating objects. To study the corresponding mechanisms of formation of small-scale structural formations, we have constructed a mathematical model of a self-gravitating disk with an anisotropic velocity diagram

$$\Psi_{Aniz} = \frac{\sigma_0}{\pi} [1 + \Omega \cdot (xv_y - yv_x)] \cdot \chi \left((1 - r^2/P\Sigma^2) (1 - P\Sigma^2 v_{\perp}^2) - P\Sigma^2 (v_r - v_a)^2 \right). \quad (1)$$

Here Ω is a dimensionless parameter characterizing the degree of rigid rotation of the disk, $0 \leq \Omega \leq 1$. v_r and v_{\perp} are the radial and tangential particle velocities, the function $\Pi(t)$ has the meaning of the expansion and compression coefficient $\Pi(t) = (1 + \lambda \cos \psi) \cdot (1 - \lambda^2)^{-1}$, $t = (\psi + \lambda \sin \psi) \cdot (1 - \lambda^2)^{-3/2}$, $v_a = -\lambda \sqrt{1 - \lambda^2} (r \sin \psi / \Pi^2)$, $v_b = \Omega r / \Pi^2$. The model pulsates with an amplitude $\lambda = 1 - (2T/|U|)_0$, where $(2T/|U|)_0$ is the initial virial parameter. For the constructed model, Nuritdinov has derived the non-stationary dispersion equation (NDE) in general form. On the basis of the found NDE, we calculated the instability criteria for sectorial and tesseral small-scale oscillation modes. The critical diagrams of virial parameter Γ degree of rotation Ω are also obtained for each of these modes, and the corresponding instability increments are calculated. In this paper, we present the results of calculations of the disk model for small-scale perturbation modes, in particular, for wave numbers $m=2$; $N=10$.

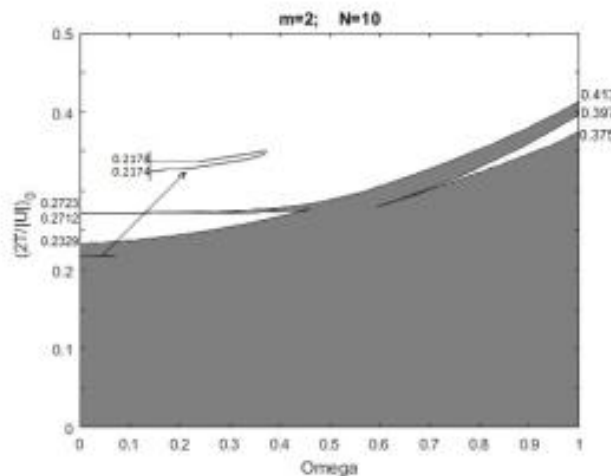


Fig. 1. Critical dependence of the virial ratio on the rotation parameter for $m=2$; $N=10$.