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ABSTRACTS

of the Uzbekistan-Malaysia international conference

COMPUTATIONAL MODELS AND TECHNOLOGIES

September 16-17th, 2022

TASHKENT

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 problen is set like this:

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -\frac{\triangle p}{\mu l}, \tag{1}$$

in the area of

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

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

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

Where $A = \frac{\triangle p}{l}, S_1 = \sqrt[n]{1 - \frac{y^n}{b^n}}, S_2 = \sqrt[n]{1 - \frac{x^n}{a^n}}$. 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 $n \to \infty$ and $,a \to \infty$, we get the exact solution for a flat pipe.

References

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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.

MSC2010 85-10

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

$$\Psi_{Aniz} = \frac{\sigma_0}{\pi}\left[1 + \Omega \cdot (x v_y - y v_x)\right] \cdot \chi\left(\left(1 - \mathrm{r}^2/\mathrm{P}\S^2\right)\left(1 - \mathrm{P}\S^2 v_\perp^2\right) - \mathrm{P}\S^2 (v_r - v_a)^2\right). \qquad (1)$$

Here Ω is a dimensionless parameter characterizing the degree of rigid rotation of the disk, $0 \le \Omega \le 1$. 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 $\Pi\,(\mathrm{t}) = (1 + \lambda\cos\psi)\cdot(1-\lambda^2)^{-1}$, $t = (\psi + \lambda\sin\psi)\cdot(1-\lambda^2)^{-3/2}$, $v_a = -\lambda\sqrt{1-\lambda^2}(r\sin\psi/\Pi^2)$, $v_b = \Omega r/\Pi^2$. 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 вЃЁvirial parameter Гч degree of rotationвЃ№ 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.

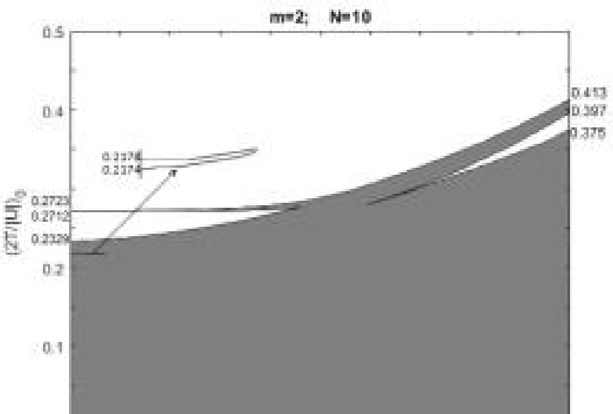

Fig. 1. Critical dependence of the virial ratio on the rotation parameter for m=2; N=10.