ON CALCULATION OF INTEGRAL PARTS OF MOTION IN THE THREE-DIMENSIONAL WIND FLOWS MODEL

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In general formulation the mathematical model of wind flows of liquid in reservoir is described by the non-stationary initial-boundary value problem for the system of nonlinear equations which can be solved only using numerical methods [1]. Taking into account the specific of Issyk-Kul Lake the general model was simplified and some classes of its analytical solutions in the areas of special form were found in [2]. The algorithms of the model that was proposed in [2] suppose calculation of the integral parts U and V of the horizontal components of the velocity vector. For this purpose the next system of equations is solved:

$$\begin{cases} \dfrac{\partial U}{\partial t} + \mu U - \ell V = -\dfrac{H}{\rho_0}\dfrac{\partial P^s}{\partial x} + \dfrac{\tau_x}{\rho_0}, \\ \dfrac{\partial V}{\partial t} + \mu V + \ell U = -\dfrac{H}{\rho_0}\dfrac{\partial P^s}{\partial y} + \dfrac{\tau_y}{\rho_0}, \\ \dfrac{\partial U}{\partial x} + \dfrac{\partial V}{\partial y} = 0, (x,y) \in \Omega_0, t > 0. \end{cases} \tag{1}$$

$$\{(x,y) \in \partial\Omega_0\} : Un_x + Vn_y = 0, \tag{2}$$

$$t = 0 : U = U_0, V = V_0. \tag{3}$$

The problem (1)-(3) is considered in the two-dimensional area Ω_0 that describes the surface of reservoir. The set $\partial\Omega_0$ is the border of the area Ω_0.

In the system of equations (1)-(3) the next notations are used: $U = U(t,x,y)$ and $V = V(t,x,y)$ are integral parts of the horizontal components of velocity vector; $P^s = P^s(t,x,y)$ is a pressure on the undisturbed area Ω_0; $H = H(x,y)$ describes the bottom contour of reservoir; $\tau_x = \tau_x(t,x,y), \tau_y = \tau_y(t,x,y)$ are the components of the tangential stress of wind friction; $\ell = \ell(x,y)$ is a Coriolis force; ρ_0 is the mean value of density; $\mu \geq 0$ is a parameter that defines a bottom friction; $n = (n_x, n_y)$ is a vector of an outer normal of the border of the area Ω_0.

In this paper new projective difference schemes for solving the problem (1)-(3) are discussed. In order to illustrate the operation and confirm the efficiency of the suggested difference schemes the results of numerical experiments that were held using analytical solutions of the system of equations (1)-(3) found in [2] are presented.

References

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