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Investigation of the approximation error of the improved Upwind Leapfrog scheme*

The mathematical model for the problem of biological kinetics is based on a system of unsteady convection-diffusion-reaction equations with a nonlinear function of a source having a stochastic character for biogenic substances coming from river drains. When solving transfer problems, the problem arises of constructing convective terms acceptable from the point of view of approximation error.

Theorem. Let solution function $q(x,t) \in C^2(G_t) \cap C^1(\bar{G}_t)$, convective exchange rate coefficient $u(x) \in C^1(\bar{G})$. When approximating a non-stationary transfer problem by a linear combination of a central difference scheme and Upwind Leapfrog scheme for each harmonic of the solution function q values u less than the actual values and differ by an amount $\alpha_1 = 1 - (\exp(j\omega mh) + 4 - 5\exp(-j\omega mh))/(2j\omega mh(2 + \exp(-j\omega mh)))$, where $\omega = \pi/L$, L - the value of the calculated interval, m - harmonic number, h - step through the space, $j = \sqrt{-1}$ [1].

It is shown that the proposed scheme approximates the convective term with the third order of accuracy in space, and the diffusion term with the first, which makes the application of this method effective in problems where convection significantly prevails over diffusion.

REFERENCES

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