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PROPAGATOR DIFFERENCE SCHEME FOR SOLVING OF THE DISSIPATIVE MURRAY EQUATION

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In this work implicit difference scheme, based on the propagator numerical method [1] for solving of the dissipative Murray equation is described. Previously propagator numerical method was elaborated and used for solving of advection-diffusion-reaction (ADR) equations, where it for wide range of parameters gives absolute stability.

The study problem can be described as follows:

$$\begin{aligned} &\frac{\partial u}{\partial t} = \frac{D}{R_e}\frac{\partial^2 u}{\partial x^2} + f\left(\frac{\partial u}{\partial x}, u\right), \quad f = -u\frac{\partial u}{\partial x} - ru, \quad u = u(t,x), \\ &\quad 0 < t \le T, \quad x \in R^1, \\ &\quad u(0,x) = u_0(x), \end{aligned} \tag{1}$$

where $D \geq d > 0$, and R_e is the Reynolds number. Such implicit propagator difference scheme is considered:

$$\Lambda(U_i^{l+1,m+1}) = \frac{1}{h_i^*}B_i U_{i+1}^{l+1,m+1} + \frac{1}{h_i^*}A_i U_{i-1}^{l+1,m+1} - Q_i U_i^{l+1,m+1} = exp\left(\frac{f_i^{l+1,m}}{U_i^l}\tau\right)\frac{U_i^l}{\tau}, \tag{2}$$

where

$$f_i^{l+1,m} = -U_i^{l+1,m}\left(\frac{U_{i+1}^{l+1,m} - U_{i-1}^{l+1,m}}{2h_i^*}\right) - rU_i^{l+1,m} \tag{3}$$

and

$$A_i = \frac{D}{R_e}\frac{1}{h_{i-1}}, \quad B_i = \frac{D}{R_e}\frac{1}{h_{i+1}}, \quad Q_i = \frac{1}{h_i^*}\left(A_{i+1} + B_{i-1}\right) + \frac{1}{\tau}. \tag{4}$$

Conditions for convergence and stability for the proposed difference scheme are discussed.

REFERENCES

[1] J. Rimšāns, D. Žaime. Propagator Method for Numerical Solution of the Cauchy Problem for ADR Equation. *Journal of Differential Equations*, **LU MII paper collection: Mathematics. Differential Equations.** 2008.Vol.8, 111-124.