

# THE FINITE-DIFFERENCE METHOD FOR THE SOLUTION OF PSEUDOPARABOLIC EQUATION WITH NONLOCAL INTEGRAL CONDITIONS

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In this work we consider the one-dimensional nonlinear pseudoparabolic equation with two non-local integral conditions and one initial condition [1]:

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} - \eta \frac{\partial^3 u}{\partial x^2 \partial t} + f(x, t, u), \quad t \geq 0, 0 < x < 1, \quad (1)$$

$$\int_0^1 u(x, t) dx = \mu_1(t), \quad \int_0^1 xu(x) dx = \mu_2(t), \quad (2)$$

$$u(x, 0) = \varphi(x). \quad (3)$$

We investigate implicit difference scheme for the solution of this problem

$$\frac{u_i^{j+1} - u_i^j}{\tau} = \Lambda u_i^{j+1} - \eta \frac{\Lambda u_i^{j+1} - \Lambda u_i^j}{\tau} + f_i^j(u_i^j), \quad (4_a)$$

$$h \left( \frac{u_0^{j+1} + u_N^{j+1}}{2} + \sum_{i=1}^{N-1} u_i^{j+1} \right) = \mu_1^{j+1}, \quad h \left( \frac{u_N^{j+1}}{2} + \sum_{i=1}^{N-1} ih u_i^{j+1} \right) = \mu_2^{j+1}, \quad (5)$$

where  $\Lambda$  is a differential operator  $\Lambda u_i^{j+1} = \frac{u_{i-1}^{j+1} - 2u_i^{j+1} + u_{i+1}^{j+1}}{h^2}$ .

For differential equation (1) we analyze two another difference analogues:

$$\frac{u_i^{j+1} - u_i^j}{\tau} = \Lambda u_i^{j+1} - \eta \frac{\Lambda u_i^{j+1} - \Lambda u_i^j}{\tau} + f_i^j(u_i^{j+1}), \quad (4_b)$$

$$\frac{u_i^{j+1} - u_i^j}{\tau} = \frac{\Lambda u_i^{j+1} + \Lambda u_i^j}{2} - \eta \frac{\Lambda u_i^{j+1} - \Lambda u_i^j}{\tau} + f_i^j \left( \frac{u_i^{j+1} - u_i^j}{2} \right). \quad (4_c)$$

The results of numerical solution are presented.

## REFERENCES

- [1] A.Bouziani, N.Merazga. Solution to a semilinear pseudoparabolic problem with integral condition. *Electronic Journal of Differential equations*, (115), 2006, 1 – 18.