Смоленский Захар 3 курс 2б группа

Лабораторная работа №10 (с исправлениями)

Построение разностных схем

Вариант 14, т.е. 4.

$$Ш(x_i, t_j) = \{(x_{i-1}, t_j), (x_i, t_j), (x_i, t_{j-1})\};$$

$$R_h(u(x_i,t_j)) = \left| \frac{\partial u(x_i,t_j)}{\partial t} - a\frac{\partial u(x_i,t_j)}{\partial x} - \left[A(x_i,t_j)\left(u(x_i,t_j) - h\frac{\partial u(x_i,t_j)}{\partial x} + \frac{h^2}{2}\frac{\partial^2 u(x_i,t_j)}{\partial x^2}\right) + B(x_i,t_j)u(x_i,t_j) + C(x_i,t_j)\left(u(x_i,t_j) - \tau\frac{\partial u(x_i,t_j)}{\partial t} + \frac{\tau^2}{2} * \frac{\partial^2 u(x_i,t_j)}{\partial t^2}\right)\right]\right|;$$

$$R_h(u(x_i,t_j)) = \left| \frac{\partial u(x_i,t_j)}{\partial t} - a\frac{\partial u(x_i,t_j)}{\partial x} - \left[(A+B+C)u(x_i,t_j) - Ah\frac{\partial u(x_i,t_j)}{\partial x} + A\frac{h^2}{2}\frac{\partial^2 u(x_i,t_j)}{\partial x^2} - C\tau\frac{\partial u(x_i,t_j)}{\partial t} + C\frac{\tau^2}{2}\frac{\partial^2 u(x_i,t_j)}{\partial t^2}\right]\right|;$$

$$R_h(u(x_i,t_j)) = \left| \frac{\partial u(x_i,t_j)}{\partial t} - a\frac{\partial u(x_i,t_j)}{\partial x} - (A+B+C)u(x_i,t_j) + Ah\frac{\partial u(x_i,t_j)}{\partial x} - A\frac{h^2}{2}\frac{\partial^2 u(x_i,t_j)}{\partial x^2} + C\tau\frac{\partial u(x_i,t_j)}{\partial t} - C\frac{\tau^2}{2}\frac{\partial^2 u(x_i,t_j)}{\partial t^2}\right|;$$

$$R_h = (u(x_i,t_j)) = \left| -(A+B+C)u(x_i,t_j) + (Ah - a)\frac{\partial u(x_i,t_j)}{\partial x} + (C\tau+1)\frac{\partial u(x_i,t_j)}{\partial t} - A\frac{h^2}{2}\frac{\partial^2 u(x_i,t_j)}{\partial x^2} - C\frac{\tau^2}{2}\frac{\partial^2 u(x_i,t_j)}{\partial t^2}\right|;$$

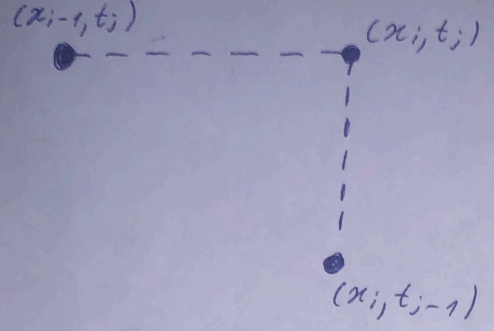
$$\begin{cases} A+B+C=0, \\ Ah - a = 0, \\ C\tau + 1 = 0; \end{cases}$$

$$A = \frac{a}{h};\quad C = -\frac{1}{\tau};$$

$$R_h(u(x_i,t_j)) = \left| -\frac{ah}{2}\frac{\partial^2 u(x_i,t_j)}{\partial x^2} + \frac{\tau}{2}\frac{\partial^2 u(x_i,t_j)}{\partial t^2}\right|;$$

$$L_h u^{(h)}(x_i,t_j) = \frac{a}{h}u_{i-1}^j - \frac{a}{h}u_i^j + \frac{1}{\tau}u_i^j - \frac{1}{\tau}u_i^{j-1} = \varphi(x_i,t_j);$$

$$L_h u^{(h)}(x_i,t_j) = \frac{(u_i^j - u_i^{j-1})}{\tau} - a\frac{(u_i^j - u_{i-1}^j)}{h} = \varphi(x_i,t_j);$$


(x_{i-1}, t_j)
(x_i, t_j)
(x_i, t_{j-1})