Abstracts of MMA2015, May 26–29, 2015, Sigulda, Latvia

A DIFFERENCE SCHEME FOR A TWO–DIMENSIONAL PARABOLIC EQUATION WITH AN INTEGRAL CONDITION

KRISTINA JAKUBĖLIENĖ

Kaunas University of Technology

Studentų St. 50, LT-51368, Kaunas, Lithuania

E-mail: kristina.jakubeliene@ktu.lt

We analyze the solution method of a two–dimensional linear parabolic problem with given integral boundary condition

$$u(x,y,t) = \iint\limits_{\Omega} K(x,y,\xi,\eta)u(\xi,\eta)d\xi d\eta + \mu(x,y,t). \tag{1}$$

This is a specific boundary value problem, since in the nonlocal condition the values of solution at contour points are associated with the double integral in the whole domain. This type of differential problem is solved using the alternating direction method:

$$\frac{u_{ij}^{n+\frac{1}{2}} - u_{ij}^{n}}{\frac{\tau}{2}} = \Lambda_1 u_{ij}^{n+\frac{1}{2}} + \Lambda_2 u_{ij}^{n} + f_{ij}^{n+\frac{1}{2}}, \quad i,j = \overline{1,N-1} \tag{2}$$

$$u_{0j}^{n+\frac{1}{2}} = h^2 \sum_{k=0}^{N} \sum_{l=1}^{N-1} K_{kl}(0,j)\rho_{kl} u_{kl}^{n+\frac{1}{2}} + \mu_{1j}^{n+\frac{1}{2}}, \quad u_{Nj}^{n+\frac{1}{2}} = h^2 \sum_{k=0}^{N} \sum_{l=1}^{N-1} K_{kl}(N,j)\rho_{kl} u_{kl}^{n+\frac{1}{2}} + \mu_{2j}^{n+\frac{1}{2}} \tag{3}$$

and

$$\frac{u_{ij}^{n+1} - u_{ij}^{n+\frac{1}{2}}}{\frac{\tau}{2}} = \Lambda_1 u_{ij}^{n+\frac{1}{2}} + \Lambda_2 u_{ij}^{n+1} + f_{ij}^{n+1}, \quad i,j = \overline{1,N-1} \tag{4}$$

$$u_{i0}^{n+1} = h^2 \sum_{k=1}^{N-1} \sum_{l=0}^{N} K_{kl}(i,0)\rho_{kl} u_{kl}^{n+1} + \mu_{3i}^{n+1}, \quad u_{iN}^{n+1} = h^2 \sum_{k=1}^{N-1} \sum_{l=0}^{N} K_{kl}(i,N)\rho_{kl} u_{kl}^{n+1} + \mu_{4i}^{n+1}. \tag{5}$$

We obtain the solution applying the nonlocal boundary conditions and constructing two systems of $2(N+1)$-th order linear algebraic equations.

REFERENCES

[1] M. Sapagovas and K. Jakubėlienė. Alternating direction method for two-dimensional parabolic equation with integral condition. *Nonlinear Anal. Model. Control*, **17** (1):91–98, 2012.

[2] K. Jakubėlienė and M. Sapagovas . On the stability of a difference scheme for a two-dimensionl parabolic equation with an integral condition. *Lith. Math. J*, **53** (3):311–323, 2013.