

ITERATIVE METHODS FOR FINITE DIFFERENCE SCHEMES WITH NONLOCAL CONDITIONS

O. ŠTIKONIENĒ¹, M. SAPAGOVAS² and A. ŠTIKONAS³

Institute of Mathematics and Informatics

Akademijos 4, LT-08663, Vilnius, Lithuania

E-mail: ¹{olgast, ²m.sapagovas}@ktl.mii.lt, ³ash@fm.vtu.lt

We consider the elliptic equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x, y)$$

in the rectangular domain $D = \{-1 < x < 1, 0 < y < 1\}$ with boundary conditions

$$u(-1, y) = \varphi_1(y), \quad u(x, 0) = \psi_1(x), \quad u(x, 1) = \psi_2(x)$$

and with non-local Bitsadze-Samarskii condition

$$u(1, y) = \gamma u(\xi, y), \quad -1 < \xi < 1.$$

The main purpose is to analyze the properties of eigenvalues and eigenvectors of the difference problem and to investigate the iterative method. In the case of nonlocal boundary condition the algebraic system is nonsymmetric, so iterative methods for such linear system are investigated. Sufficient condition for linear independence and positivity of eigenvectors is found.

The linear system for such problem has different properties for the various values of parameters γ and ξ , namely, all eigenvalues may be positive and different, matrix structure is not simple, the minimal eigenvalue may be zero or negative, the maximal positive eigenvalue is simple or multiply and so on.

Some results on convergence of iterative method with the Chebyshev set of parameters are received.

REFERENCES

- [1] M. Sapagovas. The eigenvalues of some problems with a nonlocal condition. *Differential Equations*, **38** (7), 2002, 1020 - 1026.