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ON THE EIGENVALUE PROBLEMS FOR STATIONARY DIFFERENTIAL AND DIFFERENCE OPERATORS WITH COUPLED BOUNDARY CONDITIONS

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We consider the eigenvalue problem for one-dimensional differential operator with given nonlocal coupled boundary conditions,

$$\frac{\mathrm{d}^2u}{\mathrm{d}x^2} + \lambda u = 0, \quad 0 < x < 1, \tag{1}$$

$$u(0) = \gamma_0 u(1), \tag{2}$$

$$\frac{\mathrm{d}u}{\mathrm{d}x}\Big|_{x=0} = \gamma_1 \frac{\mathrm{d}u}{\mathrm{d}x}\Big|_{x=1}, \tag{3}$$

and its finite-difference counterpart,

$$\frac{U_{j-1} - 2U_j + U_{j+1}}{h^2} + \lambda U_j = 0, \quad j = 1, 2, \ldots, N-1, \quad hN = 1, \tag{4}$$

$$U_0 = \gamma_0 U_N, \tag{5}$$

$$\frac{U_1 - U_0}{h} = \gamma_1 \frac{U_N - U_{N-1}}{h}, \tag{6}$$

where $\gamma_0, \gamma_1 \in \mathbb{R}$, $\gamma_0 + \gamma_1 \neq 0$. Such problem with $\gamma_0 = 0$ and $\gamma_1 = \beta$, $|\beta| > 1$, in finite-difference aspect was investigated by A. V. Gulin et al. (see [1] and references therein). We also briefly consider the similar two-dimensional differential and finite-difference problems.

The main aim of our work is to investigate the dependence of the qualitative structure of the spectrum of problems (1)–(3) and (4)–(6) on the parameters γ_0, γ_1, i.e., to formulate conditions of existence of zero, positive, negative or complex eigenvalues. We use technique, which is used, for example, in papers [2; 3] to investigate similar problems with other types of nonlocal conditions.

REFERENCES

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