BOUNDS FOR EIGENVALUES OF AN EIGENVALUE PROBLEM ARISING IN THE DESIGN OF INTEGRATED OPTICAL CHIPS

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In the design of integrated optical chips the eigenvalue problem

$$-\Delta u(x,y) + \alpha(x,y)\, u(x,y) = \lambda\, u(x,y) \text{ in } \Omega \subset \mathbb{R}^2,\ u(x,y) = 0 \text{ on } \partial\Omega\,,$$

arises. Here $\alpha : \Omega \to \mathbb{R}$ is a piecewise continuous function. Typical features of the technological problem are the possible occurence of eigenvalue clusters and the necessity of quite stringent relative error tolerances for the eigenvalues.

For the computation of bounds we use finite elements based on the Rayleigh - Ritz and Temple - Lehmann - Goerisch methods for upper and lower eigenvalue bounds, respectively.