عنوان مقاله:

Direct and inverse problems of ROD equation using finite element method and a correction technique

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خلاصه مقاله:

The free vibrations of a rod are governed by a differential equation of the form $(a(x)y^\prime)^\prime + \lambda a(x)y(x) = 0$, where $a(x)$ is the cross sectional area and λ is an eigenvalue parameter. Using the finite element method (FEM) we transform this equation to a generalized matrix eigenvalue problem of the form $(K - \Lambda M)u = 0$ and, for given $a(x)$, we correct the eigenvalues Λ of the matrix pair (K,M) to approximate the eigenvalues of the rod equation. The results show that with step size h the correction technique reduces the error from $O(h^{2}i^{4})$ to $O(h^{2}i^{2})$ for the i-th eigenvalue. We then solve the inverse spectral problem by imposing numerical algorithms that approximate the unknown coefficient $a(x)$ from the given spectral data. The cross section is obtained by solving a nonlinear system using Newton's method along with a regularization technique. Finally, we give numerical examples to illustrate the efficiency of the proposed algorithms.

کلمات کلیدی:

Rod equation, eigenvalue, finite element method, direct problem, Inverse problem, Sturm-Liouville

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