Investigation of eigenvibrations of a loaded bar

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Abstract

© The Authors, published by EDP Sciences, 2018. The differential eigenvalue problem describing eigenvibrations of a bar with fixed ends and attached load at an interior point is investigated. This problem has an increasing sequence of positive simple eigenvalues with limit point at infinity. To the sequence of eigenvalues, there corresponds a complete orthonormal system of eigenfunctions. We formulate limit differential eigenvalue problems and prove the convergence of the eigenvalues and eigenfunctions of the initial problem to the corresponding eigenvalues and eigenfunctions of the limit problems as load mass tending to infinity. The original differential eigenvalue problem is approximated by the finite difference method on a uniform grid. Error estimates for approximate eigenvalues and eigenfunctions are established. Theoretical results are illustrated by numerical experiments for a model problem. Investigations of this paper can be generalized for the cases of more complicated and important problems on eigenvibrations of beams, plates and shells with attached loads.

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