Abstract

Finite Element method is a numerical method for finding approximate solution to boundary value problems for partial differential equations. It uses subdivision of a whole problem domain into simpler domain, called finite elements, and variation methods from the calculus of variations to solve the problem by minimizing an associated error function.

Finite element method (FEM) is applied in engineering as a computational tool for performing engineering analysis. FEM form a global linear system of algebraic equations (homogenous/ non-homogenous) to find the solution of analysis problems.

In structural dynamic problems the algebraic equations will of the form \([K]{u}=\omega^2[M]{u}\), \([K]\) and \([M]\) are stiffness and mass matrices. Solving this large order system will generate natural frequencies and mode shape of the structure. Since most of the analysis is carried out for first few frequencies and mode shape of the structure, solving the entire system is required iterative method used to transform system into reduced system from where the eigenvalues are
extracted in increasing order .(Lanczos/subspace).

In the proposed work, the Lanczos algorithm implementation is modified to extract the natural frequencies and mode shapes of the structure in a given input frequency range. The eigenvalues and eigenvectors are computed in multiple passes to Lanczos reduction algorithm. In order to get faster converges of previously calculated eigenvectors and used subsequent reorthogonalization vectors. This reduced the overall time required to extract frequencies and mode shapes .This is one of requirements of in-house developed FEM based structural analysis software FEASTSMT.

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Index Terms

Computer Science Applied Mathematics

Keywords

Lanczos algorithm, FEASTSMT, Finite element analysis.