Structural Dynamic Response under Uncertainty - An Interval Finite Element Approach

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Abstract

An analysis of the structural dynamic response under uncertainty is presented. Uncertainties in load and material are modeled as intervals exploiting the interval finite element method (IFEM). To reduce overestimation and increase the computational efficiency of the solution, we do not solve the dynamic problem by an explicit step-by-step time integration scheme. Instead, our approach solves for the structural variables in the whole time domain simultaneously by an implicit scheme using discrete Fourier transform and its inverse (DFT and IDFT). Non-trivial initial conditions are handled by modifying the right-hand side of the governing equation. To further reduce overestimation, a new decomposition strategy is applied to the IFEM matrices, and both primary and derived quantities are solved simultaneously. The final solution is obtained using an iterative enclosure method, and in our numerical examples the exact solution is enclosed at minimal computational cost.