Interval optimization for the structural-acoustic system with interval parameters in the mid-frequency range

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Abstract

Recently a hybrid finite element /statistical energy analysis (FE /SEA) method has been developed for the mid-frequency analysis of complex systems. This method can be extended for the analysis of random systems with parametric and non-parametric uncertainties by allowing the FE components to possess parametric uncertainty. This paper concerns the interval optimization of the structural-acoustic system with interval parametric and non-parametric uncertainties in the mid-frequency range. The interval optimization can be carried out by employing the nested double loop optimization method, whose computational cost is commonly considerable. To improve the computational efficiency of the nest optimization, the second-order Chebyshev polynomials are introduced to approximate the extreme values in the inner loop. Therefore, the interval optimization problem is converted into a corresponding single-loop one, whose computational cost is acceptable. The effectiveness of the proposed method is demonstrated by two structural-acoustic systems with interval parametric and non-parametric uncertainties in the mid-frequency range.

Keywords: Hybrid Finite Element/Statistical Energy Analysis; Interval optimization; Chebyshev polynomials; Interval uncertainty; Structural-acoustic systems