ABSTRACT

Optimal Topology Design of a Structure under Periodic Loads with a Specified Frequency Range

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In structural design under periodic loads both structural stiffness and resonance avoidance in a specified frequency range are essential design requirements. To achieve these design objectives topology optimization method in dynamic problem considering periodic loads is proposed for minimizing the dynamic mean compliance of a structure.

Dynamic displacements are approximated by employing the mode acceleration method which describes more accurate dynamic responses and sensitivity analysis compared to the mode superposition method. To minimize the dynamic mean compliance when the excitation loading is applied in a specified frequency range frequency shift method is suggested so that natural frequencies of a structure are

relocated by the gradual movement of excitation frequencies. Homogenization design method with the modified optimality criteria method is adopted for topology optimization and subspace iteration method is exploited for solving the eigenvalue problem.

The accuracy of the mode acceleration method is verified by comparing the sensitivity of the objective function with the direct and modal frequency response methods. Numerical examples show that the proposed method provides the efficient structural design where a resulted structure has appropriate stiffness and their natural frequencies are not located in a excitation frequency range.