ABSTRACT

Topology Design of a Structure with a Specified Eigenfrequency

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When a dynamic load applies a structure, natural frequency is important to design a safe structure. If a structure can have a specified frequency, it is possible to design to avoid resonance and to design a functional structure that is needed to have a specified frequency according to a specified frequency. Topology optimization is applied to determine the layout of structural component to obtain a specified frequency and the topology design problem is formulated to minimize the difference between the specified structural frequency and a given frequency. The homogenization method is employed and the topology design problem is solved by the optimality criteria method. The value of a weighting factor plays an important role in this topology design problem. A weighting factor is chosen experimentally, in order to obtain a suitable speed and stable convergence of the scheme. The specified structural frequency approaches fast near a

given frequency by using the large value of the weighting factor and converges stably by using the suitable value of the weighting factor. The modified optimality criteria method approximated by using the binomial expansion is also suggested to determine the suitable value of the weighting factor, which makes convergence stable and slow automatically in algorithm. As the previous formulated problem is simply modified, topology optimization for maximizing the difference between the specified structural frequency and a given frequency can be considered. When the constrained material is distributed constantly in design domain, the calculated natural frequency is considered an excited frequency and it is set up a given frequency. It is possible to avoid resonance by moving away the specified structural frequency from the given frequency. The results of several test problems are compared with the other journals and show the validity of the proposed algorithms.