

TOPOLOGY OPTIMIZATION OF BINARY STRUCTURES FOR ACOUSTIC PROBLEM

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Abstract

This study proposes a novel continuous topology optimization of binary structure (TOBS) framework for acoustic and acoustic–structure interaction systems. Topology optimization for such systems has been extensively investigated using gradient-based optimization techniques. However, due to the high sensitivity of dynamic responses to small variations in design variables, achieving clear convergence to distinct solid and void regions—without intermediate densities—remains a significant challenge. To address this issue, a relaxed formulation of the TOBS method employing continuous design variables is introduced and applied to both acoustic and coupled acoustic–structure interaction problems. Furthermore, a mixed-integer linear programming (MILP) strategy is incorporated, in which the number of admissible discrete design candidates is progressively reduced, thereby mitigating the persistence of intermediate design variables. The effectiveness of the proposed approach is demonstrated through representative acoustic design problems and acoustic–structure interaction applications.