

Diverse Competitive Designs for SIMP-based Topology Optimization

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Abstract

Design optimization is often carried out in the conceptual design stage without full knowledge of the objective functions and constraints. Alternatives near the single topology optimal design may be better practical because the single optimal design could be rendered useless by refinements in the model or the optimization problem formulation. We therefore explore strategies for finding diverse optima using SIMP-based approach in topology optimization. We focus on the problem of finding competitive diverse alternatives to single optimal design with diversity constraints. In this paper, we present two optimization strategies and three algorithms with different types of diversity evaluation (using Euclidean norm, Pearson correlation coefficient and polynomial interpolating function as constraints). Several test cases are used to compare the algorithms. Effectiveness and numerical influences for the three algorithms are explored by comparing their results. The comparison for computational costs and objectives' performances between finding two competitive diverse alternatives and one single optimal design is also discussed.