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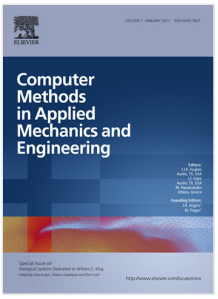

Development of Pareto topology optimization considering thermal loads

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Development of Pareto Topology Optimization Considering Thermal Loads

Meisam Takalloozadeh and Gil Ho Yoon

Abstract

In this research, we developed a level-set based topology optimization with a topological derivative formulation considering thermal load. Thermo-elasticity equations were utilized to obtain the sensitivity of the objective function after inserting a small hole in the domain. Total strain energy and the maximum stress in the design domain were taken as the objective functions. After taking the thermal loading effect into account, the total strain energy density function became a nonhomogeneous function of the strain. In addition, temperature variation changed Hooke's law from a linear homogeneous to a linear nonhomogeneous expression including a zero order term. We derived the sensitivity value of the selected objective functions with respect to a perturbation in the structural domain under mechanical and thermal loads while considering these changes in the governing equations. We performed several numerical optimization problems to demonstrate the validity of the present level-set based Pareto topology optimization. Two types of examples (compliance and stress minimization) were solved based on the chosen objective functions. Furthermore, in the stress minimization examples, the derived formula was extended to consider thermal effects in the failure theories for pressure independent and dependent materials.

Keywords: Topology Optimization; Sensitivity Analysis; Pareto Method; Thermal load; Drucker-Prager Criterion