MULTIPHYSICS DESIGN OPTIMIZATION USING AN ADJOINT SENSITIVITY ANALYSIS

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KEYWORDS

Computational Fluid Dynamics, CFD, Design Optimization, OptiStruct, AcuSolve, Solid-Isotropic Material with Penalty, SIMP, Aerospace, Topology Optimization, Thermal Loading, Mass Reduction

ABSTRACT

Optimal design methods involving the coupling of fluid and structural solutions are a topic of active research; particularly for aerospace applications. The paper presents a coupled fluid and structure approach to topology optimization. A gradient based method is used to minimize the compliance of a structure subject to thermal loading. The optimal material distribution to minimize compliance is computed using the Solid-Isotropic Material with Penalty (SIMP) method. A volume fraction constraint is imposed in order to iteratively reduce the parts mass. Draw constraints are used to ensure manufacturability. The thermal loading is computed iteratively using a computational fluid dynamics solution. The coupled sensitivities at the boundaries are addressed explicitly. The optimization produces an innovative design which increases the heat rejection rate of the part while reducing the mass.