

MULTIOBJECTIVE TOPOLOGY OPTIMIZATION: NOVEL INSIGHTS AND A COMPARISON OF SCALARIZATION STRATEGIES

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Abstract

Topology optimization generates optimal designs by optimizing an objective under a number of constraints. While considerable research has focused on improving and extending single-objective formulations, design is usually a trade-off between conflicting criteria. This calls for a multiobjective treatment of topology optimization. The presentation aims to bridge the considerable gap between the topology and multiobjective optimization fields through three contributions. First, we provide a short theoretical comparison of the two most commonly used scalarization techniques, the weighted sums and epsilon constraint methods, to the Pascoletti-Serafini scalarization, which is well-established in the multiobjective optimization community. Second, we compare these three methods numerically through a host of biobjective topology optimization problems, covering minimization of volume, compliance, maximum stress and dynamic compliance. Finally, the third contribution is a novel insight into the structure of the Pareto frontier: it consists of pieces that belong to local fronts. This is illustrated via a simple truss optimization example and also readily apparent in the numerical examples, where local fronts can be recognized to cause disconnected and/or concave fronts.