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ROBUST TOPOLOGY DESIGN OF CONTINUUM STRUCTURES USING ISOLINES UNDER LOADING UNCERTAINTY

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Uncertainty is a crucial aspect in structural design and optimization to produce robust and reliable solutions. The classical engineering approach takes into account uncertainties using factors of safety. However, this focus can sometimes provide too conservative designs. Nowadays, there are two main approaches that consider uncertainties in topology optimization. The first is named reliability-based topology optimization (RBTO) and the second one is named robust topology optimization (RTO). This latter approach has become more a more popular in the last years, and it focuses on making the structural designs insensitive to noise factors. Although, structural topology optimization is a mature field, the literature on topology design under loading uncertainty has relatively few publications. The aim of this work is to introduce uncertainties in loading conditions in the deterministic compliance or total strain energy problem using the Isolines Topology Design (ITD) method to solve optimization problem The objective is to minimize expected compliance with uncertainty in loading magnitude and applied direction, where uncertainties are assumed normally distributed and statistically independent. This strategy is equivalent to multiple load case problem where loading conditions and weighting factors and derived analytically to accurately and efficiently compute expected compliance and sensitivities. The validity of this technique is demonstrated on several examples, including comparisons with results by other methods, providing quality solutions, without the need to interpret the topology. This work was supported in part by the Ministerio de Economía y Competitividad of Spain, via the research Project DPI2011-26394 and Departamento de Estructuras y Construcción of Universidad Politécnica de Cartagena. Its support is greatly appreciated.