

Reliability Based Topology Optimization: An Efficient Method for Material Uncertainty

Authors : Mehdi Jalalpour, Mazdak Tootkaboni

Abstract : We present a computationally efficient method for reliability-based topology optimization under material properties uncertainty, which is assumed to be lognormally distributed and correlated within the domain. Computational efficiency is achieved through estimating the response statistics with stochastic perturbation of second order, using these statistics to fit an appropriate distribution that follows the empirical distribution of the response, and employing an efficient gradient-based optimizer. The proposed algorithm is utilized for design of new structures and the changes in the optimized topology is discussed for various levels of target reliability and correlation strength. Predictions were verified thorough comparison with results obtained using Monte Carlo simulation.

Keywords : material uncertainty, stochastic perturbation, structural reliability, topology optimization

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