11th World Congress on Structural and Multidisciplinary Optimisation
07th -12th, June 2015, Sydney Australia

Applications of a Consistent Grayscale-free Topology Optimization Method to Industrial Design Problems

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Abstract

In a previous research, we proposed a consistent grayscale-free topology optimization method using the level-set method and zero-level boundary tracking mesh. In this method, the shape and topology of the design target are represented using the level-set method and the state variables are computed using a mesh tracking the zero iso-contour of the level-set function, which we call the zero-level boundary. Because of the characteristics of the level-set method and zero-level boundary tracking mesh, essentially grayscale-free representation is achieved. Furthermore, a double-well potential based regularization technique is employed in the proposed method to regularize the structural optimization problem. Because of these enhancements, we realize essentially grayscale-free topology optimization where the design variables are updated on the basis of the standard framework of mathematical programming. In the present research, we apply the proposed grayscale-free topology optimization method to several structural optimization problems in industry, such as the minimum compliance and invehicle reactor design problems. Through the application to these design problems, we investigate the potential of the proposed grayscale-free topology optimization method.