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Topology optimizations of structures with inverse Fourier transform and real coded

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Abstract

Checkerboard patterns are posing significant problems for topology optimization. These problems were observed in the early pioneering works on the homogenization method (Bendsoe and Kikuchi(1988)), solid isotropic material with penalization (SIMP) method (Bendsoe(1989)), genetic algorithms (GA) (Chapman et. al. (1994)) and evolutionary structural optimization (ESO) method (Chu et.al. (1996)). Various methods for preventing checkerboard patterns have been proposed (Fujii and Kikuchi (2000), Wang et.al.(2004)). This paper presents another simple method for topology control and optimization of structures using inverse Fourier transform and a real-coded genetic algorithm (GA). The proposed method can not only suppress checkerboard patterns but can also control the complexity of topology in a very simple manner by restraining the minimum wave length of the inverse Fourier function. Displacement minimization problems that consider a volume constraint for plane stress finite element meshed plates and three-dimensional cylindrical trusses are solved. It is observed from numerical results that the proposed method gives clear topologies.