Topology optimization of continuum structures made of non-homogeneous materials of isotropic or cubic symmetry

Sławomir Czarnecki, Radosław Czubacki, <u>Tomasz Lewiński</u>, Paweł Wawruch

Warsaw University of Technology, Faculty of Civil Engineering, Department of Structural Mechanics and Computer Aided Engineering, Armii Ludowej 16, 00-637 Warsaw, Poland, t.lewinski@il.pw.edu.pl

Abstract

The paper concerns optimum design of elastic moduli corresponding to: i) nonhomogeneous isotropy, or to ii) cubic symmetry, aimed at minimization of the total compliance. Similarly to the Free Material Design the cost of design is assumed as the integral of the trace of the elastic moduli tensor over the feasible domain. A proof is given that both the optimum design formulations discussed reduce to auxiliary problems being tensorial counterparts of the Monge-Kantorovich scalar problem. The paper comprises numerical analysis of the mentioned auxiliary problems and puts forward case studies concerning isotropy design. A characteristic feature of optimal isotropic designs is emergence of auxetic properties, where Poisson ratio attains negative values.

Keywords: Free material design, compliance minimization, anisotropy, cubic symmetry.