Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXXVI, págs. 1693-1693 (resumen)
José G. Etse, Bibiana M. Luccioni, Martín A. Pucheta, Mario A. Storti (Eds.)
San Miguel de Tucumán, 6-9 Noviembre 2018

MATERIALS INVERSE DESIGN IN 3D PROBLEMS USING ELASTIC SYMMETRY PROPERTIES

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Keywords: Inverse homogenization, 3D topology optimization, symmetries, topological derivate.

Abstract. The aim of this work is to present an optimization computational tool for the material design of 3D elastic composites, by means of inverse homogenization. The specific problem here studied consists of determining the material micro-architecture, such that the elastic effective properties copy those of a target elasticity tensor. Given unit cell, which is the design domain, the spatial distribution of the faces is found through a rather conventional topology optimization problem. The specific methodology here proposed is to analyze the symmetry class of the target tensor, and use this information to deduce the shape of the unit cell. An analysis of the correlation between physical properties of the target tensor (symmetry properties) and geometric properties of the micro-architecture is presented. Given the relation between both properties, the proposed inverse design algorithm select an appropriate unit cell shape, that will be the domain of the topology optimization problem. In addition, with the goal of guaranteed the wanted effective properties, an imposition of predefined geometric symmetries to the topology is evaluated.