Homogenization-based stiffness optimization and projection of 2D coated structures with orthotropic infill

This paper concerns compliance minimization and projection of coated structures with orthotropic infill material in 2D. The purpose of the work is two-fold. First, we introduce an efficient homogenization-based approach to perform topology optimization of coated structures with orthotropic infill material. The design space is relaxed to allow for a composite material description, which means that designs with complex microstructures can be obtained on relatively coarse meshes. Second, a method is presented to project the homogenization-based designs on a fine but realizable scale. A novel method to adaptively refine the lattice structure is presented to allow for a regular spacing of the infill. Numerical experiments show excellent behavior of the projected designs, with structural performance almost identical to the homogenization-based designs. Furthermore, a reduction in computational cost of at least an order of magnitude is achieved, compared to a related approach in which the infill is optimized using a density-based approach.

General information
Publication status: Published
Organisations: Solid Mechanics, Department of Mechanical Engineering, Delft University of Technology
Corresponding author: Groen, J. P.
Contributors: Groen, J. P., Wu, J., Sigmund, O.
Pages: 722-742
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Computer Methods in Applied Mechanics and Engineering
Volume: 349
ISSN (Print): 0045-7825
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
Original language: English
Keywords: Topology optimization, Coated structures, Homogenization, High-resolution, Infill
DOIs:
10.1016/j.cma.2019.02.031
Source: FindIt
Source-ID: 2444541594
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review