Optimal microstructures

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Abstract

The aim of this poster is to present examples of three-dimensional microstructures obtained with topology optimization, which exhibit macroscopic properties close to the theoretical bounds. Examples include isotropic microstructures with optimal stiffness or optimal structural damping for two-phase materials, as well as minimum/maximum thermal expansion for three-phase materials. The work builds on and extends results presented in [1] and [2].

A discussion on optimization formulations best suited for obtaining the microstructures is included. How to assure the manufacturability of the microstructures is also discussed. This and the usefulness of material microstructural design are put into a larger context by Alexandersen, J. et al. in the poster titled "A critical evaluation of homogenisation-based multiscale topology optimisation".

[1] E. Andreassen, B. S. Lazarov, O. Sigmund, Design of manufacturable 3D extremal elastic microstructure, Mechanics of Materials 69 (1), 1-10, 2014.

[2] C. S. Andreasen, E. Andreassen, J. S. Jensen, O. Sigmund, On the realization of the bulk modulus bounds for two-phase viscoelastic composites, Journal of the Mechanics and Physics of Solids 63, 228-241, 2014.