## **Accepted Manuscript**

Topology optimization for concurrent design of structures with multi-patch microstructures by level sets

Hao Li, Zhen Luo, Liang Gao, Qinghua Qin

PII: DOI: Reference:	S0045-7825(17)30751-X https://doi.org/10.1016/j.cma.2017.11.033 CMA 11692
To appear in:	Comput. Methods Appl. Mech. Engrg.
	31 July 2017 23 November 2017 30 November 2017

Please cite this article as: H. Li, Z. Luo, L. Gao, Q. Qin, Topology optimization for concurrent design of structures with multi-patch microstructures by level sets, *Comput. Methods Appl. Mech. Engrg.* (2017), https://doi.org/10.1016/j.cma.2017.11.033

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

## Topology optimization for concurrent design of structures with multi-patch microstructures by level sets

Hao Li<sup>a</sup>, Zhen Luo<sup>b,\*</sup>, Liang Gao<sup>a,\*\*</sup> and Qinghua Qin<sup>c</sup>

<sup>a</sup> The State Key Lab of Digital Manufacturing Equipment and Technology Huazhong University of Science and Technology, 1037 Luoyu Road, Wuhan, Hubei 430074, China

<sup>b</sup> The School of Mechanical and Mechatronic Engineering University of Technology, Sydney, 15 Broadway, Ultimo, NSW 2007 Australia

<sup>c</sup> The Research School of Engineering Australian National University, Acton, ACT 2601, Australia

**Corresponding author:** Phone: +61 2 9514 2994; E-mail: zhen.luo@uts.edu.au (Dr Z. Luo<sup>\*</sup>)

Phone: +86 27 8755 9419; E-mail: gaoliang@hust.edu.cn (Prof L. Gao\*\*)

## Abstract

This paper focuses on the novel concurrent design for cellular structures consisting of multiple patches of material microstructures using a level set-based topological shape optimization method. The macro structure is featured with the configuration of a cluster of non-uniformly distributed patches, while each patch hosts a number of identical material microstructures. At macro scale, a discrete element density based approach is presented to generate an overall structural layout involving different groups of discrete element densities. At micro scale, each macro element is regarded as an individual microstructure with a discrete intermediate density. Hence, all the macro elements with the same discrete densities (volume fractions) are represented by a unique microstructure. The representative microstructures corresponding to different density groups are topologically optimized by incorporating the numerical homogenization approach into a parametric level set method. The multiscale concurrent designs are integrated into a uniform optimization procedure, so as to optimize both topologies for the macrostructure and its microstructures, as well as locations of the microstructures in the design space. Numerical examples demonstrate that the proposed method can substantially improve the structural performance with an affordable computation and manufacturing cost.

Keywords: Topology optimization; Cellular structures; Multiscale design; Level set method.

Download English Version:

## https://daneshyari.com/en/article/6915665

Download Persian Version:

https://daneshyari.com/article/6915665

Daneshyari.com