

Accepted Manuscript

Optimization of structures with thin-layer functional device on its surface through a level set based multiple-type boundary method

Qi Xia, Tielin Shi

PII: S0045-7825(16)30176-1

DOI: <http://dx.doi.org/10.1016/j.cma.2016.08.001>

Reference: CMA 11082

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date: 14 April 2016

Revised date: 29 June 2016

Accepted date: 2 August 2016

Please cite this article as: Q. Xia, T. Shi, Optimization of structures with thin-layer functional device on its surface through a level set based multiple-type boundary method, *Comput. Methods Appl. Mech. Engrg.* (2016), <http://dx.doi.org/10.1016/j.cma.2016.08.001>

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.



Optimization of structures with thin-layer functional device on its surface through a level set based multiple-type boundary method

Qi Xia*, Tielin Shi

*The State Key Laboratory of Digital Manufacturing Equipment and Technology,
Huazhong University of Science and Technology, Wuhan, China*

Abstract

Functional structure, i.e., native base structure equipped with thin-layer functional devices on its surface, is important in many engineering applications. The performance of such a functional structure is seriously affected by the configuration of the base structure and the surface functional devices, and the optimization of configuration is a simultaneous topology optimization of the boundaries that belong to different types. In the present study, load cell is taken as an example of the functional structure, and strain gauge is taken as an example of the functional device. The task of designing a load cell is accomplished by solving a multi-objective topology optimization problem whose objective makes a compromise between stiffness and flexibility of the base structure. The design variables include two types of boundaries: functional boundary where a strain gauge is installed, the free boundary where there does not exist any connection to the environment. The optimization problem is solved by using a level set based multiple-type boundary method. Two level set functions are used to represent a functional structure and the two types of boundaries. Evolution of the two boundaries is modeled by two independent Hamilton-Jacobi equations. Re-meshing is conducted in each iteration of optimization. Quadrilateral body-fitted mesh is used for the finite element analysis, and the artificial weak material is not used. Numerical examples in two dimensions are investigated.

Keywords: configuration optimization, topology optimization, functional surface, level set method, topology description model

*Corresponding author. Tel:+86-27-87559544. Fax:+86-27-87556835

Email addresses: qxia@mail.hust.edu.cn (Qi Xia), tlshi@mail.hust.edu.cn (Tielin Shi)

Download English Version:

<https://daneshyari.com/en/article/4964059>

Download Persian Version:

<https://daneshyari.com/article/4964059>

[Daneshyari.com](https://daneshyari.com)