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Multi-Scale Topology Optimization Method Considering Multiple Structural Performances

Wenjun Chen[1] and Yingjun Wang[1,*]

[1] National Engineering Research Center of Novel Equipment for Polymer Processing, The Key Laboratory of Polymer Processing Engineering of the Ministry of Education, Guangdong Provincial Key Laboratory of Technique and Equipment for Macromolecular Advanced Manufacturing, South China University of Technology, Guangzhou, 510641, China

[*]Corresponding Author: Yingjun Wang. Email: wangyj84@scut.edu.cn

ABSTRACT

The rapid development of topology optimization has given birth to a large amount of different topology optimization methods, and each of them can manage a class of corresponding engineering problems. However, structures need to meet a variety of requirements in engineering application, such as lightweight and multiple load-bearing performance. To design composite structures that have multiple structural properties, a new multi-scale topology optimization method considering multiple structural performances is proposed in this paper. Based on the fitting functions of the result set and the bisection method, a new method to determine the weight coefficient is proposed in this paper, which can shorten the gap between the optimized results and the design requirement. Several numerical examples are proposed to demonstrate practicality of the proposed method. To further explore the performance of the proposed method, the numerical examples are carried out considering two different objective functions. The results show that the proposed method is effective and practical in both the situation of the multi-objective functions. The proposed method provides the structures with a larger result set, where the result points have different macroscopic properties comparing with the single-scale situations. This method is with high efficiency and convenient implementation.

KEYWORDS

Multi-scale topology optimization; steady-state heat conduction; eigenvalue optimization; multiple microstructures

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