APCOM & ISCM
11-14th December, 2013, Singapore

Topological design of microstructured composites using level set methods

Yiqiang Wang[1], Zhen Luo[1,*], Nong Zhang[1], Zhan Kang[2]

[1] School of Electrical, Mechanical and Mechatronic Systems
University of Technology, Sydney, NSW, Australia

[2] State Key Laboratory of Structural Analysis for Industrial Equipment
Dalian University of Technology, Dalian, China
yiqiang.wang@uts.edu.au; zhen.luo@uts.edu.au

This study proposes a topology optimization method, using level set models for the systematic design of microstructured periodic composites with extreme thermal expansions. Composite materials with extreme or unusual or prescribed thermal expansion behavior have been of great interest from both the point of an academic and engineering view. In the numerical implementation, the design of extreme composites can be regarded as an inverse homogenization process, minimizing the prescribed material properties by achieving the optimal material distribution within each base cell. In contrast to the existing topology optimization methods, this study attempts to solve the problem by using a level-set based topological shape optimization method, due to the unique characteristics of the level set methods, such as a smooth design boundary, distinct material phases, integrated shape optimization of the boundary and topology optimization of the structure. A typical numerical example is shown to demonstrate the effectiveness of the present method.

Keywords: Topology optimization, Level set method, Periodic composites, Thermo-mechanical process