Topological optimization of anisotropic thermal structure based on meshless method and RAMP model

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Abstract

The transform model of thermal conductivity for anisotropic structure is built by using matrix transform method. The calculation model of steady heat transfer analysis under mixed boundary conditions is established using meshless method, and the essential boundary condition is enforced by penalty method. The complex engineering examples are performed the heat transfer analysis using meshless method, and the numerical solutions have good stability and higher accuracy. The topological optimization model of anisotropic thermal structure is established integrating meshless method with rational approximation of material properties (RAMP) model, in which the node density and heat dissipation is selected as design variable and objective function, respectively. Some typical examples are solved using the proposed model and computer program, and the correctness of topological optimization model is verified. Moreover, the temperature field of topological structure is analyzed, and the effect of the orientation angle of anisotropic structure and orthotropic factor on the final topological structure is also studied. The investigation provides a significant method for the topological optimization design of anisotropic thermal structure.

Keywords: Topological optimization of thermal structure; anisotropic structure; meshless method; RAMP model

*This research is supported by National Natural Science Foundation of China [51405415, 51375417], Hunan Provincial Natural Science Foundation of China [2016JJ3120], Scientific Research Start-up Foundation of Xiangtan University (No. 14QDZ06), and the first author is gratefully acknowledged.