数学与系统科学研究院

计算数学所网络学术报告

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报告题目：

A wavelet based learning multiscale approach for estimation of the effective thermal conductivities of composites

邀请人：　毛士鹏 研究员

报告时间：2020 年 12 月 15 日（周二）

下午 13:30-14:30

报告工具：腾讯会议（ID：267 928 025）

会议链接：

https://meeting.tencent.com/s/lR7r4no2Szuh

Abstract:

Multiscale modeling for the estimation of effective thermal conductivity fields of composites with periodic and random microstructure remains a challenging problem. This is mainly due to the non-linear physics, the high-dimensional property, and the fact that many repeated evaluations of the multiscale model are often required. In this study, we develop a wavelet based learning network to predict the effective thermal conductivities of composites with heterogeneous conductivity using the wavelet transform. In addition, by virtue of asymptotic homogenization method (AHM), a offline multiscale model is proposed for establishment of the material database with high-dimensional and highly-complex mappings. The wavelet based learning strategy and the offline multiscale material database ease the training of neural networks, enabling us to efficiently build more simple networks that have an essentially increasing capacity and resisting noise for approximating mappings of very high complexity. The numerical experiments performed using 2-D and 3-D periodic and random microstructure models illustrate the performance of the integrated method. The obtained results indicate that the wavelet based learning multiscale approach is a robust method for estimation of the effective conductivity fields with different heterogeneity patterns. The proposed method can significantly reduce the computation time, and can be further extended to predict effective mechanical properties of composites.

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