



The Hong Kong University of Science and Technology

Department of Mathematics

Seminar on Applied Mathematics

*A novel asymptotic-analysis-based
homogenisation approach towards fast design of
infill graded microstructures*

by

Prof. Yichao Zhu

*Department of Engineering Mechanics,
Dalian University of Technology*

Abstract

Graded microstructural configurations (GMCs) have demonstrated their values in various engineering fields, and their production becomes increasingly feasible with the development of modern fabrication techniques, such as additive manufacturing. In this talk, a homogenisation framework to underpin the fast design of devices filled with quasi-periodic microstructures is proposed first [1]. The novel framework is aimed for addressing the challenging issue limiting the existing approaches from wide application, that is, how to manage the balance between resolution and efficiency for cross-scale design approaches. With the use of asymptotic analysis, the processes of GMC representation, stress analysis and optimisation get systematically integrated in the proposed method. Since the mathematical structure of the present approach makes it generically compatible with computational parallelism, a divide-and-conquer scheme is further introduced to make full use of this feature [2]. The extremely high efficiency of the proposed approach resulted from employing parallel computing techniques, can be directly spotted in a number of three-dimensional examples involving considerably complex GMCs, which have barely been attempted by other optimisation schemes used for designing GMs in literature. The final goal of this talk is to help explore the matching point between the present scheme for designing GMCs and more practical experimental works.

[1] A novel asymptotic-analysis-based homogenisation approach towards fast design of infill graded microstructures. Y. C. Zhu et al., *J. Mech. Phys. Solids*, **124** (2019):612-633. [2] A parallel divided-and-conquer strategy for the fast design of quasi-periodic graded microstructures. Y.C. Zhu et al., submitted for publication.

Date: Friday, 5 July 2019

Time: 3:00p.m. – 4:00p.m.

**Venue: Room 3472, Academic Building,
(Lifts 25-26), HKUST**

All are welcome!