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**Multi-scale modelling of advanced engineering materials:
from understanding microphysics to enriched continuum description**

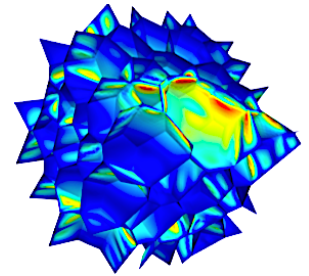
SPEAKER

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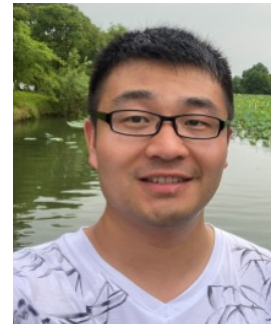
ABSTRACT

Advanced engineering materials with extraordinary mechanical properties have emerged to meet the growing requirements in modern applications. However, their complex microstructures and mechanisms have raised significant computational challenges. To address this, multi-scale modelling approaches are suitable candidates. Multi-scale modelling approaches adopting a classical continuum description at the macroscale have exhibited remarkable success for conventional engineering materials. Yet, the classical continuum description often fails for advanced engineering materials, which may require enrichment of the macroscopic kinematics to capture the microphysics as well as adaption of the scale transition scheme. Despite a critical role, what macroscopic description shall be adopted is usually not known a-priori for a given material system. In this talk, a systematic strategy from understanding microphysics to macroscopic enriched continuum description for advanced engineering materials, will be introduced. This strategy will be demonstrated through three examples: locally resonant acoustic metamaterials, multi-phase interfaces in multi-phase steels and shell-based cellular materials (including foams and lattice structures). Other relevant open challenges will be discussed as well.



ABOUT THE SPEAKER

Lei Liu is a Postdoctoral Researcher at Division of Material and Computational Mechanics, Chalmers University of Technology, Sweden since November 2023. Prior to joining Chalmers, he obtained his PhD degree at Mechanics of Materials Section, Eindhoven University of Technology, the Netherlands. His research focuses on developing efficient multi-scale computational homogenization approaches, and applying advanced computational tools to understand and predict the structure-property relationships of complex materials. He has published 16 papers in international journals, with 10 first-author papers (including JMPS, CMAME and Acta Mater.). Besides, he has delivered 13 talks in international conferences and 3 invited lectures/seminars at other European institutes.



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