数学与系统科学研究院

计算数学所学术报告

报告人：Prof. Wing Kam Liu

（ PhD, PE, Walter P. Murphy Professor, Northwestern University，Director of Advanced Material Systems and Simulation，Director of International Research Center for Computational Mechanics at Dalian University of Technology ）

报告题目：

Microstructural material database for self-consistent clustering analysis of strain softening materials

邀请人： 崔俊芝 院士

报告时间：2017 年 8 月 21 日（周一）

下午 15:30-16:30

报告地点： 数学院南楼七层

702 教室

Abstract:

The advent of advanced processing and manufacturing techniques provides unparalleled freedom to design new material classes with complex microstructures across scales from nanometers to meters. As these new materials become more prevalent in design and manufacturing, so does the need to understand the failure limits of these materials. To design using these materials it is necessary to develop high fidelity multiscale material models that capture the bulk structural performance while accounting for the microscopic aspects, which are extremely important in advanced materials. In this lecture a new data-driven computational framework for the analysis and design of these complex material systems will be presented. A mechanistic concurrent multiscale method called self-consistent clustering analysis (SCA) is developed for general inelastic heterogeneous material systems. The efficiency of SCA is achieved via data compression algorithms which group local microstructures into clusters during the off-line training stage, thereby reducing required computational expense. Its accuracy is guaranteed by introducing a self-consistent method for solving the Lippmann-Schwinger integral equation in the on-line predicting stage. The integration of microstructure reconstruction and subsequent high-fidelity multiscale predictions of the materials behavior leads to the generation of vast amounts of reliable data. This structure-property feedback loop enables the design of new material systems with new capabilities. In mathematical physics, the "structure" and "property" can be interpreted as the nonlocal interaction of the microstructure clusters and the virtual work at the corresponding material point, respectively. Based on the computational design of experiments, data mining techniques offer the ability to discover the influence of the microstructure on the macroscopic materials behavior. The proposed framework will be illustrated for advanced composites and the integrated design of various advanced material systems.

Wing Kam Liu教授简介：

Liu is the Walter P. Murphy Professor of Northwestern University, President of the International Association for Computational Mechanics (IACM), Past Chair (2017-2018) (Chair 2015-2016) of the USNC/TAM and a BISO Member, both USNC/TAM and BISO are under the umbrella of the US National Academies. He received Ph.D. and M.S. from Caltech, and B.S. from the University of Illinois at Chicago. Liu's selected honors include Japan Society of Computational Engineering Sciences Grand Prize; Computational Mechanics Award from Japanese Society of Mechanical Engineers; Honorary Professorship from Dalian University of Technology, IACM Gauss-Newton Medal and Computational Mechanics Award; ASME Dedicated Service Award, ASME Robert Henry Thurston Lecture Award, ASME Gustus L. Larson Memorial Award, ASME Pi Tau Sigma Gold Medal and ASME Melville Medal; John von Neumann Medal and Computational Structural Mechanics Award from the USACM. Selected synergistic activities includes the development of ICME multiscale theories, methods, and software for the design and analysis of engineering material systems, materials design, additive manufacturing, and technology transfer through working with multiple major Corporations. He was the founding Director of the NSF Summer Institute on Nano Mechanics and Materials and Founding Chair of the ASME NanoEngineering Council. He is the editor of two International Journals and honorary editor of two journals and has been a consultant for more than 20 organizations. Liu has written four books; and he is a Fellow of ASME, ASCE, USACM, AAM, and IACM.

欢迎大家参加！