Lecture Series

北京大学力学与工程科学系

北京大学应用物理与技术研究中心

计算力学高级讲习班

Speaker：Prof. Wing Kam Liu

Northwestern University

时间：2014 年 11 月 10-12 日

地点：北京大学工学院 1 号楼 210 报告厅

2014 年 11 月 10-12 日，计算力学专委会主办、北京大学力学系及应用物理与技术研究中心承办计算力学高级讲习班，邀请国际计算力学协会主席、美国西北大学 Wing Kam Liu 教授等面向研究生和青年学者讲授无网格方法、多分辨率力学、多尺度计算等前沿研究的理论与应用。欢迎有志于相关研究工作的人员积极报名参加。

会议不收取注册费，交通、住宿自理。

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计算力学高级讲习班回执

姓名		性别		学生/教师	
联系电话			电子邮箱		
单　　位					

日程安排

时　　间	11 月 10 日	11 月 11 日	11 月 12 日
9:00-11:00	**Lecture 1 （Liu）**	**Lecture 2（Liu）**	**Lecture 3（Liu）**
12:00-13:00	午餐	午餐	午餐
13:00-16:00	**Lecture 4 （唐少强）**	**Lecture 5 （唐山）**	

Lecture 1 An Overview of the Progress of Meshfree Particle Methods: From SPH to EFG to RKPM to XFEM to Meshfree Peridynamics

We shall discuss meshfree particle methods and why, how is it different from traditional FEM, etc. Then we move to SPH, EFG, RKPM and RKEM, and a survey of different computational methods including NURBS, Isogeometric Analysis, XFEM (chapter 11 of the BLME Nonlinear Finite Element Book), peridynamics, and their relations. We then move into multiscale continuum dynamics and what are the new research directions. This will probably give students research directions in this area.

Lecture 2 Multiresolution Mechanics of Heterogeneous Materials

It will be an overview of Chapter 12 of the BLME Nonlinear Finite Element Book with a concentration of one of the "Grand Challenges" that I am proposing to the TMS Workshop Multiresolution Theories and Experiments for Concurrent Multi-materials Constitutive Laws and its Implementation and Validation.

Lecture 3 Multiscale Analysis and Materials Design of Additive Manufactured Products

3D printing or additive manufacturing refers to the various processes for printing three-dimensional objects. The Laser Engineered Net Shaping (LENS) process deposits layers of metallic particles (powder) on a substrate and fuses them via a high-powered laser. The accumulation of these fused layers yield a final 3-D component which in many cases would be impossible by other manufacturing methods. However, for implementation of such components in a fully operational system, an aircraft engine for example, a much more comprehensive study of the subscales of the material and their corresponding behaviors is required. Repeatability and control of the microstructure, and subsequently the final material properties, of LENS manufactured components from the standpoint of process parameters such as laser power, feedrate, hatch spacing, layer depth, and others is incredibly important. Due to the highly localized nature of the key physics and mechanics of the process we must turn to multiscale simulation methods which give us the capability of extracting the essence of the phenomena that occur within these

fine-scale regions. The LENS process also provides an excellent materials design challenge. The material microstructure constituents are inherently modularized by the powder mixing process which combines a specific composition of assorted materials to obtain desirable material properties for the component. Again, we turn to multiscale simulation and design for a combined optimization of the (1) material composition, (2) material microstructure, and (3) process parameters for direct control of the product-level performance.

Lecture 4 有限差分多尺度方法 （唐少强教授，北京大学）

Lecture 5 材料和结构失稳的计算力学研究 （唐山教授，重庆大学）

About the speaker:

Wing Kam Liu（廖荣锦）教授是美国西北大学机械工程系 Walter P Murphy 讲席教授，国际计算力学协会主席，美国理论与应用力学国家委员会（USNCTAM）主席，美国国家科学基金委纳米力学与材料暑期研究所创所所长，ASME（美国机械工程师协会）纳米工程委员会创会主席。

Liu 教授是国际上基于多尺度模拟的工程与科学方面的学术领袖，他完成的基础创新性工作对于纳米材料的分析设计、工程材料系统、生物过程、生物和非生物材料在药物传送的应用等方面发挥了重要作用。其研究工作的巨大影响力从同行的广泛引用中可见一斑（SCI 引用 13860 次，H 因子为 60；Google Scholar 引用为 36500 次，H 因子为 86）。他于 2014 年被 Thompson Reuters 评为“高被引用研究人员”，而早在 2001 年，他就成为“工程领域最高影响、最多引用的作者之一，高引用作者数据库的首批成员”。

Liu 教授先后担任了许多重要学术职务，获得了国际计算力学协会最高奖 Gauss-Newton 奖、ASME 及 USACM 及日本机械工程师协会等的许多奖项，并被聘为大连理工大学荣誉教授等，是多个国际学术期刊的编委，还在二十多个政府和国际机构中任职。他是 ASME, ASCE, USACM, AAM, IACM 的会士。