東京大学グローバルCOEプログラム　機械システム・イノベーション国際拠点

GMSI Global Center of Excellence for Mechanical Systems Innovation

2009. 7. 2 GMSI Seminar Series

Mechanical behavior of nanostructures and hierarchical materials

Professor Catalin R. PICU

Rensselaer Polytechnic Institute

日時：2009年 7月 2日（木） 14:45～16:15
会場：東京大学工学部2号館 2F 222講義室

要旨

Testing material properties at the nanoscale using specially designed nanostructures will be discussed in the first part of the talk. The emerging field of nanotechnology requires basic understanding of the mechanical behavior of materials at the nanoscale. Ideally, one would perform testing on suitable nanoscale specimens that mimic the common macroscopic samples. However, both the fabrication and the actual testing of such small samples are challenging. In the present work, we measure the elastic and inelastic behavior of individual (isolated) helical nanosprings and nanorods fabricated by the oblique angle deposition with substrate rotation using a tip-cantilever assembly attached to a conventional atomic force microscope (AFM). The fatigue behavior of these nanostructures is also studied. Applications of nanostructures to nano- electromechanical pumps and as compliant inter-layers in microelectronic devices will be discussed.

The second part of the talk will address the mechanics of composite materials with hierarchical microstructure. Many such materials exist in nature, including biological materials, which are typically structured on multiple scales, from the nano to the macroscale, as well as some rock and aerogels. In such materials the amount of geometric detail observed in the microstructure increases from scale to scale in a self-similar manner. To solve mechanics boundary value problems on these structures using current multiscale methods is impractical since no scale decoupling can be identified. I will present a method for solving boundary value problems defined on such stochastic, self-similar structures. As an application, I will show that semiflexible random fiber networks, such as the eukaryotic cells cytoskeleton, belong to this class, will discuss the implications of this observation on the mechanics of the network and will demonstrate how one can solve boundary value problems defined on the scale of the entire cell.

主催：　東京大学グローバルCOEプログラム「機械システム・イノベーション国際拠点」事務室
本件連絡先：　東京大学大学院工学系研究科マテリアル工学専攻　准教授　井上 純哉
E-mail: inoue@material.t.u-tokyo.ac.jp　Phone: 03-5841-7165
GCOE事務局　E-mail: gmsi-office@mechasys.jp　Phone: 03-5841-7437