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Department of Mechanical Engineering
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“Some Recent Studies on the Mechanics of Carbon Nanotubes”

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Friday, February 24, 2006, 11:00am
Room 173 Light Engineering

Abstract

Carbon nanotubes (CNTs) have been subjected to intensive study since their discovery in 1991 due to their unique combinations of mechanical, electrical and chemical properties. The mechanical properties of CNTs must be fully understood in order to fulfill their promising applications. In this talk, the elastic properties of single-walled and multi-walled carbon nanotubes in the axial and radial directions are studied by using the molecular dynamics (MD) simulations. New phenomenological continuum models and their effective elastic moduli are generalized from the MD analyses. Both MD and continuum approaches are then applied to explore the thermal vibration properties of CNTs, the lateral and radial vibration characteristics of CNTs under various loading modes, and the buckling behaviors of CNTs under bending, compression, and torsion, as well as nanoindentation. The numerical studies offer useful insights to apply CNTs as nanowires in nanoelectronics, nanostrain sensors, nanotransistors, nano-valves, nanocomposites and new methods of measuring the CNT elastic properties.

About the Speaker

Xi Chen was born in July 1976. He received his Bachelor's degree from Xi'an Jiaotong University in 1994, Master's degree from Tsinghua University in 1997, and his Ph.D. in Solid Mechanics from Harvard University in 2001 by working with Professor John W. Hutchinson. He received his postdoc training at Harvard University from 2001-2003. He has been an Assistant Professor of Civil Engineering at Columbia University since July 2003 and will be promoted to an Associate Professor in 2006. He uses multiscale theoretical, experimental and numerical approaches to investigate various research frontiers in molecular biomechanics, nanoscale energetics, nanoindentation, mechanics of carbon nanotubes, fracture and fatigue, smart materials, thin films and small material structures. He has authored or co-authored over 50 journal papers.