



## **STEVENS INSTITUTE OF TECHNOLOGY DEPARTMENT OF MECHANICAL ENGINEERING**

**Thursday December 9, 2010  
Carnegie Room 315, Time 12:30pm**

### **Nanoscale Hydrodynamics and “Smart” Fluids: Manipulating Nanotubes/Nanowires in Fluid Flows with Electric Fields**

**Professor Jerry Wei-Jen Shan  
Rutgers - The State University of New Jersey**

Nanotubes and nanowires, with their essentially 1D structure, are highly polarizable particles and can be readily manipulated with external electric fields. As a result, electromagnetic forcing of nanotubes and nanowires in liquid suspension offers a simple and highly controllable system for exploring the nanoscale physics, as well as the macroscopic consequences, of field-induced alignment and assembly of highly anisotropic particles in a fluid. In this talk, we introduce our work on the fluid mechanics of: (1) Individual, single-wall carbon nanotubes (SWNTs) forced to rotate in a quiescent fluid, (2) SWNTs under the competing effects of shear flow and electric-field-induced torques, and (3) the controllable effective viscosity of SWNT suspensions under electric fields. We also briefly introduce our work on the thermophysical properties of nanotube and nanowire suspensions, including: (1) The possibility of smart heat-transfer fluids having enhanced, anisotropic, and actively controllable thermal conductivities, and (2) the speed of sound in microstructured nanotube suspensions.

---

**Dr. Jerry W. Shan** is an associate professor in the Department of Mechanical and Aerospace Engineering at Rutgers University (New Jersey, USA). He received all his degrees from the California Institute of Technology (Ph.D. in Aeronautics in 2001, M.Sc. in Aeronautics in 1996, and B.Sc. in Engineering & Applied Science in 1995). Professor Shan is a fluid dynamicist with experience in experiments and analysis of fluid flows at scales ranging from flows about individual nanoparticles, to vesicular cell mimics, to large-Reynolds-number turbulent flows. His recent work focuses on the fluid mechanics and thermophysical properties of nanotube and nanowire suspensions under electromagnetic fields. He is a 2007 recipient of the National Science Foundation CAREER award.