

**MECHANICAL ENGINEERING DEPARTMENT
ME/ISyE 8773-8774**

Nanoscale Heat Transfer in Thermoelectric Materials

by

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Wednesday, October 31, 2007

3:15 p.m. — Refreshments before the seminar

**3:30 p.m. — Graduate Seminar
Room 1130 ME**

ABSTRACT — Heat transfer in nanostructures may differ significantly from that in the bulk materials since the characteristic length scales associated with heat carriers, i.e., the mean free path and the wavelength, are comparable to the characteristic length of the nanostructures. Nanostructured materials hold the promise of novel phenomena, properties, and functions, which were not possible before. Thermoelectric properties are among the properties that may drastically change at nanoscale. The efficiency of thermoelectric energy conversion in a material is measured by a non-dimensional figure of merit (ZT) defined as, $ZT = sS^2T/k$ where s is the electrical conductivity, S is the Seebeck coefficient, T is the temperature, and k is the thermal conductivity. During the last decade, advances have been made in increasing ZT using nanostructures. In this talk, we present the simulation results for thermal transport in 2-D and 3-D nanocomposites. The Boltzmann Transport Equation (BTE) for the phonon intensity is solved in conjunction with suitable boundary and interface treatment. The treatment of interfaces between the two materials significantly affects the thermal characteristics of the nanocomposites. Unlike in bulk composites, the results show a strong dependence of thermal conductivity, temperature, and heat flux on the wire size, wire atomic ratio, and interface specularity parameter.

BIO — **Cyrus K. Madnia** is Professor of Mechanical & Aerospace Engineering and Director of the CFD Laboratory at the State University of New York at Buffalo, where he has been on the faculty since 1989. Professor Madnia received his BSE, MSE, and Ph.D. (1989) from the University of Michigan (Ann Arbor). During the summer of 1990 he had a visiting appointment at the NASA Langley Research Center. Dr. Madnia is a recipient of the National Science Foundation CAREER Award (1996). He also received the Society of Automotive Engineers, Ralph R. Teeter Educational Award (1996), and SUNY Chancellor's Award for Excellence in Teaching (2002). His research profile has also appeared in several national and international publications. Professor Madnia's research interests include combustion, turbulence, transport phenomena, and more recently nanoscale energy transport and conversion. During Professor Madnia's stay at SUNY-Buffalo, he has published more than 50 journal and conference papers and he has delivered numerous lectures and invited talks in North America, Europe, and Asia.

Informal Faculty Luncheon: Wednesday, October 31, 2007, 12:00 noon. Meet in 1100 ME and walk to lunch with other faculty. Prof. Cyrus Madnia will be able to attend.