ASME Solar Energy Division 2001 Graduate Student Award

The Solar Energy Division of ASME is pleased to announce the recipients of the 2001 Graduate student award. This award recognizes the outstanding achievements of a graduate student working in any area of solar energy. The recipients were honored at the *Forum 2001 Solar Energy: The Power to Choose* held April 21–25 in Washington DC. Applications for the 2002 award are due December 15, 2001. The application form and instructions are available at http://www.asme.org/divisions/solar/announce.htm

James T. McLeskey, Jr.
Department of Mechanical and Aerospace Engineering

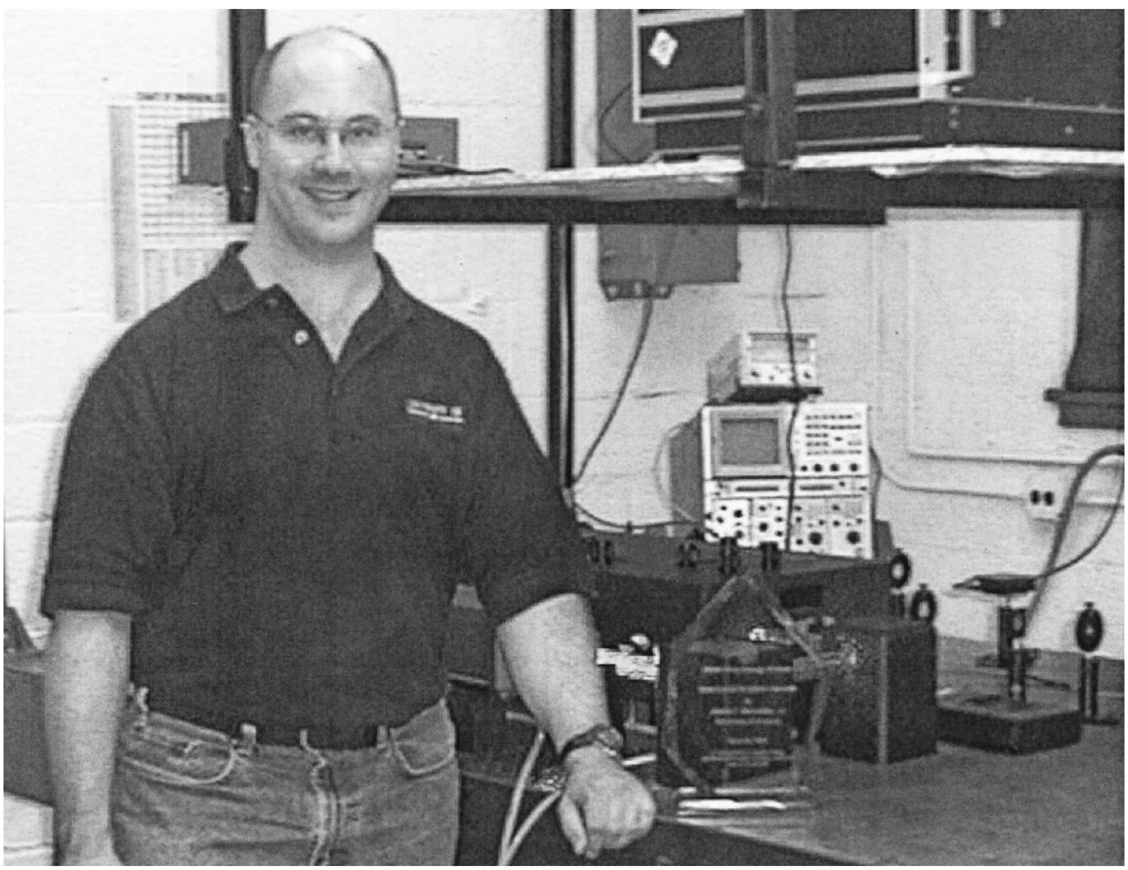
Advisor: Professor Pamela M. Norris

Femtosecond Energy Diffusion Studies of Amorphous Silicon Solar Cells

The Microscale Heat Transfer Laboratory at the University of Virginia is developing sensor technology aimed at improving the manufacturing process for hydrogenated amorphous silicon (a-Si:H) solar cells and thus lowering costs. The research will also provide a better understanding of the microscopic carrier interactions and properties of a-Si:H which may help to increase cell efficiency.

The Femtosecond Energy Diffusion (FED) sensor is a non-contact, non-destructive device based on the pump-probe technique. In this method, an excited state is produced by a high intensity laser pulse (the ‘‘pump’’) and the decay of that excited state is measured by monitoring the change in transmission of a less intense time-delayed laser pulse (the ‘‘probe’’). The pump pulse causes a photoinduced change in the absorption coefficient of a-Si:H and analytical models of the change are being developed. This should lead to a better understanding of the density of states of a-Si:H and thus higher cell efficiencies.

Recent experiments have shown the FED sensor to be capable of detecting differences in bandgap (and thus Si:Ge ratios in a-SiGe:H), phosphorous and boron doping levels, and hydrogenation level. The FED sensor can monitor these properties in each layer of an a-Si:H solar cell and may prove useful in a factory environment to detect problems rapidly and to help maintain control of the entire manufacturing process, leading to lower manufacturing costs.



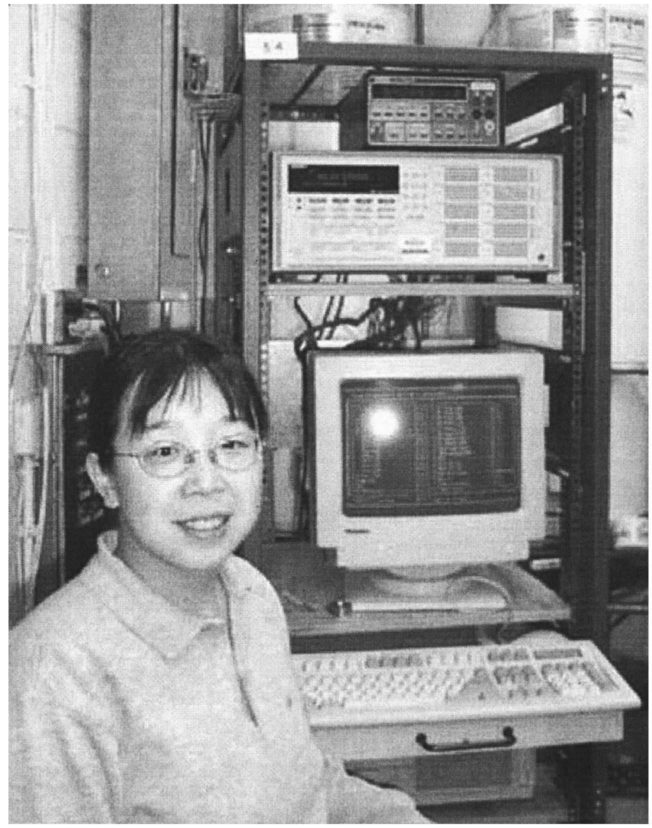
James T. McLeskey, Jr.

Wei Liu
Department of Mechanical Engineering
Advisor: Professor Jane H. Davidson

Natural Convection Heat Transfer in a New Polymer Solar Water Heating System

A proposed low-cost solar water heating system is a modification of the conventional integral-collector storage system. It is an unpressurized polymer container that contains an immersed heat exchanger made of many small diameter plastic tubes. When hot water is needed, cold water is forced through the tubes and heated by natural convection. The natural convection flow in this geometry is a complex interaction of sinking plumes of water near the cold tubes and a large-scale buoyant flow along the heated front face of the collector. The objective of my work is to develop natural convection heat transfer correlations that can be used to design the collector/heat exchanger system.

The natural convection process during both charging and discharging was measured for various values of solar radiation and hot water demand flow rates. Initial work focused on a single tube heat exchanger and a bundle of eight tubes with a pitch-to-diameter ratio of 2.4. Natural convection Nusselt number correlations indicate the large scale mixing promoted by the collector increases the rate of heat transfer about 20% compared to that of a tube immersed in an infinite medium. For the tube bundle, heat transfer is further increased because sinking cool plumes from the upper tubes impinge on the lower tubes. This enhancing ''velocity effect'' offsets the decrease in temperature of the fluid near the tubes. Additional experiments are planned to investigate the effect of pitch-to-diameter ratio on heat transfer in tube bundles and to optimize the design.



Wei Lu