The Department of Mechanical Engineering is proud to announce the
Freudenstein Distinguished Lecture

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Smart Solar Powered Sustainable Clean Water Systems for Small Remote Communities

This talk focuses on the autonomous control of small-scale photovoltaic-powered reverse osmosis (PVRO) desalination systems. Such systems can provide fresh water to remote communities that do not have sufficient natural clean water, a growing problem of international importance.

Producing clean drinkable water from seawater or brackish ground water by desalination is a power hungry process. Hence powering desalination with solar energy is attractive. Photovoltaic-powered reverse osmosis systems have been shown to be both technically feasible and economically viable for cases where the water demand is relatively small – 1,000 to 10,000 liters per day.

However, current PVRO has important technical limitations to be practical for small communities. First its performance is a function of input water chemistry, solar insolation, the temperature of its environment and input water. To be practical, its behavior must be constantly regulated to compensate for changes in these factors. In the field it is not feasible to do this manually. The work reported on here, mechatronic (robotic) technology is used to develop systems that can self-adapt to optimize their performance. In this research, models of the complex nonlinear performance of PVRO systems have been developed and experimentally validated. These models are used to develop algorithms to permit these systems to autonomously optimize their performance. These algorithms have been implemented at MIT in an experimental PVRO system using embedded microcomputer controllers. Experimental results are presented that show the effectiveness of the MIT algorithms. When tested in a remote Mayan village located in the Yucatan Peninsula, the effectiveness of this technology has been successfully demonstrated.

Steven Dubowsky

Professor Steven Dubowsky received his BS from Rensselaer Polytechnic Institute and his MS and PhD degrees from Columbia University, where Ferdinand Freudenstein was his research advisor. At MIT he holds appointments in the Mechanical Engineering Department and the Department Aeronautics and Astronautics. He is also the Director of the MIT Field and Space Robotics Laboratory. Dr. Dubowsky’s research has included the development of optimal and self-learning adaptive control methods for robotic systems, including space robots. He has authored or co-authored over 350 papers. His current research includes fuel cell power for field robotic systems and sensor networks and photovoltaic powered clean water systems for challenging field environments. Professor Dubowsky has served as an advisor to the National Science Foundation, the National Academy of Science/Engineering, the Department of Energy, and the US Army. He is Fellow of the ASME and IEEE and is a member of Sigma Xi, and Tau Beta Pi honor societies.

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