abstract
It has been demonstrated that the color pattern of the human fingernail changes in a predictable manner when the fingertip is pressed against a surface. This phenomenon was first exploited by Mascaro and Asada, who created photoplethysmograph fingernail sensors as a non-obtrusive means of measuring fingertip touch force. Since that time, Dr. Mascaro’s fingernail sensing research has diverged into two parallel efforts: 1. developing stretchable circuit technology that will improve the wearability of fingernail sensors, and 2. developing a system for imaging the fingernails with videocameras, which eliminates the need for any wearable technology. This talk will present an overview of Dr. Mascaro’s work on fingernail sensing, with particular focus on recent work in fingernail imaging. Challenges including image registration and fingernail tracking will be discussed, as well as automated calibration for touch force prediction, which involves using a high-fidelity haptic interface to apply forces to the human fingertip. Results from full three-dimensional force magnitude prediction will be presented. By extending force prediction to multiple fingers, we can achieve totally unconstrained measurement of human grasp forces, with applications to robotics, rehabilitation, and human-machine interaction. Dr. Mascaro will also give a brief overview of other projects in his Biorobotics Lab, including bioinspired robot muscles, human finger kinematics, and omnidirectional force-feedback joysticks.

biosketch
Stephen A. Mascaro received the B.A. degree in physics from Houghton College, Houghton, NY, and the B.S. degree in mechanical engineering from Clarkson University, Potsdam, NY, both in 1995. He received the M.S. and Ph.D. degrees in mechanical engineering from the Massachusetts Institute of Technology (MIT), Cambridge, MA, in 1997 and 2002, respectively.

He is currently an Associate Professor in the Department of Mechanical Engineering at the University of Utah, Salt Lake City, where he joined in 2005. His research interests include robotics and control, system dynamics, human-machine interaction, haptics, and bioinspired actuation. Dr. Mascaro received the Best Paper Award at the 1999 IEEE International Conference on Robotics and Automation for his original work on fingernail sensors. His current research on fingernail imaging is supported by the National Science Foundation through the National Robotics Initiative. He is a member of the American Society of Mechanical Engineers and the IEEE Robotics and Automation Society.