Title: Human-Robot Interaction and Human-Robot Teams

Speaker: Dr. Vladimir Lumelsky

University of Wisconsin-Madison

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Abstract: The ability by a robot to operate in an uncertain environment, such as near humans or far away under human control, potentially opens a myriad uses. Examples include robots preparing the Mars surface for human arrival; robots for assembly of large space telescopes; robot helpers for the elderly; robotic search and disposal of war mines. So far advances in this area have been coming slowly, with a focus on specific tasks rather than a universal ability typical in nature. Challenges appear both on the robotics side and on human side: robots have hard time adjusting to an unstructured environment, whereas human cognition has serious limits in adjusting to robots and grasping complex 2D and 3D motion tasks. As a result, applications where robots operate near humans – or far away under their control – are exceedingly rare. The way out of this impasse is to supply the robot with a *whole-body sensing* - an ability to sense surrounding objects at the robot's whole body - and algorithms capable of utilizing these data in real time. This calls for large-area flexible sensing arrays - sensitive skin covering the whole robot body akin to the skin covering the human body. Whole-body sensing brings interesting, even unexpected, properties: powerful robots become inherently safe; human operators can move them fast, with "natural" speeds; robot motion strategies exceed human spatial reasoning skills; it becomes realistic to utilize natural synergy of human-robot teams and allow a mix of supervised and unsupervised robot operation. We will review the cognitive science, mathematical, algorithmic, and hardware (materials, electronics, computing) issues involved in realizing such systems.