Title: **Human-Robot Interaction and Whole-Body Robot Sensing**

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Abstract: Applications where robots are expected to operate in an uncertain environment, often with human-robot interaction, are a fast-growing area. Examples include robots preparing the Mars surface for human arrival; robots for assembly of large space telescopes; robot helpers for the elderly; robot search and disposal of war mines. Advances in this area, while impressive, are also slow to come, due to difficulties that involve both the robotics and the human side. Namely, while robots may even exceed the human ability for complex spatial reasoning, it's very hard to supply them with a sense of "self-awareness" they need to adjust to their surroundings. On the other hand, while humans are very good in defining robots' tasks and subtasks, they have difficulty controlling robots in tasks that require complex spatial reasoning. The obvious solution is human-robot teams. This requires, first, careful delineation of responsibilities of the team members, and second, software and hardware means to achieve the robot "self-awareness". The solution for the latter is to supply the robot with a *whole-body sensing*, plus related intelligence - an ability to sense surrounding objects at the robot's whole body and automatically utilize these data in real time, thus freeing the human from the responsibility for positioning the robot. This calls for large-area flexible sensing arrays - a sensitive skin that covers the robot's whole body. Such sensing hardware gives rise to interesting, even unexpected, properties: robots become inherently safe; human operators can move them fast, with "natural" speeds (something that is impossible today); resulting motion control strategies may exceed human spatial reasoning skills; a synergy of human-robot teams becomes realistic; the result is a natural mix of supervised and unsupervised operation. We will review the mathematical, algorithmic, cognitive science, and hardware (materials, electronics) issues involved in realizing such systems.

Biography: Dr. Lumelsky is Professor Emeritus in University of Wisconsin-Madison. His Ph.D. in Applied Math is from the Moscow Institute of Control Sciences, Russian National Academy of Sciences. He has held research, faculty, and administrative positions with Ford Motor Research Labs, General Electric Research Center, Yale University, University of Wisconsin-Madison, University of Maryland-College Park, NASA-Goddard Space Center. Concurrently he held visiting positions with the Tokyo institute of Science, Japan; Weizmann Institute, Israel; USA National Science Foundation; USA-Antarctica South Pole Station.

He has served on Editorial Boards of IEEE Sensors Journal (as Founding Editor-in-Chief), IEEE Transactions on Robotics and Automation, and other journals; on governing bodies and committees of IEEE (including IEEE Fellow Committee), IEEE Robotics and Automation Society, IEEE Sensors Council (including as President); as chair and co-chair of major international conferences, and guest editor for special journal issues. He has served as consultant to NSF, DARPA, European Commission, and as a litigation technical witness (expert) in court cases. He has authored over 200 publications (books, journal papers, conferences, reports); is IEEE Life Fellow, and member of ACM and SME.