

Keynote

ON LARGE SYSTEMS OF INTERACTING ROBOTS, AGENTS AND HUMANS



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ABSTRACT

In recent years we have seen the development of a new class of systems, involving the interaction of large numbers of software agents, robots and humans. Such systems may involve sensor networks and multiple heterogeneous robots along with humans. The design of such systems must take into account the different capabilities of each subgroup and allow for local autonomy while providing for communication and cooperation. Each robot is a complex system in its own right, consisting of sensors, actuators, structure and computers. Equally important are networks of software agents, intelligent entities not embodied in hardware. Current systems of this type may involve hundreds or thousands of entities.

Analysis of such systems involves a blend of tools from artificial intelligence, dynamical system theory, and network analysis, among others. In this presentation we discuss some examples of such systems from various extremes, e.g., systems with large numbers of software agents and a few robots, as contrasted with system containing robot “swarms” and few if any software agents. Such large systems are in fact “systems of systems” and they raise issues of system autonomy, interaction and adaptation. These will be discussed, along with the question of emergent behaviors.

The concluding section of the talk will consider issues of ethics and the implementation of ethical standards in robots and systems involving robots.

Biography

George A. Bekey is an Emeritus Professor of Computer Science at the University of Southern California. His research interests include autonomous robotic systems, multi-robot cooperation and human-robot interaction. He received his Ph.D. in Engineering from UCLA. Following employment at Beckman Instruments and TRW Systems he joined the faculty at USC in 1962. He served as Chairman of the Electrical Engineering-Systems Department from 1978 to 1982, Chairman of the Computer Science Department from 1984 to 1989 and Associate Dean for Research of the USC School of Engineering from 1999 to 2001. He has published over 200 papers and several books in robotics, biomedical engineering, computer simulation, control systems, and human-machine systems. Dr. Bekey is a Member of the National Academy of Engineering, a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and of the American Association for Artificial Intelligence (AAAI). He was the Founding Editor of the journal *Autonomous Robots*, and of the *IEEE Transactions on Robotics*. During 1996 and 1997 he served as President of the IEEE Robotics and Automation Society. His latest book entitled "**Autonomous Robots: from biological inspiration to implementation and control**" was published by MIT Press in 2005. George officially retired in 2003, but continues to be active on a part-time basis both at USC and at California Polytechnic University in San Luis Obispo, where he is a Research Scholar and a consultant to the College of Engineering. His current research concerns robot ethics and the development of altruistic robots. He is also affiliated with a robotic startup company in Los Angeles.