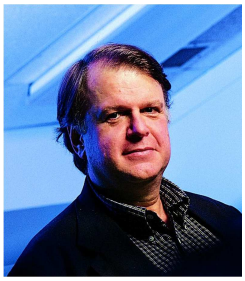
ITR Seminar series on May 24, 2013 at ITR Seminar room (Barerstr. 21, 4th floor)

"CPS Modeling Integration Hub and Design Space Exploration with Application to Microrobotics"

by



John S. Baras, Lockheed Martin Chair in Systems Engineering

The Institute for Systems Research,
Electrical and Computer Engineering Department,
Fischell Bioengineering Department, and
Applied Mathematics, Statistics & Scientific Computation Program,
University of Maryland College Park
USA

B.S. in Electrical Eng. from the Nat. Techn. Univ. of Athens, Greece, 1970; M.S. and Ph.D. in Applied Math. from Harvard Univ. 1971, 1973. Since 1973 with the Electrical and Computer Engineering Department, and the Applied Mathematics Faculty, at the University of Maryland College Park. Since 2000 faculty member in the Fischell Department of Bioengineering. Founding Director of the Institute for Systems Research (ISR) from 1985 to 1991. Since 1991, has been the Director of the Maryland Center for Hybrid Networks (HYNET). Fellow of the IEEE and a Foreign Member of the Royal Swedish Academy of Engineering Sciences. Received the 1980 George Axelby Prize from the IEEE Control Systems Society and the 2006 Leonard Abraham Prize from the IEEE Communications Society. Professor Baras' research interests include control, communication and computing systems.

Email: baras@isr.umd.edu Web page: http://www.isr.umd.edu/~baras/

Abstract

We describe a new methodology and environment for Cyber Physical Systems (CPS) synthesis and demonstrate it in the design of microrobots viewed as CPS. Various types of microrobots have been developed in recent years for applications related to collaborative motion such as, sensor networks, exploration and search-rescue in hazardous environments and medical drug delivery. However, control algorithms for these prototypes are very limited. Our new approach for modeling and simulation of the complete microrobotics system allows the robots to complete more complex tasks as per specifications. Since the microrobots tend to have small features, complex micro-structures and hierarchy, the control laws cannot be designed separately from the physical layer of the robots. Such a type of microrobot is indeed a CPS, as control in the cyber side, and the material properties and geometric structure in the physical side, are tightly interrelated. This design approach is important for microrobots, capable of collaborating and completing complex tasks.