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Peter Sagirow Distinguished Seminar Series

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Cybernetics, Artificial Intelligence and the Avoidance of Mathematical Blind Spots

Abstract

When first discussed by Wiener, cybernetics captured the imagination of the scientific public and served as the rallying cry for groups of scientists and engineers seeking a broadly encompassing view of what engineering and life scientists might hope to achieve by working together. Aided by the work of luminaries such as John von Neumann and Claude Shannon, a rosy picture emerged, warmed by the aura of mathematical truth. Looking back, it seems fair to say that the results achieved by this movement in the 50's and 60's are more apparent in terms of the organizations and journals that flourished, rather than the new modes of thought that emerged. When the proponents of artificial intelligence came along a bit later, cybernetics was not able to hold its ground. The same fate awaited artificial intelligence as its first summer soon fell prey to the famous AI winter during which it lost considerable credibility. However, today we have, for example, robots that do our work and search engines that supplement our memory, fulfilling at least part of the vision that fueled the early hopes for cybernetics.
In this talk we will trace this history and peer into the future, interpreting the various stages of these developments in terms of the mathematical paradigms each stage relied on. In a nutshell, Wiener set the world down a path dominated by continuous mathematics, Fourier transforms, and stationary stochastic processes. AI took a different path based on the expectation that loosely structured computer programs could replicate in machine form, most of what was needed. In this talk I will argue that a great deal of the conceptual progress in these areas has come from work lying close to the boundary between continuous and discrete mathematics and that progress has been slowed by our lack of courageous exploration of this area. I will illustrate with examples showing how amorphous this boundary is and how fruitful its exploration has been.

About the Speaker

Roger Brockett is the An Wang professor of electrical engineering and Computer Science at Harvard University. He has been exploring questions in engineering and applied sciences since starting graduate school in 1960, and has been teaching since his appointment as an Assistant Professor at MIT in 1963. He is one of the most influencial pioneers and leaders in the field of systems and control theory with seminal contributions to differential geometric methods in nonlinear control, the geometric approach to the sufficient statistics problem in nonlinear estimation, formal languages for motion control, hybrid systems, flows for computation related to integrable systems, stabilization theory, quantum control, and, most recently, optimal control of Markov processes. He has received major awards from IEEE (Institute of Electrical and Electronic Engineers), ASME (American Society of Mechanical Engineers), SIAM (Society of Industrial and Applied Mathematics), and AACC (American Automatic Control Council), is a member of the US National Academy of Engineering and is this year recipient of the IEEE Leon Kirchmayer Award for Graduate Education. He has directed approximately 60 Ph.D. theses and authored about 200 research papers.
For further information see http://people.seas.harvard.edu/~brockett/brockett.html.

Friday, 24 April 2009, 2 p.m.
Universität Stuttgart
Lecture Room: V 7.03, Pfaffenwaldring 7, Campus Stuttgart-Vaihingen

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