

## UTC INSTITUTE FOR ADVANCED SYSTEMS ENGINEERING

### Distinguished Lecture Series

Monday October 23rd, 2017

1:00pm – 2:00pm

UConn, Storrs Campus – ITEB 336

[To view live webcast click here](#)

### Stable Optimal Control and Semicontractive Dynamic Programming

We consider discrete-time infinite horizon deterministic optimal control problems with nonnegative cost per stage, and a destination that is cost-free and absorbing. The analysis applies to both regulation/control problems and shortest path problems (with arbitrary state and control spaces). The popular linear-quadratic regulator problem is a special case. Our aim is to connect dynamic programming-based optimal control theory, and classical notions of controllability and stability. We introduce a new unifying notion of stable feedback policy, based on perturbation of the cost per stage, which in addition to implying convergence of the generated states to the destination, quantifies the speed of convergence. We consider the properties of two distinct cost functions:  $J^*$ , the overall optimal, and  $\hat{J}$ , the restricted optimal over just the stable policies. Different classes of stable policies (with different speeds of convergence) may yield different values of  $\hat{J}$ . We show that for any class of stable policies,  $\hat{J}$  is a solution of Bellman's equation, and we characterize the smallest and the largest solutions: they are  $J^*$ , and  $J^+$ , the restricted optimal cost function over the class of (finitely) terminating policies (the ones that achieve controllability). We also characterize the regions of convergence of various modified versions of value and policy iteration algorithms, as substitutes for the standard algorithms, which may not work in general.

#### Dimitri P. Bertsekas

Dimitri P. Bertsekas' undergraduate studies were in engineering at the National Technical University of Athens, Greece. He obtained his MS in electrical engineering at George Washington University in 1969, and his Ph.D. in system science in 1971 at M.I.T. Dr. Bertsekas has held faculty positions with the Engineering-Economic Systems Dept., Stanford University (1971-1974) and the Electrical Engineering Dept. of the University of Illinois, Urbana (1974-1979). Since 1979 he has been teaching at the Electrical Engineering and Computer Science Department of at M.I.T., where he is currently McAfee Professor of Engineering. He has held editorial positions in several journals. His research at M.I.T. spans several fields, including optimization, control, large-scale computation, and data communication networks, and is closely tied to his teaching and book authoring activities. He has written numerous research papers and sixteen books and research monographs, several of which are used as textbooks in MIT classes. Professor Bertsekas was awarded the INFORMS 1997 Prize for Research Excellence in the Interface Between Operations Research and Computer Science for his book "Neuro-Dynamic Programming" (co-authored with John Tsitsiklis), the 2000 Greek National Award for Operations Research, the 2001 ACC John R. Ragazzini Education Award, the 2009 INFORMS Expository Writing Award, the 2014 ACC Richard E. Bellman Control Heritage Award for "contributions to the foundations of deterministic and stochastic optimization-based methods in systems and control," the 2014 Khachiyan Prize for Life-Time Accomplishments in Optimization, and the SIAM/MOS 2015 George B. Dantzig Prize.

### Upcoming Distinguished Lectures

11/13/17 – Prodrimos Daoutidis – Energy Efficiency & Sustainability: New Vistas for Systems and Control Research

### Upcoming Seminars

10/30/17 – Jun Ueda  
Human-Robot Physical Interaction for Neuromuscular Adaptive Robot Co-workers  
12/4/17 – Lyle Ungar  
Deep Learning and its Impact on Engineering

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