

COLLEGE OF ENGINEERING

Control Seminar



Sponsored by: Bosch, Ford, and Toyota

Uniform Strong Regularity, Newton's Method and Model Predictive Control



ASEN DONTCHEV

Adjunct Professor
University of Michigan
Department of Aerospace Engineering

Friday, January 18, 2019

3:30 – 4:30 pm 1500 EECS

ABSTRACT: We consider a finite-horizon continuous-time optimal control problem with nonlinear dynamics, an integral cost, control constraints and a parameter which represents uncertainty. After a discretization of the problem, we employ a model predictive control (MPC) algorithm to obtain a piecewise constant function in time as control. We consider the question under what conditions the MPC-generated control is a good approximation of an optimal feedback control of the continuous-time system. An answer to that question is found which is based on the concept of uniform strong regularity. It allows us to establish uniform Lipschitz stability of the discretized problem, uniform convergence of the Newton method employed, as well as an estimate of the difference between the MPC-generated control and the optimal feedback control. The talk is based on a series of joint works with M. Huang, I. Kolmanovsky, M. Krastanov, D. Liao-McPherson, M. Nicotra, V. Veliov and P. Vuong.

BIO: Asen Dontchev received successively MSc (in 1971) and PhD (in 1974) in Control Sciences from the Warsaw University of Technology. After his graduation he began working at the Department of Operations Research of the Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences. He became "Doctor of Mathematical Sciences" in 1987 and soon after that – full Professor. Since 1990 he has been Associate Editor at Mathematical Reviews and since 2000 – Adjunct Professor at the University of Michigan. From 2007 till 2009 he was acting as a Program Director of the Analysis Program, DMS of the US National Science Foundation. Since 2010 Dontchev's research has been funded by the National Science Foundation (USA). He has supervised six Bulgarian, one Spanish and one Guinea Ph.D. students. Asen Dontchev has about 150 publications, including three books (published by Springer, one of which was translated into Russian) and three textbooks. According to Google Scholar his works are cited more than 5700 times, and according to MathSciNet more than 2200 times by more than 880 authors (since 2000). He has been visiting scholar at universities in Austria, France, Italy, Switzerland, Spain, and has given invited talks at a number of meetings. In 1994, he was awarded with the Mathematics Prize of the Bulgarian Academy of Sciences. He has been a member of the editorial boards of the following international journals: *Serdica Mathematical Journal*, *Computational Optimization and Applications*, *SIAM Journal on Optimization* (till 2009), *Journal of Dynamical and Control Systems* (till 2017), *SIAM Journal on Control and Optimization* (corresponding editor), *Open Journal of Applied Mathematics*, *Journal of Industrial and Managerial Optimization* (till 2009), *Mathematica Balkanica*, *Journal of Mathematical Analysis and Applications* (till 2016), *Journal of Optimization Theory and Applications*.

M | **ECE** ELECTRICAL &
COMPUTER ENGINEERING
UNIVERSITY OF MICHIGAN

BOSCH



Questions? Contact: Judi Jones asap@umich.edu