



AIRCRAFT CONTROL AND GUIDANCE SYSTEMS COMMITTEE

Spring 2013 Short Course

5 March 2013

8:00am to 5:00pm

L₁ Adaptive Control and its Transition to Aerospace Applications

by Dr. Naira Havakimyan

Course Description: The course will present the historical developments in adaptive control and focus on L1 adaptive control as a means for ensuring desired predictable response in the presence of various uncertainties in system dynamics and environment. Comparison will be drawn with various control methods like model reference adaptive control (MRAC), internal model controllers (IMC), and disturbance observers (DOB). L1 adaptive control architectures use fast estimation schemes along with low-pass filtered control signals, which decouple the estimation loop from the control loop, and reduce the design tradeoff to selection of the structure and the bandwidth of a low-pass filter for achieving the desired response. The course will present state feedback and output feedback architectures, flight control design methods, and transition of those to NASA's AirSTAR platform.

About the Instructor: Naira Hovakimyan received her MS degree in Theoretical Mechanics and Applied Mathematics in 1988 from Yerevan State University in Armenia. She received her PhD in Physics and Mathematics in 1992 from the Institute of Applied Mathematics of Russian Academy of Sciences in Moscow, majoring in optimal control and differential games. In 1997 she was awarded a governmental postdoctoral scholarship to work in INRIA, France. In 1998 she was invited to the School of Aerospace Engineering of Georgia Tech where she worked as a research faculty member until 2003. In 2003 she joined the Department of Aerospace and Ocean Engineering of Virginia Tech, and in 2008 she moved to University of Illinois at Urbana-Champaign where she is a professor, university scholar, and Schaller faculty scholar of Mechanical Science and Engineering. She has co-authored a book and more than 250 refereed publications. She is the recipient of the SICE International Scholarship for the best paper of a young investigator in the VII ISDG Symposium (Japan, 1996), and Naira is also the 2011 recipient of *AIAA Mechanics and Control of Flight* award. She is an associate fellow and life member of AIAA, a Senior Member of IEEE, and a member of SIAM, AMS and ISDG. Her research interests are in the theory of robust adaptive control and estimation, control in the presence of limited information, networks of autonomous systems, game theory and applications of those in safety-critical systems of aerospace, mechanical, electrical, petroleum and biomedical engineering.



Course Prerequisites: A background in classical control and linear systems theory. A background in robust control and Lyapunov stability theory is helpful but not required.

Course Cost: \$450 per person. Cost includes course and handouts. Breakfast and lunch is provided.

How to Register: Register online at www.acgsc.org or email secretary@acgsc.org

Course Location: Atlantis Casino Resort and Spa, Treasures D Room, Reno NV.