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Control of Uncertainty or Control with Uncertainty? A New Control Design Paradigm for Autonomous Stochastic Systems



Panagiotis Tsiotras

*David and Andrew
Lewis Endowed Chair
Professor at the
School of Aerospace
Engineering,
Georgia Institute of
Technology*

ABSTRACT:

Uncertainty propagation and mitigation is at the core of all robotic and control systems. The standard approach so far has followed the spirit of control of a system “with uncertainties,” as opposed to direct control “of uncertainties.” Recent advances from controllability of the covariance of the distribution of the state trajectories provide us with a new tool to control stochastic systems with strict performance guarantees. In this talk I will review some recent results on covariance control for discrete stochastic systems subject to probabilistic (chance) constraints and will demonstrate the approach on several control and robot motion planning problems under uncertainty. The resulting theory has close connections to the classical Optimal Mass Transport (OMT) problem, it is elegant and numerically efficient (often resulting in a convex program). I will also discuss some current trends and potential directions for future work.

BIOGRAPHY:

Dr. Panagiotis Tsiotras is the David and Andrew Lewis Endowed Chair Professor at the School of Aerospace Engineering at Georgia Tech. At Georgia Tech, he is also the Director of the Dynamics and Control Systems Laboratory and an Associate Director for the Institute for Robotics and Intelligent Machines (IRIM). His current research interests are in optimal and nonlinear control and their connections with AI and applications to aerial, space and ground vehicle autonomy. He holds degrees in Mechanical Engineering, Aerospace Engineering, and Mathematics. He is currently the Chief Editor of the Frontiers of Robotics and AI in the area of Space Robotics and an Associate Editor for Dynamical Games and Applications. Previously, he served at the Editorial Boards of the AIAA Journal of Guidance, Control, and Dynamics, the IEEE Transactions of Automatic Control, the IEEE Control Systems Magazine, and the Journal of Dynamical and Control Systems. He is the recipient of the NSF Career Award, the IEEE Excellence Award in Aerospace Control, the Outstanding Aerospace Engineer award from Purdue, and the Sigma Xi Research Excellence Award. He is a Fellow of AIAA, IEEE, and AAS.