

Multidisciplinary Simulation, Estimation, and Assimilation Systems

Seminar Series

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Optimal Trajectory Planning and Assignment Problems for Kinematic Agents with State-Dependent Metrics

Abstract: In the recent years there has been an increased interest in developing control and navigation strategies for multi-agent systems. Typical tasks include guiding a team of small autonomous agents (e.g., UAVs, UUVs) towards a given goal, or assigning a set of stationary or moving targets to a team of pursuing agents. For heterogeneous teams of kinematic agents or for agents whose motion is affected by the environment they operate in (for example, the motion of unmanned aerial or marine/submersible vehicles may be significantly affected by the prevailing local winds or sea currents). For such problems the Euclidean distance may not be an appropriate figure of merit to define suitable proximity relationships. Instead, time-to-intercept or fuel-to-consume may be a more appropriate cost to use. In this talk, we will discuss the optimal partitioning problem for a team of agents in the plane when the proximity relationships are dominated by such state-dependent metrics. We will introduce the concept of Zermelo-Voronoi partitions to analyze the particular case of a team of UAVs/UUVs operating in the presence of winds or currents. We provide a numerically efficient construction of these partitions by taking advantage of the structure of the underlying optimal control problem, which may include both regular and abnormal extremals. By exploiting the well-known duality between navigation in the presence of environmental disturbances and pursuit problems, we will then utilize these partitions to solve a certain class of group pursuit problems. We will finally briefly elaborate on some potential extensions.

Biography: Prof. Panagiotis Tsiotras is the Dean's Professor at the Daniel Guggenheim School of Aerospace Engineering at the Georgia Institute of Technology (Georgia Tech) and the Director of the Dynamics and Control Systems Laboratory in the same department. He is also affiliated with the Institute for Robotics and Intelligent Machines (IRIM) at Georgia Tech. He has held visiting appointments with at Ecole des Mines (Mines ParisTech), INRIA-Rocquencourt in France, JPL, and MIT. He received his PhD degree in Aeronautics and Astronautics from Purdue University in 1993, and he also holds degrees in Mechanical Engineering and Mathematics. He is a Fellow of AIAA.

Friday, May 22, 2015

2:00PM; Rm. 5-314

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