Aerospace Seminar

Suman Chakravorty

Associate Professor of Aerospace Engineering, Texas A&M

Fundamental Problems in Space Situational Awareness (SSA)

Monday, Feb. 25, 2019 | DLC | 12:00 P.M.

Abstract: As the number of Resident Space Objects (RSO) increases, and with the attendant increase in the volume of space debris, it has become very important to keep an accurate track of the RSO population with limited space and ground based sensing resources. Achieving this seemingly Herculean task requires us to address two fundamental problems in SSA that nonetheless have broader implications beyond the SSA problem.

Multi-RSO tracking: This is the estimation theoretic problem at the heart of the SSA problem, and requires that we keep accurate track of the RSOs given sparse data from the sensors. This not only requires accurate tracking techniques for the individual RSOs, but also needs to account for the "Data Association Problem (DAP)" that arises from the ambiguity between RSOs, for instance, from long periods without data and collision events. S*ensor Tasking:* This is the control theoretic problem central to SSA. Broadly speaking, the problem amounts to tasking sensors based on the current RSO knowledge such that the information regarding the system is maximized over some foreseeable horizon.

The problems above lead to seemingly intractable problems, but any reliable and robust SSA solution needs to tackle these satisfactorily. We shall give an overview of novel methods that we have developed over the past several years that can be used to accomplish these goals. In particular, we shall introduce "curse of dimensionality" free particle filters called the Particle Gaussian Mixture (PGM) filters for accurate tracking, and a Randomized Finite Set Statistics (R-FISST) based approach for solving the multi-RSO DAP. If time permits, we shall also cover the Information Space Receding Horizon Control (IRHC) approach for tractable sensor tasking.

Bio: Suman Chakravorty obtained his B.Tech in Mechanical Engineering in 1997 from the Indian Institute of Technology, Madras and his PhD in Aerospace Engineering from the University of Michigan, Ann Arbor in 2004. From August 2004-August 2010, he was an Assistant Professor with the Aerospace Engineering Department at Texas A&M University, College Station and since August 2010, he has been an Associate Professor in the department. Dr. Chakravorty's broad research interests lie in the estimation and control of stochastic dynamical systems with application to autonomous, distributed robotic mapping and planning, and situational awareness problems. He is a member of AIAA, ASME and IEEE. He is an Associate Editor for the ASME Journal on Dynamical Systems, Measurement and Control and the IEEE Robotics and Automation Letters.

Smead Aerospace
UNIVERSITY OF COLORADO **BOULDER**

Be Boulder.