PHYSICAL MATHEMATICS SEMINAR

Mathematical Challenges in Space Situational Awareness

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ABSTRACT:

Space Situational Awareness (SSA) is the comprehensive knowledge of the near-Earth space environment accomplished through the tracking and identification of Earth-orbiting space objects (satellites, debris) needed to protect space assets and maintain awareness of potentially adversarial space deployments. Fundamental to SSA are the problems of data/track association (correlation), nonlinear estimation (data fusion), conjunction analysis (probability of collision), and maneuver detection. Common amongst these challenges is the need to predict the future location of an orbiting object (i.e., orbit propagation) while correctly managing and representing its uncertainty.

Efficiently and accurately modeling trajectories of the vast number of objects in orbit around the Earth (Figure 1) is difficult because the equations of motion are nonlinear, the infrequency of observations may require modeling trajectories over long periods of time, and the number of objects to be modeled is on the order of 10^5 and growing owing to object breakups and improved sensors. In this talk, I will present a new technique for propagating orbits in the presence of uncertain initial conditions and dynamics, and demonstrate how this technique can be applied to problems that arise in other fields. The broader mathematical challenges in SSA will also be discussed.

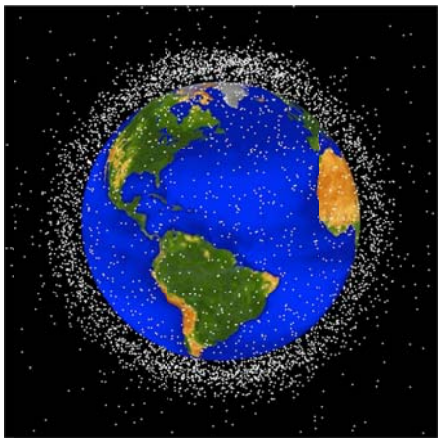

Figure 1: Image courtesy of NASA Orbital Debris Program Office

TUESDAY, OCTOBER 2, 2012
2:30 PM
Building 4, Room 145

Reception at 3:30 PM in Building 2, Room 290
(Math Dept. Common Room)

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