The University of Mississippi

Department of Mathematics

Statistics Seminar

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Orbit Uncertainty Propagation Using Sparse Grid-Based Method

Abstract: Tracking resident space objects (RSOs) has gained much attention in recent years because of the hazard posed by inactive RSOs to active RSOs. One challenge for RSO tracking is orbit uncertainty propagation. Owing to the sparsity of the available tracking sensor data and the nonlinearity of the orbital dynamics, the uncertainty of the orbit of an RSO is highly non-Gaussian after long-term propagation. The state-of-the-art methods for non-Gaussian uncertainty propagation include the Gaussian mixture method that approximates the non-Gaussian probability density function (pdf) by a mixture of Gaussian pdfs and the state transition tensor- and generalized Polynomial Chaos-based method that compute the moments of the non-Gaussian pdf directly.

This talk presents a sparse grid-based method for moment propagation. The idea of the method is to represent the initial orbit uncertainty by a sparse grid based on the Smolyak rule, propagate each and every sparse grid points through the nonlinear orbital dynamics, and then compute the moments of the orbit from the sparse grid points. The method is compared with the Monte Carlo methods and the full grid method in a two-body problem and a three-body problem. It is more accurate and more efficient than the Monte Carlo methods and more efficient than the full grid method.

Time: 2:00 P.M.
Date : Friday, October 21, 2011
Place: Hume 331

Faculty, staff and students are welcome to attend