

# MAE Seminar Series

## Satellite Formations: Orbit Mechanics and Control

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### **Abstract**

This talk will introduce a method for modeling satellite relative motion dynamics subject to the J2 perturbation using the mean reference and differential orbital elements. The mean elements based approach allows for the determination of the initial conditions to setup formations an easy task. We will discuss the effects of the perturbation, particularly the quasi-periodic nature of the relative motion. We will also derive a condition for equalizing the in-plane and out-of-plane frequencies. These results provide information on formations which are economical to control over long periods of time. Next, a method for long-term formation maintenance and inter-satellite fuel balancing using continuous as well as a two-impulse-per-orbit scheme will be presented. An example of optimally maintaining a projected circular formation will be considered to demonstrate the efficacy of the proposed method. In this talk we will showcase two instances which show that some complex problems have easy solutions which can be obtained from the basics.

### **Bio**

Dr. Vadali has been a member of the faculty at Texas A&M University since 1986, where he is currently the Stewart & Stevenson-I Endowed Professor of Aerospace Engineering. He served on the faculty of Iowa State University from 1983 till 1985. He received his B.Sc. (Hons) in Mechanical Engineering from Sambalpur University, India, his M.E. (Distinction) in Aeronautical Engineering from the Indian Institute of Science, and his Ph.D. in Engineering Mechanics from Virginia Tech. He is a Fellow of the AAS and an AIAA Associate Fellow. He has served as an Associate Editor of the AIAA Journal of Guidance, Control, and Dynamics. He is a co-author of the upcoming book "Spacecraft Formation Flying: Dynamics, Control and Navigation."

**104 Knox Hall**  
**Thursday, October 8th, 2009**  
**3:30 - 4:30 pm**

Please contact Dr. Tarunraj Singh at [tsingh@buffalo.edu](mailto:tsingh@buffalo.edu) for more information or to request a meeting with Dr. Vadali.