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SEMINAR SERIES

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Dynamical Systems: Concepts, Techniques, and Applications Planning

ABSTRACT

Challenges in dynamics have fascinated physical scientists (and mankind in general) for thousands of years. Notable among such challenges are those of celestial mechanics, especially the determination of the motion of objects in space. Problems in astrodynamics and dynamical astronomy have set the stage for impressive implementations and breakthroughs in the study of dynamical systems. While there are no fixed extremities, astrodynamics denotes the dynamics and control of spacecrafts while dynamical astronomy is concerned with the motion of other bodies in the solar system. From a dynamical systems perspective, it is very useful to combine the two subjects. In this talk, we will explore the use of different concepts and techniques in dynamical systems theory while highlighting several recent technical advances. Particularly, we will look at three applications: A) Trajectory design strategies to the Moon: This work aims to develop a catalog of orbital transfers in the Earth-Moon system that can serve in a useful capacity for future mission design applications. B) Semi-analytic methods for dynamical systems: Because interpreting complex motions is crucial to addressing challenges in aerospace research, we will emphasize the role of transformation laws to rectify the motion of a dynamical system through physics-informed analysis. C) Computational vision techniques for aerospace: Achieving closure between modeling, simulations, and experiments to facilitate theory-to-industry goals. While the concepts and techniques discussed in this talk are applied towards astrodynamics applications, they can also be used to address a broad range of dynamical systems challenges in mechanics, optics, fluid flow, plasma dynamics, and other avenues of research.

BIO

Roshan Thomas Eapen is a Doctoral Candidate in the Aerospace Engineering department at Texas A&M University. He is currently on the Heep Graduate Fellowship from the Hagler Institute of Advanced Studies. Roshan received his M.S. in Aeronautics and Astronautics from Purdue University in 2017. His research combines dynamical systems theory with computational vision applications to model and study a diverse range of engineering problems. He has worked on multiple sponsored projects by NASA, AFRL, NSF, and other companies with a focus on trajectory design, relative motion, terrain relative navigation, Entry, Descent, and Landing, and in the development of physics-based realistic image generation software.