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3:00-4:00 pm
https://psu.zoom.us/j/93543835672

# Efficient Navigation for Low-Energy Lunar Transfers Planning

## ABSTRACT

Low-energy transfers permit travel from the Earth to the Moon with reduced $\Delta$ by taking advantage of chaotic dynamics in the Sun-Earth-Moon gravitational system, and these savings can enable lunar missions by smallsats or other resource-constrained spacecraft. However, these trajectories expose a spacecraft to long periods of unstable dynamics, and navigation along them currently relies on frequent, expensive tracking by ground-based infrastructure. This talk aims to answer two key questions: (1) How can one design measurement and correction schedules that ensure a successful transfer with the minimum amount of ground-based tracking, and (2) what features of low-energy transfers predict optimized missions with low navigation costs?

The first part of the talk will introduce the dynamics, measurement, and correction models for low-energy transfers in the circular-restricted four-body problem (CRFBP), and demonstrate a genetic-algorithm-based procedure for the efficient chance-constrained optimization of tracking and correction schedules. The second part of the talk will present preliminary results from a survey of optimized schedules over the parameterized low-energy transfer design space; characteristics common to low-cost transfers will be explored, and metrics predictive of various aspects of performance will be discussed.

## BIO

Riley Fitzgerald is a Doctoral Candidate in Aeronautics and Astronautics at the Massachusetts Institute of Technology, where he performs research as a Fellow with The Charles Stark Draper Laboratory, Inc. and as part of the MIT Space Telecommunications, Astronomy, and Radiation (STAR) Laboratory. His research focuses on the interactions between astrodynamics, spacecraft navigation, and resource-limited space system design, and has touched on subjects as wide-ranging as optimal solar sail orbit transfers, LEO density measurement, smallsat formation flight, and exoplanet orbit identification. He holds a SM in Aeronautics and Astronautics from MIT, and a BSE in Mechanical and Aerospace Engineering from Princeton University.