Department of Aerospace Engineering Seminar Series

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INTERPLANETARY MISSION DESIGN VIA MULTI-OBJECTIVE HYBRID OPTIMAL CONTROL

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ABSTRACT: Preliminary design of low-thrust interplanetary missions is a highly complex process. The mission designer must choose discrete parameters such as the number of flybys, the bodies at which those flybys are performed, and in some cases the final destination. Because low-thrust trajectory design is tightly coupled with systems design, power and propulsion characteristics must be chosen as well. In addition, a time-history of control variables must be chosen which defines the trajectory. There are often many thousands, if not millions, of possible trajectories to be evaluated. The customer who commissions a trajectory design is not usually interested in a point solution, but rather the exploration of the trade space of trajectories between several different objective functions. This can be a very expensive process in terms of the number of human analyst hours required. An automated approach is therefore very diserable. This work presents such an approach by posing the mission design problem as a multi-objective hybrid optimal control problem. The method is demonstrated on hypothetical missions to asteroids and to the moons of Mars.

BIO: Jacob Englander is a member of the Navigation and Mission Design Branch at NASA Goddard Space Flight Center. He earned his Ph.D. from the University of Illinois at Urbana-Champaign in 2013. Dr. Englander's responsibilities at Goddard include interplanetary mission design, trajectory design tool development, and optimization research. His interests include low-thrust and high-thrust interplanetary trajectory optimization, hybrid optimal control, and global search methods.

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