Title: The patched three-body-two-body model: a trajectory design method for all seasons

Speaker: Elena Fantino, Khalifa University of Science and Technology, Abu Dhabi, UAE

Abstract:

I will review the main features and advantages of a simple and very versatile trajectory design technique obtained by patching the circular restricted three-body problem and the two-body problem when these models have a common primary (e.g., the Sun in the case of a Sun-planet system, the planet in the case of a planet-moon system). The methodology works in the planar as well as in the spatial domain, and offers the mission designer an analytical (hence, computationally attractive) medium-fidelity tool to evaluate time of flight and transfer ΔV for missions based on low-energy trajectories (hyperbolic invariant manifolds of libration point orbits, transit orbits) leading towards one or more flyby or destination bodies. In essence, the technique consists in: 1) neglecting the gravitational attraction of the smaller primary when the spacecraft is sufficiently far from it; 2) defining the osculating Keplerian orbit of the spacecraft around the larger primary; 3) computing transfers towards the smaller primary of the destination three-body system by finding intersections between confocal coplanar ellipses. The last step introduces a degree of freedom which enables multiple solutions and optimization/trade studies. The method lends itself to a variety of applications, from tours of planetary systems to missions performing rendezvous with near-Earth objects. Initially developed for impulsive maneuvers, the technique has recently been expanded and its current capabilities include low-thrust transfers.