

Dear Holmes Family,

I am glad to have the opportunity to thank you personally for your generosity. Without fellowships like this, many students would be unable to pursue the education of their dreams.

During the last quarter in Mechanical and Aerospace department of University of California in Irvine, this fellowship provided me a sufficient support not only financially, but also as a great motivation to pursue my research with professor Villac. It remains as an honor for me during my future years of study here at UC Irvine.

My research was on design, navigation and guidance of stable transfers. During the last quarter I had this chance to complete the main part of this research and submitted a paper to the 21<sup>st</sup> AAS/AIAA Space Flight Mechanics Meeting. The conference committee has accepted my paper for this conference and this is considered as a great achievement for me.

That paper addresses the optimization of stable multi-impulse transfers. These transfers allow a spacecraft to coast near families of stable periodic orbits while staying within the associated stability region. They result in fail-safe transfers with respect to miss-thrust and may provide an interesting navigation and control strategy for human mission to small bodies. The optimization problem considered consists of the minimization of sequences of small impulses transfer- ring a spacecraft between two given periodic orbits within a stable family, under path and impulse constraints to stay within the stability region. A two-level optimization strategy is proposed that results in locally optimal transfers. An "inner" optimization solves the problem of minimum fuel direct transfer between two nearby orbits while an "outer" optimization solves the problem for the optimal selection of the series of intermediate orbits. Simple cases where (semi-) analytic solutions are available (Hohmann and minimum impulse Lambert transfers) are used to both validate the proposed strategy and investigate the issue of global optimality. The proposed method is also illustrated for the case of transfer along distant retrograde orbits in the restricted three-body problem. This case indeed represent of large class of stable capture routes to low altitude orbits in a variety of systems.

Once again, I am honored to be a recipient of the Holmes fellowship and I offer my sincerest thanks for your generous support.

Sincerely,

Navid Nakhjiri

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