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Analysis of launch opportunity for low-thrust interplanetary missions

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Interplanetary missions are strictly dependent on the launch opportunity. Mission planning requires knowledge not only of the technological and cost constraints but also the study of the influence of the launch opportunity on the spacecraft performance and on the feasibility of the mission itself. Porkchop plots are very effective tools to design an interplanetary mission, providing a graphical and optimized overview of the relationship between the fundamental parameters of the mission design: the launch date, the duration and the energy. In this way it is possible to evaluate the best region to accomplish the mission under current constraints. Porkchop plots in their usual implementation are, however, applicable only to impulsive (chemical or NTP) propulsion. In this paper an interplanetary mission from Earth to Mars is analyzed, comparing plots similar to porkchop plots, but obtained for low thrust, NEP and SEP. As a first approximation, the orbits of the two planets are considered as coplanar and circular. Then, using the ephemerides, elliptical and non coplanar orbits are taken into account and the "ideal" plots are compared with the actual ones, referred to a particular launch opportunity. Finally, some numerical examples are carried out.

Biography

Maffione Porzia Federica completed her Master's degree in Mechatronic Engineering from Polytechnic of Turin. Her project thesis was on space propulsion for human spaceflight with VASIMR and the aim of this project was to study the optimization problem with indirect method. Currently, she is doing PhD at Polytechnic of Turin and her research is about interplanetary missions design for NEP and SEP. Her first publications are on optimal low-thrust trajectories.

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