Paper ID: 15701
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ASTRODYNAMICS SYMPOSIUM (C1)
Mission Design, Operations and Optimisation (2) (5)

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OPTIMAL SPACECRAFT TRAJECTORIES FOR FLIGHT TO ASTEROID APOPHIS WITH LOW THRUST

Abstract

An analysis of spacecraft energy optimal flight to the Near-Earth asteroid Apophis using a high thrust chemical engine for escape and a low thrust electric-jet engine for interplanetary flight is performed in the Paper. The initial flight time from 2012 to 2022 and the duration of interplanetary flight from 185 to 365 days are investigated for the cases of ideal and piecewise-constant thrust. The results were obtained using a developed hybrid method of space trajectories optimization. This method combines some direct and indirect computational procedures. The initial approximation was obtained using global search method and then improved by traveling tube algorithm and local variations one. The Pontryagin method with parametric continuation of solution was used to obtain the final results. The numerical characteristics of the optimal trajectories for the flight duration of 185 and 365 days with using the Rocket Soyuz are presented. The study was supported by Russian Foundation for Basic Research (grant N 09-01-00710) and by Scientific Schools Support Program (grant NSh-6700.2010.1).