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TRAJECTORY ANALYSIS AND DESIGN FOR AN EUROPEAN FAST KINETIC DEFLECTION MISSION

Abstract

In the recent years, the number of Near Earth Asteroids (NEO) has increased exponentially thanks to new observations and investigation. Some of these asteroids have a very low probability of impact with the Earth in the following decades and are catalogued as Potentially Hazardous Asteroids (PHA). Therefore, Planetary Defense studies are aimed at the development of techniques to respond to the possibility of such a threat in the future.

In this context, the European Space Agency has promoted a study to analyze the current capability to achieve the deflection of a real target asteroid of around 50m in the shortest possible time using a kinetic impactor. A mission like this imposes very important challenges to overcome for its success, two are of special relevance:

1- The short warning time (only few years) since the PHA discovery to its close approach with Earth.

2- The complex GNC system required to impact the target at a very high speed.

As Airbus Defence and Space subcontractor, DEIMOS is in charge of the trajectory design, requiring the search and optimization of thousands of trajectories to hundreds of asteroids, particularly those included in the Potentially Hazardous Asteroids list. The search and optimization of trajectories are constrained by different mission and operational parameters, such us warning time, maximum transfer time, Sun Phase angle at impact, or the arrival velocity at the target body. In the proposed paper, the methodology followed during the trajectory design procedure is presented, together with the main results that in consequence allow the generation of maps reporting the deflection capabilities depending on the asteroid, the S/C design and the mission characteristics.

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