

PDC2023
Vienna, Austria

DEFLECTION AND DISINTEGRATION OF ASTEROID BY KINETIC PENETRATION

Yonghe Zhang⁽¹⁾, Bingwen Qian⁽²⁾, Hui Liu⁽³⁾, and Yamin Wang⁽⁴⁾

⁽¹⁾*Innovation Academy for Microsatellites, Chinese Academy of Sciences, Shanghai, China, 201203, zhangyh@microstate.com*

⁽²⁾*Northwest Institute of Nuclear Technology, Xi'an, Shanxi, 710613, 13572851949@163.com*

⁽³⁾*Beijing Institute of Control and Electronics Technology, Beijing, China, 100038, 13522911941@139.com*

⁽⁴⁾*Innovation Academy for Microsatellites, Chinese Academy of Sciences, Shanghai, China, 201203, wangym@microstate.com*

Keywords: *asteroid defense, kinetic penetration, high porosity asteroid*

ABSTRACT

Kinetic energy deflecting asteroids is the most important means of asteroid defense, and has been tested by the mission of DART. Recent asteroid exploration mission, Hayabusa-II and OSIRIS-Rex have shown that small size asteroids have a low density and are likely to have highly porous interior structures. Apophis, known as a high-risk asteroid, has a diameter of 390 meters and an estimated density of 2.6 tons per cubic meter, lower than cement blocks on Earth. Most of the high-risk asteroids are small in size. There are even a kind of opinion that small asteroids are rubble piles.

Kinetic energy penetration has been widely used in destroying cement building and boulders in the ground. In this paper, a concept of destroying and deflecting asteroids by kinetic penetration projectile is proposed. Through kinetic penetration, high-porous asteroids would be deflected and broken up into small pieces, removing the threat to Earth. In addition, compared with a direct impact, kinetic energy penetration does not rely on kinetic energy transfer to change the asteroid's orbit, reducing the impact speed and the technology requirements of navigation and control, and the mass of spacecraft.

The mission proposal aimed at the disintegration of asteroid with a diameter of 30 meters has been designed, including candidate asteroids, deep space trajectories, high-precision navigation and control, structure and function of penetration projectile, and the platform of spacecraft. The effects of asteroid porosity, size and mass of kinetic energy projectile, impact velocity and angle on the effect of deflection and disintegration were analyzed.

Comments:

(Space Mission & Campaign Design, Oral)