

IAF ASTRODYNAMICS SYMPOSIUM (C1)
Interactive Presentations - IAF ASTRODYNAMICS SYMPOSIUM (IP)

Author: Mr. Javad Shams
K. N. Toosi University of Technology, Iran, luftwaffe.jg52@gmail.com

Prof. Jafar Roshanian
K. N. Toosi University of Technology, Iran, roshanian@kntu.ac.ir

INVESTIGATING UN-STABILITY PHENOMENA AND CHAOTIC BEHAVIOR IN DEFLECTION OF
POTENTIAL HAZARDOUS ASTEROID

Abstract

This survey focuses on the investigation of un-stability and chaotic behavior likewise nonlinearity effects such a technically challenging of deflection of hazardous celestial object named Apophis. Asteroid Apophis is candidate as potential hazardous asteroid that probability of its hit with Earth in future is high. So implementation the mission of deflecting this dangerous asteroid and reducing the risk of its impact on the planet is of great importance. Hence in this paper well known solar collector method in order to execute asteroid deflection mission is proposed. Consequently, practically viable technologies that can be used to mitigate threats from near Earth crossing asteroids is investigated based on mathematical relations for analyzing nonlinear dynamic systems. To investigate such missions for called asteroid, well known Hill-Clohessy-Wiltshire (HCW) equations is discussed that based on the fundamentals of asteroid deflection dynamics corresponding to relative motion dynamic. Cause of the nature of the spacecraft's functional environment in space and uncertain forces acted on such asteroids, it is concluded that governing equations corresponding to mentioned mission going on un-stability and it may will impact with Earth for precession years. Also, it should be noted that many uncertainties can affect the asteroid as perturbation force. These forces are resulted in un-stability of dynamic system of asteroid. An extended with additional terms, including the yarkovsky effect and more perturbation sources such as gravitational perturbation, must be employ for the accurate orbit prediction of asteroid Apophis. Uncertain phenomena acted on case study asteroid in this survey is discussed and concluded that nominal trajectory of mentioned asteroid will probably change. Next with respect to disclosed missions, mathematical analysis is demonstrated to investigate unstable behavior of this asteroid upon proposed space missions. In this way, analyzing (HCW) equations is necessary. Result figures, show un-stability as non-asymptotically of the dynamic system. From other view this unstable system with respect to corresponding references is in the category of unstable mode. It should also be noted that in the following, this instability can, under certain conditions and due to the uncertainties in space, affect the asteroid, even enter into chaotic and unpredictable behavior. Therefore in this case, with the specific characters of chaotic behavior, the effective performance of the mission is challenged. Consequently, in order to designing the assigned mission, it should consider these issues as well as inconsistency and possible chaotic behavior, so that the mission does not encounter any problems.