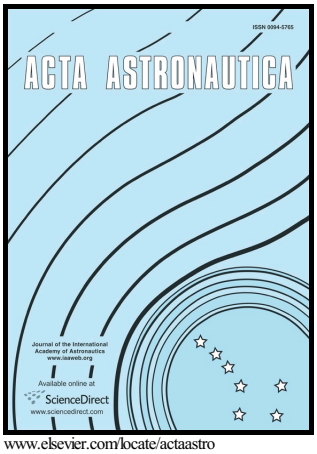

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Mauricio M. Guelman

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CLOSED-LOOP CONTROL FOR GLOBAL COVERAGE AND EQUATORIAL HOVERING ABOUT AN ASTEROID

Mauricio M. Guelman[1*]

Technion, Israel Institute of Technology, Technion City, Haifa 32000, Israel

[*]aerglmn@tx.technion.ac.il

The purpose of this work is to develop a simple control law to implement stable orbits about a small rotating celestial body to achieve global coverage as well as fixed-body hovering on the equatorial plane. The celestial body is assumed to be rotating about a principal axis, with constant rotational velocity along the largest moment of inertia. A simple three dimensional closed-loop guidance law function of position and velocity is defined and analyzed, enabling the determination of the guidance constants to assure convergence to any desired circular orbit about the irregular celestial body, controlling independently five orbital parameters: inclination, right ascension of the ascending node, orbital radius, orbital rate and equatorial longitude. Representative numerical results are presented for an Eros type asteroid.

1. Introduction

Small bodies, such as asteroids and comets have been of increasing interest due both to their scientific importance and possible practical applications. There is a clear interest to understand the primal constituents and dynamical processes of the solar system and the possible mining of asteroids for exotic materials has been proposed [1]. There are a number of ongoing [2] and future missions to these bodies. A common feature of many of these missions is a phase of close orbiting these bodies as well as hovering.

Generally, close-proximity operations around small objects are extremely challenging since the dynamics of the spacecraft are complicated by the irregular shape and mass distribution of

[1] Emeritus Professor, Faculty of Aerospace Engineering, Technion, I.I.T., Haifa 32000, Israel