13th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Space Elevator Tether and Space Mineral Resources (3)

Author: Dr. Alexander Burov
A.A.Dorodnicyn Computing Centre, FRC Computer Science and Control, Russian Academy of Sciences, Russian Federation

Prof. Anna Guerman
Centre for Mechanical and Aerospace Science and Technologies (C-MAST), Portugal
Prof. Ivan Kosenko
A.A.Dorodnicyn Computing Centre, FRC Computer Science and Control, Russian Academy of Sciences, Russian Federation
Ms. Alessandra Ferraz
National Institute for Space Research - INPE, Brazil
Mr. Vasily Nikonov
Lomonosov Moscow State University, Russian Federation

DYNAMICS OF SPACE ELEVATOR ON ASTEROID

Abstract

Dynamics of space elevators attached to large celestial bodies, such as the Earth or the Moon, have been studied in considerable details in quite a number of publications. Meanwhile, a space elevator on small body, that is, a tether anchored to a body surface used for payload transportation, can offer many advantages associated to a space elevator exploration, e. g., it is cheap and safe. However, in analysis of a space elevator dynamics in the vicinity of a small body one has to take into account its shape, dimensions, asymmetric mass distribution, proper rotation, etc.

We consider dynamics of a space elevator on an asteroid, i. e., spacecraft attached to a rotating asteroid with a light inextensible tether. We study the domains attainable for the spacecraft depending on such problem parameters as the angular velocity of the asteroid, the tether length, the position of the anchor at the surface, etc. We develop a method based on Routh procedure that allows one to identify the relative equilibria of the system in study and to analyze its stability and bifurcations. Some non-trivial classes of the solutions are found and their relations to the libration points are examined.