

IAF ASTRODYNAMICS SYMPOSIUM (C1)  
Attitude Dynamics (1) (8)

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ATTITUDE DYNAMICS AND CONTROL OF SPACE OBJECT DURING CONTACTLESS  
TRANSPORTATION BY ION BEAM

**Abstract**

Creating systems for passive space objects' contactless transportation is topical task of space industry. Such systems can be used to solve the problem of space debris removal and for servicing satellites with failed propulsion systems. A mechanical system consisting of a passive space object and an active spacecraft equipped with marching engines and an engine generating an ion flow is considered in this study. The ion flow is directed to a passive space object. Crashing into the surface of an object, ions exert a force influence on it. The forces and torques arising in this way are similar to the aerodynamic forces and torques acting on the body when moving in a rarefied medium. Previous studies have shown that in the case of plane motion, an ion beam can be used to stabilize the angular oscillations of a space object in equilibrium. The aims of this work is to study a spatial motion dynamics of a passive space object and developing control law providing stabilization of the object oscillations in an equilibrium state. A mathematical model describing the spatial motion of a passive space object relative its center of mass when it is under the influence of ion beam created by an active spacecraft is developed. An analysis of the unperturbed motion of the system is carried out. Possible equilibrium positions are identified. The law of controlling the ion beam velocity, which provides stabilization of the spatial oscillations of the object in the equilibrium position, is proposed. The effectiveness of the law is confirmed by the results of numerical simulations. The results can be used in the development of new contactless transportation systems.