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Capture and removal of space debris from geostationary orbit using electromagnetic induction

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The present study discusses the technique for active space debris removal using electromagnetically induced force in electrically conductive materials. The force in action is called Lorentz force which acts on an electrically conductive material when it is moving through uniform or non-uniform magnetic field distribution [2]. The basic principle of this idea is in accordance to Faraday's law of induction and Lenz's law [1]. In this paper, focus is on developing a method to capture or accelerate / decelerate the electrically conductive debris with the goal of transferring it to a separate orbit such as, graveyard orbit.For the current idea, a hypothetical toroidal coil is assumed to generate sufficiently strong magnetic field when applied electrical current, which is realized on the debris in motion. Orbital dynamics of the debris is studied incorporating the proposed method and results are drawn. The applicability of the idea is discussed and, areas of improvement and further study are recognized.
Numerical simulation for the proposed system showed that different magnitudes of input currents have particular set of consequences. With higher input currents (I = 15 A, 20 A) are able to effectively change the semi-major axis of the debris. The proposed technique has potential use for removing conductive space debris such as discarded fuel tanks, higher stages and combustion chambers which are generally made from copper alloys.

Источники и литература

1) Griffiths D. J. Introduction to electrodynamics, Fourth edition, Boston: Pearson, 2013
2) Landau L. D., Lifshitz E. M. Electrodynamics of Continuous Media, Volume 8, Course of theoretical physics, p. 429.

Иллюстрации

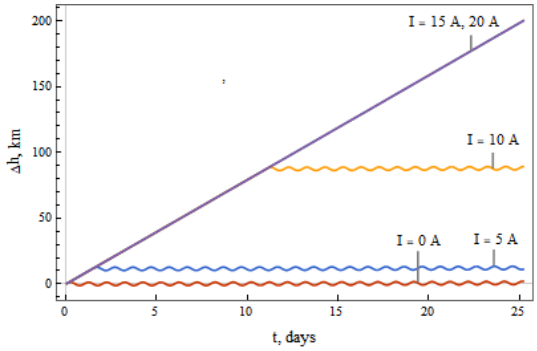

Рис. 1. Change in semi-major axis of the debris