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SOLAR MAGNETIC SAILING CONFIGURATION AND INTER-PLANETARY TRAVEL - AN EXPLORATORY STUDY

Abstract

The concept of magnetic sail was invented in collaborative work by Dana Andrews and Robert Zubrin in 1988. Since then, further studies and concepts on this topic have been developed many researchers and theoretical physicists. For example, Winglee et al (2000) expanded the concept by introducing plasma injection as a means of expanding the created magnetic field. Funaki has lead research work in magnetic sails and propulsion systems that utilize magnetic fields (Funaki et al, 2007). Magnetic sail, which utilizes the interaction by solar wind contained in a flux of real particles, is unique but has not been implemented for interplanetary propulsion system. A magnetic sailing spacecraft (MagSail) utilizes the interaction between solar wind and magnetic field that is generated by a loop of superconducting wire attached onboard of the spacecraft. The working principle of the MagSail is then reviewed, elaborated and analyzed to study its performance. The equation of motion for orbital dynamic of MagSail is elaborated and parametric studies are carried out to explore the probable trajectories of interest for space travel. In particular the Logarithmic spiral trajectories for MagSail interplanetary travel are investigated. The results of the analysis together with circle-to-circle planetary transfer such as Venus and Mars are elaborated for insight and comparative purposes.