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AUTONOMOUS NAVIGATION STRATEGY FOR SMALL SATELLITE LOW ENERGY LUNAR TRANSFER

Abstract

Traditionally, Small satellite missions have been limited to Earth mainly, due to the propellant required for direct transfers. This problem has been addressed and solved by using Low Energy Trajectories to moon, demonstrated by Hiten and GRAIL missions and have become a corner stone of potential Lunar Exploration missions. Another factor limiting the reach of private and small satellite missions to moon has been access to DSN for navigation. The cost-inefficient operations of DSN and inability of private and small organisation to use DSN have been a major stumbling block. Autonomous Navigation has been a developing concept in theory but largely lacks application in deep space exploration and is greatly undermined by traditional ground control. Autonomous Navigation ensures less-to-no ground dependency and comparatively lower propellant amount for orbit/trajectory control and stationkeeping, maintaining precisely, the orbit/trajectory by more frequent but lower magnitude burns. A strategy for lunar missions by low-energy transfer not demanding exclusive DSN access will open new horizons and revolutionize Lunar Exploration. The paper addresses autonomous navigation strategy with sufficient ground intervention for a small satellite transferred by Low-Energy Trajectory to the Moon and lays out operations, hardware, and principal performance analysis of Autonomous Navigation as compared to complete Ground based (Single station Ranging and Doppler) Navigation.