

Three Dimensional Flexible Dynamics of Continuous Cislunar Payloads Transfer System

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Abstract : Based on the Motorized Momentum Exchange Tether (MMET), with the principle of momentum exchange, the three dimension flexible dynamics of continuous cislunar payloads transferring system (CCPTS) is built by Lagrange method and its numerical solution is solved by Mathematica software. In the derivation precession of potential energy, this paper uses the Tylor expansion method to simplify the Lagrange equation. Furthermore, the tension coming from the centripetal load is considered in the elastic potential energy. The comparison simulation results between the 3D rigid model and 3D flexible model of CCPTS shows that the tether flexibility has important influence on CCPTS's orbital parameters (such as radius of CCPTS's COM and the true anomaly) and the tether's rotational movement, the relative deviation of radius and the true anomaly between the two dynamic models is about 0.00678% and 0.00259%, the relative deviation of the angle of tether-span and local gravity gradient is about 3.55%. Additionally, the external torque has an apparent influence on the tether's axial vibration.

Keywords : cislunar transfer, dynamics, momentum exchange, tether

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