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NUMERICAL DYNAMICS AND STABILITY STUDY FOR TWIN TETHERED OBJECTS

Abstract

The controversial problem of the efficiency of tethered twin masses for soft landing is investigated through an inverse dynamics method. The deployment phase is detailed, with emphasize on the specific dynamics of very long strings and their consequence upon the stability of motion of twin tethered objects in orbit. Re-entry dynamics and necessary initial conditions for a secure soft landing for planets with atmosphere are analyzed. Additionally, the landing method is considered for central bodies without atmosphere (Moon and other similar satellites of the planets). The efficiency of the system is compared with the gasdynamical or ballute soft landing solutions, in terms of mass consumption. The technology for the string deployment is considered as given at any desired size within a circular orbit for a twin system with uneven masses. Numerical simulations cover the descent trajectory of the landing mass and the post-landing evolution of the orbital mass after de-connection. Emphasize is put on dynamic loads within the cable during the eigen-descent phase and at the landing position regarding safe anchoring capabilities. The estimates are based on simplifying assumptions regarding the inertial behavior of the hyper-long string.