DYNAMICAL SUBSTITUTES OF EQUILIBRIUM POINTS OF ASTEROIDS UNDER SOLAR RADIATION PRESSURE

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Abstract: *Previous works have focused on the hovering points [1] or periodic motion [2] for an imperfect solar sail near an asteroid with the Hill approximation. Equilibrium points and the associated invariant manifolds of a rotating nonspherical asteroid has also been investigated and the landing trajectories and maneuver strategies have been designed for specific asteroid[3]. In the current study, we analysed the equivalent equilibrium points, i.e., dynamical substitutes of an asteroid under solar radiation pressure (SRP) in the asteroid rotating frame. The uniformly rotating triaxial ellipsoid is adopted to model the gravitation of the asteroid. First, the equations of motion with SRP included are constructed in the rotating frame and are then expanded with respect to the original equilibrium points without considering SRP to obtain the linearised equation for the dynamical substitutes. The linearised solutions are numerically corrected to compute the dynamical substitute orbits. Second, the stability properties of the dynamical substitutes are inspected by calculating the corresponding eigenvalues of the Monodromy matrix. Different orientation angles of the solar panel are considered to analyse their influence on the stability. Third, we numerically integrate the unstable dynamical substitutes in the direction of the corresponding unstable vector to find the invariant manifolds that can intersect with the asteroid surface. This may serve as an option for future landing on the asteroid as well as in-situ observation. In addition, the search for intersections in phase space of the invariant manifolds of both the dynamical substitutes and the libration points of the Hill approximation is also carried out to reveal the underlying dynamical relationship of these two gravitation regimes. Throughout our analyses, the parameters of the triaxial ellipsoid model of the asteroid, such as the mass, size and period, and those corresponding to the SRP, such as the size of the solar panel and its orientation, are all taken into account and varied in order to fully evaluate the possible results.*

Keywords: *Asteroid, Dynamical Substitute, Solar Radiation Pressure, Equilibrium Points.*

1. References

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