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Triangular Libration Points in the R3bp under Combined Effects of Oblateness, Radiation and Power-Law Profile

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Abstract : We study the e□ffects of oblateness up to J4 of the primaries and power-law density profile (PDP) on the linear stability of libration location of an innitesimal mass within the framework of restricted three body problem (R3BP), by using a more realistic model in which a disc with PDP is rotating around the common center of the system mass with perturbed mean motion. The existence and stability of triangular equilibrium points have been explored. It has been shown that triangular equilibrium points are stable for 0 < μ □< μ□c and unstable for □μc ≤ □μ ≤ □1/2, where □c denotes the critical mass parameter. We find that, the oblateness up to J2 of the primaries and the radiation reduces the stability range while the oblateness up to J4 of the primaries increases the size of stability both in the context where PDP is considered and ignored. The PDP has an e□ect of about □≈0:01 reduction on the application of □c to Earth-Moon and Jupiter-Moons systems. We find that the comprehensive eff□ects of the perturbations have a stabilizing proclivity. However, the oblateness up to J2 of the primaries and the radiation of the primaries have tendency for instability, while coe□cients up to J4 of the primaries have stability predisposition. In the limiting case c = 0, and also by setting appropriate parameter(s) to zero, our results are in excellent agreement with the ones obtained previously. Libration points play a very important role in space mission and as a consequence, our results have a practical application in space dynamics and related areas. The model may be applied to study the navigation and station-keeping operations of spacecraft (innitesimal mass) around the Jupiter (more massive) -Callisto (less massive) system, where PDP accounts for the circumsolar ring of asteroidal dust, which has a cloud of dust permanently in its wake.

Keywords : libration points, oblateness, power-law density profile, restricted three-body problem
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