Stable periodic orbits of the equal-mass zero angular momentum three-body problem

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In 2009, Martynova, Orlov and Rubinov investigated the stability of a special 2D initial conditions' domain of the equal-mass zero angular momentum planar three-body problem [1]. Their motivation for considering this particular domain was that the well-known stable periodic orbits consisting of the Figure-8 orbit, the Schubart orbit and the Broucke orbit, belong to it. Based on the results from [1], one may conjecture that the rather large stability regions found in [1] are generated by a large number of stable periodic orbits. Indeed, during the period of 2013-2018, hundreds of new collisionless periodic orbits were discovered in that same initial conditions' domain, many of them shown to be linearly stable [2, 3, 4].

In this presentation, we report the results from our recently conducted high-precision numerical study, which is intended to confirm and expand the knowledge about the 2D domain of initial conditions in [1]. The main results are as follows: four stability regions are established in the domain and 971 verified initial conditions for linearly stable periodic collisionless orbits are found. Many of the identified initial conditions are new ones. The periodic orbits within each stability region exhibit characteristic patterns in their syzygy sequences. Additional computations suggest that these orbits are KAM-stable orbit candidates. The presentation is based on our recent work [5].

References

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