Celestial Mechanics and Dynamical Astronomy (2021) 133:53
https://doi.org/10.1007/s10569-021-10052-6

ORIGINAL ARTICLE

The circular restricted 4-body problem with three equal primaries in the collinear central configuration of the 3-body problem

Jaume Llibre[1] · **Daniel Paşca**[2] · **Claudià Valls**[3]

Received: 26 July 2021 / Revised: 21 September 2021 / Accepted: 5 November 2021

Abstract
We study the dynamics of the circular restricted 4-body problem with three primaries with equal masses at the collinear configuration of the 3-body problem with an infinitesimal mass. We calculate the equilibrium points and study their linear stability. By applying the Lyapunov theorem, we prove the existence of periodic orbits bifurcating from the equilibrium points and, further, prove that they continue in the full 4-body problem. Moreover, we prove analytically the existence of Hill and of comet-like periodic orbits.

Keywords Circular restricted 4-body problem · Collinear central configuration · Periodic orbit

Mathematics subject classification Primary 70F07 · 70F15

The second author dedicates this paper to Professor George Dincă on the occasion of his 80th birthday, with deep esteem and respect.

✉ Daniel Paşca
dpasca@uoradea.ro

Jaume Llibre
jllibre@mat.uab.cat

Claudià Valls
cvalls@math.ist.utl.pt

[1] Departament de Matemàtiques, Universitat Autònoma de Barcelona, Bellaterra, 08193 Barcelona, Catalonia, Spain

[2] Department of Mathematics and Informatics, University of Oradea, University Street 1, 410087 Oradea, Romania

[3] Departamento de Matemática, Instituto Superior Técnico, Av. Rovisco Pais 1049-001, Lisboa, Portugal

Published online: 01 December 2021