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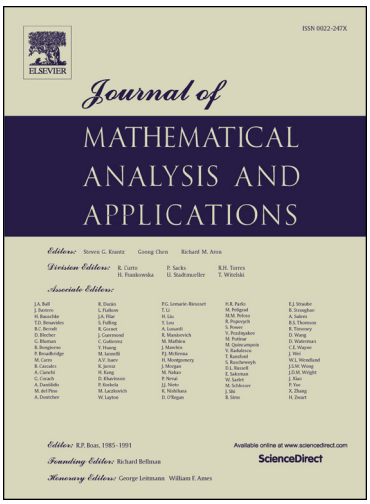

Some Notes on Four-body Co-circular Central Configurations

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Some Notes on Four-body Co-circular Central Configurations

Dedicated to Professor Yiming Long for his 69-th Birthday

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Abstract

There are two symmetric families of four-body co-circular central configurations, namely the kite and isosceles trapezoid. Using mutual distances as coordinates, we prove that if the four-body central configuration is an isosceles trapezoid, then the diagonals of the isosceles trapezoid cannot be perpendicular to each other. Furthermore, we show that for any four-body co-circular central configuration, the diagonals of the quadrilateral cannot be perpendicular except that the configuration is a kite.

Keywords: Four-body problem, Co-circular central configurations, Isosceles trapezoid, Mutual distances, Kite

1. Introduction

The numbers and shapes of central configurations for the Newtonian n-body ($n \geq 4$) problem are important and difficult problems in Celestial Mechanics. In 1995 and 1996, Albouy [1, 2] proved that there are exactly four equivalent classes of central configurations for the planar Newtonian 4-body problem with equal positive masses. In 2006, Hampton and Moeckel [8] proved the finiteness of central configurations for Newtonian four-body problems with any given positive masses. Furthmore, in 2012, Albouy and Kaloshin [4] showed the finiteness of central configurations for Newtonian five-body problem except for masses in a codimension two subvariety.

In 1932, Macmillan and Bartky [9] showed that for any given four masses and any assigned order, there is a convex co-planar central configuration for 4-body problem. In 2004, Xia [12] gave a simpler elegant proof of this result. In the paper of Macmillan and Bartky [9], they also proved that there is a unique isosceles trapezoid central configuration of the co-planar 4-body problem with two pairs of equal masses located at the adjacent vertices of the configuration. In 2012, Xie [13] gave an explicit expression for the masses in

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