Bifurcations of the Spatial Central Configurations in the 5-Body Problem

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1 Introduction

A configuration of n particles is called central when the acceleration vector of each particle is a common scalar multiple of its position vector. One of the reasons why central configurations are interesting is that they allow us to obtain explicit homographic solutions of the n-body problem, that is, motions where the configuration of the system changes size but keeps its shape. Also, they are important in the study of total collisions.

Even the finiteness of the number of central configurations is a very difficult question. This conjecture was proposed by Chazy [6] and Wintner [17] and was listed by Smale as problem number 6 on his list of problems for this century [15]. Central configurations, which appear so deeply in the dynamics of the n body problem are very difficult to count [15]. A complete enumeration of all such solutions for $n \geq 4$ represents a very difficult task for the present day methods.

For the collinear n-body problem, an exact count of the central configurations of n bodies was found by Moulton back in 1910. He showed that there are $n!/2$ equivalence classes.

Saari [13] proved that the regular $N-1$ dimensional simplex is a central configuration of N bodies for any value of the masses. In particular, case $N = 4$

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M. Corbera et al. (eds.), *Extended Abstracts Spring 2014*, Trends in Mathematics 4,
DOI 10.1007/978-3-319-22129-8_2