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FAMILIES OF CONTINUA OF CENTRAL CONFIGURATIONS IN CHARGED PROBLEMS

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Abstract. In this paper the central configurations for charged problems are studied, that is, symmetrical configurations of point particles with positive masses and charges of any sign moving under Newtonian and Coulombian forces has been considered. As two different kinds of forces are acting simultaneously, the number of central configurations can change drastically depending on the parameters. We start studying central configurations in the rhomboidal problem, where four point particles are located at the vertices of a rhombus. In this model we prove that choosing the parameters in a particular way yields a continuum of central configurations. Generalizing the above example, it was considered the study of two arbitrary regular concentric n-gons of n_1 and n_2 particles respectively, and another point particle at the origin. Supposing some additional hypothesis on the parameters it was possible to get families of continua of central configurations rotating one n-gon with respect to the other.

Keywords. n-body problem, charged problem, central configurations.
AMS subject classification: 70F10, 70F15.

1 Introduction

The charged n-body problem studies the dynamics of n point particles endowed with masses and charges, moving under the influence of the respective Newtonian and Coulombian forces. The idea to combine these two kind of forces is not new, in 1921 Irving Langmuir (1932 Chemistry Nobel Price) used a combination of them to give a model for the helium atom [6], where the computed theoretical spectrum agrees with the measured one. Until that time, the planetary model introduced by N. Bohr using only Coulombian forces, very effective to explain the spectrum of the hydrogen atom, had failed to provide a good approximation for helium.

A recent trend in theoretical physics is the study of dynamics for the classical atom, mainly for the benefit of semi-classical theory; in this way, the study of charged problems play an important role. The potential of the charged problem is the same as that of the Newtonian n-body problem, except that the product of masses $m_i m_j$ in the Newtonian case is replaced by $\lambda_{ij} = m_i m_j - e_i e_j$, where e_i and e_j represent electrostatic charges on the