

THE STABILITY PROBLEM AND THE EXISTENCE OF PERIODIC ORBITS IN THE HEAVY TOP DYNAMICS

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Abstract. The stability problem and the existence of periodic orbits for the heavy top dynamics are discussed and some of its properties are pointed out.

1. Introduction

In the last time there was a great deal of interest in the study of the heavy top dynamics. The goal of our paper is to present some old and new aspects from its stability problem and from the problem of the existence of its periodic orbits.

2. The Heavy Top

The heavy top is by definition a rigid body which moves around a fixed point in the 3-dimensional space. The rigidity means that the distances between the points when the body moves remain the same, so they are fixed.

The dynamics of the heavy top is described by the following set of differential equations, usually called **Euler equations**:

$$\begin{aligned}\dot{m}_1 &= a_1 m_2 m_3 + mgl(\gamma_2 \chi_3 - \gamma_3 \chi_2) \\ \dot{m}_2 &= a_2 m_1 m_3 + mgl(\gamma_3 \chi_1 - \gamma_1 \chi_3) \\ \dot{m}_3 &= a_3 m_1 m_2 + mgl(\gamma_1 \chi_2 - \gamma_2 \chi_1) \\ \dot{\gamma}_1 &= \frac{m_3 \gamma_2}{I_3} - \frac{m_2 \gamma_3}{I_2} \\ \dot{\gamma}_2 &= \frac{m_1 \gamma_3}{I_1} - \frac{m_3 \gamma_1}{I_3}\end{aligned}\tag{1}$$