

Effects of J_2 Perturbation on Geometrical Relative Motion

W. A. Rahoma^{1,2}, Deleflie, F.^{2,3}

1: Department of Astronomy and space Science, Faculty of Science, Cairo University, 12613, Egypt

2: Laboratoire d'Astronomie de Lille/Université de Lille, 1 impasse de l'Observatoire 59000 Lille, France

3: Observatoire de Paris, IMCCE, GRGS, 75, PARIS, France

Abstract

By exploiting a direct geometrical approach, an exact and efficient analytic formulation of relative motion was presented.

Using the orbital elements without imposing any particular conditions on the base or the target satellites trajectories, exact expressions for the relative motion are obtained in a closed form. This solution allows the parameterization of the relative motion manifold and offers new methods to study its geometrical and topological properties.

The study is exact and it maintains a high degree of accuracy even in the presence of J_2 perturbations, which is adequate for long-term prediction of bounded relative orbits.

Keywords: Relative Motion, Geometrical Approach, Satellites Constellations