



ON THE DYNAMICS OF THE SOLAR SYSTEM I: ORBITAL INCLINATION AND NODAL PRECESSION

RAMON GONZÁLEZ CALVET

Communicated by Charles-Michel Marle

The dynamic equations of the n -body problem are solved in relative coordinates and applied to the solar system, whence the mean variation rates of the longitudes of the ascending nodes and of the inclinations of the planetary orbits at J2000 have been calculated with respect to the ecliptic and to the Laplace invariable plane under the approximation of circular orbits. The theory so obtained supersedes the Lagrange-Laplace secular evolution theory. Formulas for the change from the equatorial and ecliptic coordinates to those of the Laplace invariable plane are also provided.

MSC: 70F10, 70F15

Keywords: Laplace invariable plane, n -body problem, nodal regression, orbital inclination, precession of the ecliptic, solar system

Contents

1	Introduction	2
2	The Solar System as a $(n + 1)$-Body Problem	4
3	The Laplace Invariable Plane	7
4	Precession of the Orbital Planes of the Planets	11
4.1	Precession of the Nodes of the Planetary Orbits with the Ecliptic	12
4.2	Synodic Periods	17
4.3	Precession of the Orbital Planes of the Planets with Respect to the Laplace Invariable Plane	18
4.4	Variation of the Inclinations of the Orbital Planes	23
4.5	Variation of the Norm of the Orbital Angular Momentum of Each Planet	25
5	Conclusions	25