ON A NEW ANALYTIC THEORY OF THE MOON’S MOTION III:
FURTHER CORRECTIONS

RAMON GONZÁLEZ CALVET

Communicated by Charles-Michel Marle

Abstract. Further corrections to the analytic theory of the lunar motion deduced
from the first-order approximation to the Lagrange equations of the Sun-Earth-
Moon system expressed in relative coordinates and accelerations are evaluated.
Those terms arising from the second-order approximation, the planetary perturba-
tions and Earth’s spheroidal shape are calculated and bounded, all of them being
very small. Finally, Earth’s gravitational parameter is calculated from gravity data
finding a value slightly higher than that provided by Jet Propulsion Laboratory.

MSC: 70F10, 86A30

Keywords: Earth’s mass, Earth’s spheroid, four-body problem, gravity, lunar mo-
tion, Moon, perigee precession, planetary perturbations, reference ellipsoid

Contents

1 Introduction 67
2 Second-Order Approximation 69
3 Spheroidal Earth 72
4 Perturbations of the Planets upon the Earth-Moon System 78
  4.1 The Sun-Jupiter-Earth-Moon System 78
  4.2 Nodal Regression and Perigee Precession 80
  4.3 Jupiter’s Perturbation on the Motion of the Earth-Moon Center of Mass 84
5 Summary of Corrections 85
6 Conclusions 86
7 Appendix. Spheroidal Earth 87
  7.1 Earth’s Shape 87
  7.2 Why is Earth’s Gravitational Potential Spheroidal? 88
  7.3 Earth’s Gravitational Potential 89
  7.4 Gravity and the Determination of Earth’s Mass 93
  7.5 Earth’s Gravitational Field over the Moon 98

References 98