

Contents

Preface	v
Chapter 1 Bibliographical Survey	1
1.1 Equations. The Triangular Equilibrium Points and their Stability	1
1.2 Numerical Results for the Motion Around L_4 and L_5	2
1.3 Analytical Results for the Motion Around L_4 and L_5	6
1.3.1 The Models Used	6
1.4 Miscellaneous Results	12
1.4.1 Station Keeping at the Triangular Equilibrium Points	12
1.4.2 Some Other Results	12
Chapter 2 Periodic Orbits of the Bicircular Problem and Their Stability	15
2.1 Introduction	15
2.2 The Equations of the Bicircular Problem	16
2.3 Periodic Orbits with the Period of the Sun	19
2.4 The Tools: Numerical Continuation of Periodic Orbits and Analysis of Bifurcations	21
2.4.1 Numerical Continuation of Periodic Orbits for Nonautonomous and Autonomous Equations	21
2.4.2 Bifurcations of Periodic Orbits: From the Autonomous to the Nonautonomous Periodic System	24
2.4.3 Bifurcation for Eigenvalues Equal to One	26
2.5 The Periodic Orbits Obtained by Triplication	28
Chapter 3 Numerical Simulations of the Motion in an Extended Neighborhood of the Triangular Libration Points in the Earth-Moon System	33
3.1 Introduction	34

3.2	Simulations of Motion Starting at the Instantaneous Triangular Points at a Given Epoch	35
3.3	Simulations of Motion Starting Near the Planar Periodic Orbit of Kolenkiewicz and Carpenter	35
Chapter 4 The Equations of Motion		47
4.1	Reference Systems	47
4.2	The Lagrangian	48
4.3	The Hamiltonian and the Related Expansions	51
4.4	Some Useful Expansions	52
4.5	Fourier Analysis: The Relevant Frequencies and the Related Coefficients	54
4.6	Concrete Expansions of the Hamiltonian and the Functions	62
4.7	Simplified Normalized Equations. Tests	65
4.7.1	Tests of the Simplified Normalized Equations	66
Chapter 5 Periodic Orbits of Some Intermediate Equations		71
5.1	Equations of Motion for the Computation of Intermediate Periodic Orbits	71
5.2	Obtaining the Periodic Orbits Around the Triangular Libration Points for the Intermediate Equations	73
5.3	Results and Comments	74
Chapter 6 Quasi-periodic Solution of the Global Equations: Semi-analytic Approach		87
6.1	The Objective	87
6.2	The Algorithm	88
6.3	The Adequate Set of Relevant Frequencies	90
6.4	Avoiding Secular Terms	94
6.5	The Coefficients Related to the Different Frequencies	94
6.6	Determination of the Coefficients of Quasi-periodic Functions Using FFT	95
6.7	Results and Conclusions	103
Chapter 7 Numerical Determination of Suitable Orbits of the Simplified System		107
7.1	The Objective	107
7.2	Description of Two Families of Algorithms. Reduction of the Linearized Equations	108
7.3	Description of the Methods. Comments	112
7.4	Results and Discussion	116
Chapter 8 Relative Motion of Two Nearby Spacecrafts		121
8.1	The Selection of Orbits for the Two Spacecrafts	121
8.2	Variations of the Relative Distance and Orientation. Results	122
8.3	Comments on the Applicability of the Results	135

Chapter 9 Summary	137
9.1 Objectives of the Work	137
9.2 Contribution to the Solution of the Problem	138
9.3 Conclusions	140
9.4 Outlook	141
Bibliography	143