SUMMARY

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This thesis studies two main applications of Lagrange's planetary equations; in the theory of artificial satellites and in the three-body problem.

The problem of the analytical theory of Earth's artificial satellites for the zonal harmonic perturbations was treated using the CUI DOU-XING technique [10], to obtain the first and second order perturbations in the orbital elements. The expressions obtained include the effects produced by the second up to sixth zonal harmonics. The secular terms of the first and second order and the periodic terms of the first order are obtained. The solution is set free from any mixed secular terms.

Numerical examples, in which the values of the orbital elements for two different satellites, used to compare our analytical solution of the perturbations in the orbital elements with those given by Slowey [65] and Susanna [72]. For the Balloon satellite 1963, 30D, [65] the values of the orbital elements at the beginning, middle of the lifetime of the Balloon, and near the decay were given. A comparison was made between our results and those obtained by Slowey at these intervals. For the Pageos 1 Balloon satellite the values of the orbital elements at the beginning, middle of the first two years of the lifetime and near the end of the second year of the satellite's lifetime were given. A comparison was made between our results and those obtained by Susanna at these intervals. These comparisons,

show that our analytical solution and computation agree conveniently with the results given by Slowey and Susanna.

The quintic equation appearing in the stationary solution of the three-body problem, namely, Lagrange's equation, was solved for a set of distances between three collinear masses m_1, m_2 and m_3 using Ioakimidis method [36]. Also a verification of this solution in the solar system with numerical examples on different collinear planets was given. Finally, a comparison of the results obtained in this thesis with those tabulated in the Nautical and Astronomical Almanac was illustrated.