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LONG-TERM ORBIT PROPAGATION USING SYMPLECTIC INTEGRATION ALGORITHMS

Abstract

Understanding the evolution of satellite orbits in the long-term is of great importance in astrodynamics. In order to achieve this, accurate propagation of the orbital dynamics of the satellite is required. This paper attempts to implement and evaluate a class of numerical integration methods known as symplectic algorithms. This class of algorithms is highly regarded in scientific applications, especially in long-term studies. The paper will demonstrate the superior accuracy and efficient speed of several algorithms of this class and obtain long-term state of satellites under the several influencing forces. Other applications such as an orbit determination process and a long-term stability analysis of a satellite in orbit around a Lagrange point in the restricted three-body problem are also performed to test the versatility of the algorithms. Within each application, several cases with different values for parameters such as the time step and duration are executed. In addition, long-term orbital evolution of a satellite in various orbital regimes is conducted. Also, applications of these algorithms in other problems in astrodynamics are discussed.