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OPTIMAL IMPULSIVE ORBITAL MANEUVER BETWEEN NONCOPLANAR NONCOAXIAL ORBITS WITH OR WITHOUT TIME CONSTRAINT

Abstract

In order to solve the problem of optimal impulsive orbital 3D maneuver with or without time constraint one must first solve the optimal condition's equations. There are different and numerous modes of geometry, all of these modes must be considered. Solving this problem with the geometric modes has, to my knowledge, not been done before. In this paper the problem has been solved in two states: with time constraint and no time constraint while considering all possible geometric modes. The purpose of this paper is solving the problem and achieving the global answer. For considering all possible modes of geometry, the relations of oblique spherical triangle must be used. All necessary angles can be determined by using these relations. In this paper, 16 modes for exposure of initial orbit to final orbit and 16 modes for exposure of transfer orbit to initial and final orbits are classified. Then, the optimal condition equations have been solved. Solving the equations led to only one local minimum and the global answer cannot be identified. Therefore, the process is required to determine global answer. In this paper, the explicit equations have been extracted which by using them, intermediary variables evaluated with respect to independent variables. Then, the function of impulse can be minimized to independent variables separately. The exact location of global answer can be determined by examining the behavior of the function to the independent variables. Therefore, the global answer can be obtained. Finally, the method is applied for the numerical example. The initial and final orbits is elliptical and non coplanar and elements of them are certain. The example is solved in two modes of time constraint and no time constraint. In time constraint mode, the time of transfer must be 2500 seconds. In this mode some results have been verified by solving the Lambert problem. In the non time constraint mode, the total required impulse is less than the time constraint mode as expected. The answers of two of these modes have been simulated by MATLAB code. The results show acceptable accuracy and high-speed computing.