Bi-Impulsive Control to Build a Satellite Constellation*

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Abstract: This paper considers the problem of optimal maneuvers to insert a satellite in a constellation. The main idea is to assume that a satellite constellation is given, with all the Keplerian elements of the satellite members having known values. Then, it is necessary to maneuver a new satellite from a parking orbit until its position in the constellation. The control available to perform this maneuver is the application of two impulses (instantaneous change in the velocity of the spacecraft) to the satellite and the objective is to perform this maneuver with minimum fuel consumption. The maneuver that changes the angular position of a satellite keeping all the other Keplerian elements constant is also considered.

Keywords: Orbital maneuver; astrodynamics; impulsive control; satellite constellation.

Mathematics Subject Classification (2000): 70F15, 70M20, 93C99.

1 Introduction

To solve the problem of optimal maneuvers to insert a satellite in a constellation, two basic types of maneuvers are simulated: the planar ones, where the initial and final orbits belong to the same plane, and the three-dimensional ones, where they belong to different planes. The initial conditions to solve this problem are the orbits of the spacecraft in the parking and in the final orbits, including the information required to specify its positions in the orbits (the true anomaly or any other equivalent quantity) and the minimum and

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