Inclination change using atmospheric drag

Walkiria Schulz[1], Antonio F.B.A. Prado[2], R. Vilhena de Moraes[3]

The current space exploration capacity is very limited by the excessive amount of fuel necessary to deliver and to transport loads in space. That situation motivated the development of techniques for the accomplishment of orbital maneuvers using natural forces, substituting, at least partly, the propulsive forces, as the atmospheric maneuvers do. Several control methods of vehicles crossing the atmosphere have being studied to assure the maintenance of the acceleration and of the heating of those vehicles inside limits previously defined. According to Miele (1996), the fuel economy for an atmospheric planar or quasi- planar transfer between an geostationary orbit and a low orbit, for example, can reaches 60% of the fuel that would be worn- out on a equivalent Hohmann transfer. In this scenery, the present work proposes the analysis of atmospheric missions through the development of a software for maneuvers calculation with continuous thrust to a vehicle that comes to use the terrestrial atmosphere to accomplish orbital changes. Several simulations were accomplished with the objective of obtaining the inclination variation due to the vehicle passage by the atmosphere. The maneuvers with plan change were chosen for this study, for they be highly costly in comparison to other orbital maneuvers and so they could generate good examples of atmospheric maneuvers application. The comparisons were made among maneuvers totally propulsive accomplished with continuous jets and maneuvers partly propulsive and partly atmospheric. However, the several simulations showed that this problem is highly dependent of initial conditions such as mass of the vehicle and initial and final orbital elements. Could be shown more advantageous to accomplish a gone down until the terrestrial atmosphere into certain cases and completely disadvantageous in others.