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NUMERICAL ANALYSIS OF A N2O/PARAFFIN FUELED HYBRID ROCKET TO PERFORM CAPTURE MANEUVERS IN A MARS ORBIT

Abstract

In this work a preliminary design of a hybrid rocket capable to reduce to negative the energy of a microsatellite in order to be captured by a Mars orbit has been performed. The first design showed the feasibility of meeting the total impulse mission requirements while respecting the constraints of weight and size. The analysis of mechanisms GriMech 3.0, 5-step mechanism and an equiilbrium model have been performed to select the best one to be implemented in numerical simulations. This analysis showed that GriMech 3.0 is not the most indicated model to work when the dissociation of nitrous oxide is an important event. Numerical simulations of the engine for ground and space operative conditions have shown to be a interesting strategy to predict phenomenons that will be experienced during the test campaign and to predict the performance of the engine. The results of this work pointed out that pressure instabilities arise due to the flow separation at the ground test operative conditions. Numerical simulations at different times showed the evolution of the pressure, temperature and species distribution in the combustion chamber. The investigation of the effect of the pre and post combustion chamber was also performed in order to define the effect of the geometric parameters on fuel mixing, and the combustionefficiency.