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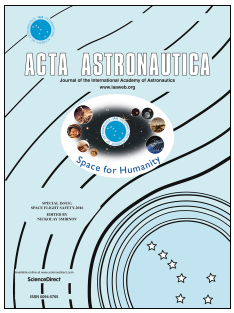

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Static and Moving Solid/Gas Interface Modeling in a Hybrid Rocket Engine

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A numerical model was developed with CFD-ACE software to study the working condition of an oxygen-nitrogen/polyethylene hybrid rocket combustor. As a first approach, a simplified numerical model is presented. It includes a compressible transient gas phase in which a two-step combustion mechanism is implemented coupled to a radiative model. The solid phase from the fuel grain is a semi-opaque material with its degradation process modeled by an Arrhenius type law. Two versions of the model were tested. The first considers the solid/gas interface with a static grid while the second uses grid deformation during the computation to follow the asymmetrical regression. The numerical results are obtained with two different regression kinetics originating from ThermoGravimetry Analysis and test bench results. In each case, the fuel surface temperature is retrieved within a range of 5% error. However, good results are only found using kinetics from the test bench. The regression rate is found within 0.03 mm.s^{-1} and average combustor pressure and its variation over time have the same intensity than the measurements conducted on the test bench. The simulation that uses grid deformation to follow the regression shows a good stability over a 10 s simulated time simulation.

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