Paper ID: 15673
oral

SPACE PROPULSION SYMPOSIUM (C4)
Advanced and Combined Propulsion Systems (8)

Author: Prof. Fulvio Stella
Universita' di Roma 'La Sapienza', Italy

MIXING ENHANCEMENT IN HYBRID ROCKET MOTOR USING VORTEX GENERATORS

Abstract

Hybrid rocket propulsion represents a possible future alternative for civilian and military rocket vehicles propulsion. A hybrid rocket is a compromise between a solid and a liquid rocket motor: uses a solid fuel and a liquid oxidizer. This configuration has several well known advantages, such as less security problems, smaller costs, etc. On the other hand, main problem of this type of motors, is the poor mixing, inside the combustion chamber, between the solid propellant and the oxidizer injected. As consequence, combustion chamber usually results to be quite long in order to respect mixing time between propellant and oxidizer. Several different solutions have been proposed in the past to overcome this problem, going from complex design of the internal propellant grain to different grain composition. In a previous work the authors have studied the presence of protrusions of thermal protections in a large solid rocket motor (i.e. ARIANE V - P230) because they are the reason for the production of large coherent vortex structures that are responsible of undesirable pressure oscillations. During this study by chance, it has been observed that these structures are also responsible for increased internal mixing with extraction of fluid from the propellant grain boundary layer. Therefore in the present work the possibility of improving internal mixing by means of obstacles placed in the combustion chamber will be discussed. A parametric study, by varying: the length of the combustion chamber, the height of the obstacle and the possibility of side injection of oxidizer, will be conducted in the present study, by means of CFD simulations.