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SPACE PROPULSION SYMPOSIUM (C4)
Propulsion System (2) (2)

Author: Prof. Domenico Simone
University of Brasilia, Brazil, domenico.simone@aerospace.unb.br

Prof. Fulvio Stella
Universita' di Roma 'La Sapienza', Italy, fulvio.stella@uniroma1.it
Dr. Marilena Giangi
Sapienza University of Rome, Italy, mgiangi@stella.dma.uniroma1.it

MODELING DISTRIBUTED COMBUSTION IN SRM

Abstract

Aim of this work is to develop and implement a model for aluminium combustion in SRM. The investigation of distributed combustion in solid-propellant rockets is mandatory for an in deep understanding of aeroacoustic phenomena, ballistic/performance predictions, predictions of thermal loads and/or erosion, etc. In fact aluminium droplets, constituting the principal component of the condensed phase evolving through combustion chamber and nozzle, burn, generating micrometric particles and smoke of alumina; these particles, which density (number of particle/ volume unit) is strongly affected by the flow field, undergo mechanical and chemical interactions with walls and the flow itself, affecting amplitude and frequency of the aeroacustic phenomena. Based on lagrangian tracking of the particles, the proposed model represents an improvement of existing numerical models, "tuned" by using experimental data of aluminium combustion available in literature. Particular attention has been focused on multiphase behaviour of the flow, including mutual particle-flow interaction and alumina particles break-up. Several simulation have been performed, comparing results in terms of temperature, pressure, vorticity field and residual mass fraction of un-burnt aluminium with available data. Based on the above results the presented model will be proposed for numerical simulations of multi-phase aluminium combustion in large scale in SRM.