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HEAT TRANSFER AND ATTITUDE INVESTIGATION OF A FLAT PLATE IN A HYPERSONIC FLOW FOR THE DEBRISK SURVIVABILITY MODELLING TOOL

Abstract

"The French Space act" has been voted by French parliament in 2008; one main goal of this law is space operations safety. To evaluate re-entry risks, CNES has decided to develop its own engineering tool, named DEBRISK, to study re-entry survivability. DEBRISK is an engineering tool giving the 3D trajectory of re-entering satellite components as well as the surface heat fluxes and debris demise altitudes or impact energies. Simple shapes can be modelled with a random tumbling attitude (spheres, boxes, flat plates and cylinders) and the most common satellite materials are available. During re-entry, the wall heat fluxes are integrated to obtain the debris temperature and in case of surface melting, debris mass and shape are adjusted. This kind of methodology has some limitations, especially for flat plates. In this paper we will present the work performed to validate the models for plat plates in DEBRISK using data from wind tunnel test experiments. In the first part on the paper a brief description on the wind tunnel setup and the results will be presented. Wind tunnel rebuilding with the MISTRAL CFD code have been conducted to validate the use of this code in the extrapolation methodology on shapes like flat plates and to evaluate the error margins. Finally, an extrapolation method from the CFD to the operational tools has been conducted.