

RESEARCH PROPOSAL

SIMULATION OF FLUID FLOW IN THE CASTING PROCESS OF SOLID PROPELLANT

My effort in the present research is to develop a physically meaningful numerical model for the solid propellant casting. The casting of the solid propellant slurry is typical of an unsteady non-Newtonian flow with free surface. The free surface is the interface between the almost incompressible propellant slurry and the low-pressure air (600 Pa to 1000Pa). Numerical simulation of this flow should be able to capture the pressure and velocities in both the fluids as well as the movement of the interface with time. Already an earlier attempt has been made in this direction from my part. The main difficulty involved was highly disparate acoustic speed in the propellant slurry and low density air (vacuum) surrounding it. One is a highly incompressible medium and the other is compressible. Hence a compressible formulation with Tait's law for both fluids was selected. A preconditioning technique was adopted to overcome this difficulty. The Non-Newtonian (Power Law) fluid properties were also incorporated. An accurate AUSM+_UP scheme were used for flux evaluation. The interface was reasonably sharp.

The resulting code turned out to be extremely restrictive in the allowable time step. Due to this reason with the computing facility available we were able to do the simulation up to few milliseconds only and no sensitivity studies were undertaken in the present configuration. My current effort is to improve upon time step so that sensitivity study can be carried out.

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