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DESIGN OF A CONICAL ANTI-SLOSH BAFFLE AND ITS EXPERIMENTAL VALIDATION FOR SLOSH STABILITY FOR THE INDIAN INTERPLANETARY MISSION

Abstract

Slosh disturbances in liquid propellant tanks is a major concern in launch vehicles, satellites and modules of interplanetary missions. During descending / braking phase of the modules of interplanetary missions, slosh stability/ slosh disturbances within acceptable limits is to be ensured through control stability studies. Bi-propellant liquid propulsion system is envisaged in the interplanetary module.Propellants are stored in two independent cylindrical tanks with spherical end domes. Sloshing phenomenon in these propellant tanks is required to be mathematically represented as pendulum mass model in control stability studies. Parameters for clean tanks required for slosh modelling for these studies are evaluated by linear velocity potential based finite element code to arrive at damping requirements and its duration, if any to achieve slosh stability. Different baffle configurations were designed to meet the damping requirement using semi-empirical relations. An inverted conical baffle is chosen based on the tank mounting requirements, fabrication easiness and mass constraint. Baffle design is validated through experimental studies carried out on model tank made of transparent Perspex material. In addition to above, its effect on slosh parameters is also established through numerical and experimental studies.