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MODELLING OF LUNAR LANDER'S THRUSTER'S EXHAUST PLUME IMPINGEMENT IN VACUUM

Abstract

This paper presents the modelling of rocket exhaust plume flow field and exhaust plume impingement in vacuum for the liquid apogee engine and attitude control thrusters of the lunar lander. Analytic formulations for rarefied gas kinetics has been taken as reference for modelling the plume flow field. The plume has been modelled as high speed, collision-less, axi-symmetric gas jet, expanding into vacuum and impinging at a normally set diffusive circular plate. Specular reflections have not been considered for the present study. Different parameters such as number density, temperature, pressure, flow velocity, heat flux etc., have been calculated and have been plotted against and compared to Direct Simulation Monte Carlo results. These analyses have provided important information for the placement of critical optical instruments and design of optimal thermal insulation for the hardware that may come in contact with the thruster exhaust.