NUMERICAL EXPLORATION OF LOW ALTITUDE ROCKET PLUME IN AIRCRAFT VICINITY

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Abstract

Low altitude plume of a solid rocket motor is numerically explored. The effects of free stream Mach number, altitude and presence of launch platform wing on plume shape are studied. Three-dimensional Reynolds Averaged Navier-Stokes (RANS) equations along with k-ε turbulence model and species transport equations are solved using commercial CFD software CFX-11. Thermochemical parameters (Mach number, pressure, temperature and propellant hot gas mass fraction) are analysed to characterize the plume. Mixing layer boundaries, its thickness and the attainment of self-similarity are evaluated to study the plume structure. With the increase of free stream Mach number, the computed plume diameter reduces. Centerline pressure, temperature and radial expansion of the plumes increases with the increase in altitude. Plume is found to be elongated and narrowed with relatively warm core region due to the presence of platform wing.

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