Paper ID: 9559
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SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Systems II (2)

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COLD FLOW SIMULATION OF VORTEX SHEDDING IN A SEGMENTED SOLID ROCKET MOTOR

Abstract

Combustion instabilities are a major problem in large solid rocket boosters. They are responsible for exciting undesirable oscillations in the propellant burn rate. It is believed that vortex shedding from upstream inhibitors is one of the phenomena responsible for the onset of these instabilities. Vortex shedding frequencies are time dependent due to the unsteady nature of the flow inside the rocket motor. When one of these frequencies coincides with a structural frequency, the oscillations can increase substantially. The protruding inhibitors are caused by their slow burn rate compared to that of the fuel. In the current research, cold flow simulations were carried out to understand the problem of vortex shedding. Results were generated for a fixed baffle diameter and distance between inhibitors while varying the flow velocity. Six different flow conditions were used starting from 70 gallons per minute to 120 gallons per minute, while vortex shedding distances corresponding to each flow configuration were measured in order to determine the Strouhal number. The Strouhal number for the various runs was found to be in the range of 0.19 to 0.28, which is slightly higher than that of previously published experiments of 0.185 to 0.20.