Study of Acoustic Resonance of Model Liquid Rocket Combustion Chamber and Its Suppression

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Abstract : Liquid rocket engine (LRE) combustion chamber is subjected to pressure oscillation during the combustion process. The combustion noise (acoustic noise) is a broad band, small amplitude, high frequency component pressure oscillation. They constitute only a minor fraction (< 1%) of the entire combustion process. However, this high frequency oscillation is huge concern during the design phase of LRE combustion chamber as it would cause catastrophic failure of the chamber. Depends on the chamber geometry, certain frequencies form standing wave pattern, and they resonate with high amplitude and are known as Eigen modes. These Eigen modes could cause failures unless it is suppressed to be within safe limits. These modes are categorized into radial, tangential, and azimuthal modes, and their structure inside the combustion chamber is of interest to the researchers. In the present proposal, experimental as well as numerical simulation will be performed to obtain the frequency-amplitude characteristics of the model combustion chamber for different baffle configuration. The experimental study aims at measuring the frequency amplitude characteristics at certain points in the chamber wall. The experimental measurement will be also used for scheme used in numerical simulation. In addition to experiments, numerical simulation would provide detailed structure of the Eigenmodes exhibited and their level of suppression with the aid of different baffle configurations.

Keywords : baffle, instability, liquid rocket engine, pressure response of chamber

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