World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:14, No:11, 2020

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

Authors : Vimal O. Kumar, C. K. Muthukumaran, P. Rakesh

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 main objective of this study is to find effect of baffle configuration that would provide better suppression of acoustic modes. 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
Conference Title : ICAME 2020 : International Conference on Aerospace and Mechanical Engineering
Conference Location : San Francisco, United States
Conference Dates : November 02-03, 2020