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DYNAMIC CHARACTERISTICS OF OPEN-TYPE SWIRL INJECTOR WITH PULSATING MANIFOLD PRESSURE

Abstract

Combustion instabilities in a liquid rocket engine are generated by coupling between the heat release oscillations and the acoustic pressure oscillations in the combustor. This instability from the combustor can affect the injector and the feed line which are in front of the combustor. These transfers worsen the instability of liquid rocket engine. A dynamically properly designed injector can be used to prevent the transfer and suppress the combustion instability. For this reason, dynamic characteristics of the injectors have to be studied. Open-type swirl injectors were designed in order to investigate the dynamic characteristics through an experimental study. The injector's were designed with replaceable swirl chamber parts to change the length and the diameter of swirl chamber. A hydro-mechanical pulsator was installed in front of the manifold of the swirl injector which produces pressure oscillations in the feed line. Pressure in the manifold, liquid film thickness in the orifice and the pressure in the orifice were measured in order to understand the dynamic characteristics of the swirl injectors. As a result, the injector's response characteristics to pressure fluctuation inputs with different geometries were obtained. The tendencies of the output parameters acquired in the study could be used to adjust the injector design to suppress the combustion instability.