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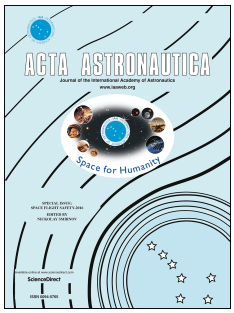

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Study on a Simplified Double-Frequency Scheme for Pulse Detonation Rocket Engines

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Abstract

To reduce hardware complexity and increase operating frequency, a simplified double-frequency scheme has been developed to obtain high-frequency detonations for pulse detonation rocket engines based on the valved and valveless schemes. This study focuses on characteristics of this simplified scheme. The critical points where detonations transit to deflagrations are considered at different operating conditions to clarify the lower boundaries of stable operations. Experimental results indicate that an ideal buffer zone may not be formed similar to the traditional valved schemes. Comparisons with the valveless scheme without the purge process show that the upper limits of oxidizer percentages are consistent to ensure stable operations, which implies that the present scheme operates potentially as the valveless mode. Detailed studies on the employed solenoid valves and impacts of retonations on the upstream passages demonstrate that solenoid valves are not able to realize intermittent supply control effectively. It is concluded that practical operations utilizing solenoid and rotary valves to control periodic supplies may also operate under a valveless scheme actually with a different upper limit of oxygen percentage in oxidizer.

Keywords: detonation; high-frequency; characteristic; simplified scheme

1. Introduction

Detonation burns a fuel-oxidizer mixture and releases its chemical energy in an extremely rapid process. In