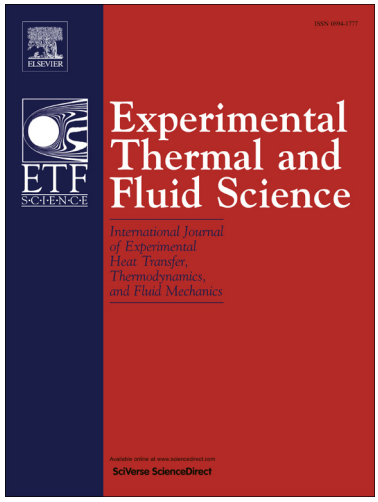

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Vijay Anand, Andrew St. George, Robert Driscoll, Ephraim Gutmark

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Vijay Anand, Andrew St. George, Robert Driscoll, Ephraim Gutmark
Gas Dynamics and Propulsion Laboratory
Department of Aerospace Engineering
University of Cincinnati, OH 45221

Abstract

The behavior of the oxidizer inlet and the fuel injection plenums during the operation of a Rotating Detonation Combustor (RDC) is studied using pressure sensors in the air injection gap, the fuel plenum, and in the combustor. Significant pressure feedback from the rotating detonation wave is observed in the air injection gap. Pressure feedback into the fuel plenum is relatively weaker. The average normalized cross-correlation between the pressure-time series in the air injection gap and within the combustor is greater than 0.3. The air injection gap has a considerable base sinusoidal oscillation in the same frequency range as a previously discovered waxing-and-waning instability in the combustor. The fundamental frequency in the air injection gap is the same as the RDC operation frequency for almost all test cases, indicating the high efficacy of the sensors in the air inlet to attain the operating frequency. Frequency analysis reveals notable spatial variation in the fuel plenum dynamics. The low frequency oscillation in the air injection gap is found to be constant at 235 (+/- 2.5) Hz for all the air flow rates and equivalence ratios tested.

Nomenclature

f	frequency (Hz)
Φ	equivalence ratio
t	Time
R	Normalized cross-correlation
x	arbitrary first pressure-time series (bar)
y	arbitrary second pressure-time series (bar)
n	sample number
N	maximum number of samples in a time series
P_C	averaged combustor pressure during operation
P_A	averaged air plenum pressure during operation (bar)
P_F	averaged fuel plenum pressure during operation (bar)
PR_A	air injection pressure ratio during operation
PR_F	fuel injection pressure ratio during operation
f_f	fundamental frequency (Hz)
σ	standard deviation