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# THE INFLUENCE OF CONFINEMENT GEOMETRY ON SPECTRAL CHARACTERISTICS AND BULK MODE RESONANCE IN A SWIRL BURNER

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### ABSTRACT

The experimental work presented in this paper aims to provide insight into the excitation of bulk mode (Helmholtz) oscillations set up in a swirl burner system. By maintaining a constant volumetric flow rate and equivalence ratio, two-dimensional Laser Doppler Anemometry (LDA) measurements were taken with a swirling flame open to atmosphere and under high levels of confinement with and without exciting conditions. Velocity derived power spectral densities and time correlations were subsequently generated from the LDA results in order to investigate the role of downstream geometry and/or hydrodynamic instabilities that may be partly responsible for the excitation of the resonant state. It was found that instabilities common to swirl flows, such as vortex shedding and the precessing vortex core, were absent from the open flame power density spectra indicating that the resonance is not excited by such fluid dynamic instabilities. By investigating the different confinement geometries it was found that resonance could be achieved without the presence of an exhaust pipe. Moreover, only a subtle change in confinement geometry was required for excitation. It is suggested that confinement promotes upstream feedback to the inlet ducting which conspires with the burner and combustor geometry to resonate. Spectral analysis of the resonant condition exhibit multiple high-energy harmonics supporting the notion that the oscillating system is made up of a multiple of oscillating components upstream.