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Critical Structures in Vortex Dominated Thermoacoustic Systems[1] C.P. PREMCHAND, Indian Institute of Technology - Bombay, ABIN KRISHNAN, MANIKANDAN RAGHUNATHAN, P.R. MIDHUN, K.V. REEJA, RAMAN I. SUJITH, Indian Institute of Technology - Madras, VINEETH NAIR, Indian Institute of Technology - Bombay — In most fluid dynamical systems, large coherent structures are involved in the process of sound production. In addition to sound production due to vortices in the flow-field, vortices also enhance heat production in combustors which in turn amplifies sound production leading to detrimental effects in thermoacoustic systems. The root cause behind this phenomenon can be understood by investigating the spatio-temporal dynamics of coherent structures responsible for sound production. Lagrangian Coherent Structures (LCSs), a sophisticated framework based on the fluid properties, currently gives the best representations of coherent structures in the fluid flow-field. Individual saddle point trajectories referred to as "critical structures", are tracked during thermoacoustic instability regime in a bluff-body combustor as they emerge from the upstream side wall and move towards the top wall of the combustor. These critical trajectories with the informed physics provide an optimal location to implement a passive control strategy. Upon control leading to suppression of tonal sound, we found that the jet pushes the trajectories to divert its path almost parallel to the horizontal axis of the combustor.

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