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Effects of Acoustic Excitation on Bluff-body Stabilized Premixed Reacting Flows VAIDYANATHAN SANKARAN, ROBERT ERICKSON, MARIOS SOTERIOU, United Technologies Research Center — Bluff body stabilized flames are used in numerous combustion applications to enable stable burning at high speeds. These confined flames are susceptible to acoustic excitation arising due to the confinement that can lead to thermoacoustic instabilities which are detrimental to the operability of the combustion device. In this study, we formulate a computational approach for the simulation of this phenomenon that is based on the one way coupling of an acoustic solution to a low Mach number but dilatational reacting flowfield. The latter is simulated with a purely Lagrangian and grid free approach that captures the rotational flowfield using the discrete Vortex Method and the reacting field by a kinematical solution of the G-equation. Earlier studies using this flow simulation approach have shown that the unsteady interactions, such as the transition from the asymmetric Von-Karman shedding to the more symmetric shedding structure present when reaction occurs can be captured accurately. Flame response to longitudinal acoustic waves is simulated and results are to be discussed in the context of transfer functions of heat release response to acoustic velocity excitation. Dominant mechanisms by which the flame responds to acoustics will also be identified. Finally, results are to be contrasted to those from analytical models that are in use in thermoacoustic studies today.

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