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The recirculation dynamics of bluff body stabilized premixed combustion. MARIOS SOTERIOU, ROBERT ERICKSON, PRASHANT MEHTA, United Technologies Research Center — Bluff body stabilized premixed combustion is present in many power generation and propulsion systems such as gas turbines and afterburners. In this environment, flow recirculation behind the bluff body provides low speed, hot products that act as an ignition source for the incoming reactants and help anchor the flame. Beyond this coarse phenomenological description, however, understanding of bluff body flame stabilization via recirculation is rather limited. This is particularly so for non-swirling systems which are the focus of this work. To investigate this problem we use numerical simulation. The computational model is Lagrangian, employing the vortex element method for the simulation of the low Mach number exothermic flow field and a G-equation flamesheet for the reacting field. Numerical results are contrasted to experimental and analytical findings to demonstrate the ability of the model to reproduce the flow unsteady behavior in both the reacting and non-reacting environments. Analysis focuses on the differences in the recirculation dynamics between the reacting (symmetric shedding) and non reacting (asymmetric shedding) flow. It is shown that these differences are sensitive to both internal flow parameters such as heat release and flame speed but also to boundary conditions such as inlet temperature and confinement.

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