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Flow-combustion interactions in ducted flameholder-stabilized premixed flames MARIOS SOTERIOU, MARCO ARIENTI, ROBERT ERICKSON, United Technologies Research Center, UNITED TECHNOLOGIES RESEARCH CENTER TEAM — Turbulent premixed combustion is present in many power generation and propulsion systems due to its large energy conversion rate (as compared to non-premixed combustion) and its potential for reduced emissions (at the lean limit). As a result, the study of turbulent premixed flames has received substantial attention in the past through experiment, analysis and simulation. In the recent past, unsteady Computational Fluid Dynamics (CFD) based models have been increasingly leveraged towards the in depth study of the physics of turbulent premixed flames. The bulk of this effort focuses on the response of the flame to turbulence. In contrast, we focus on the opposite problem, i.e. the modification of the turbulent flowfield by the flame. This topic has also received some attention but with a strong emphasis on planar (in the mean), flames propagating normal to the flow. Instead, we focus on flameholder-stabilized ducted flames, i.e. ones in which the flame is confined and substantially inclined to the incoming flow. The fundamental mechanisms by which the flame impacts the flow, i.e. dilatation, baroclinic vorticity generation and molecular diffusion enhancement are discussed in detail and their relative impact quantified. Limitations of modeling these mechanisms in current state of the art CFD models are also addressed.

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