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Large eddy simulation of flame flashback in a turbulent channel MALIK HASSANALY, CHRISTOPHER LIETZ, VENKAT RAMAN, Univ of Texas, Austin, HEMANTH KOLLA, JACQUELINE CHEN, Sandia National Laboratory, ANDREA GRUBER, SINTEF Energy Research, COMPUTATIONAL FLOW PHYSICS GROUP TEAM — In high-hydrogen content gas turbines, the propagation of a premixed flame along with boundary layers on the combustor walls is a source of failure, whereby the flame could enter the fuel-air premixing region that is not designed to hold high-temperature fluid. In order to develop models for predicting this phenomenon, a large eddy simulation (LES) based study is carried out here. The flow configuration is based on a direct numerical simulation (DNS) of a turbulent channel, where an initial planar flame is allowed to propagate upstream in a non-periodic channel. The LES approach uses a flamelet-based combustion model along with standard models for the unresolved subfilter flux terms. It is found that the LES are very accurate in predicting the structure of the turbulent flame front. However, there was a large discrepancy for the transient evolution of the flame, indicating that the flame-boundary layer interaction modulates flame propagation significantly, and the near-wall flame behavior may be non-flamelet like due to the anisotropic of the flow in this region.

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