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STOCHASTIC MODELING OF A LIFTED METHANE/AIR JET FLAME

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The One-Dimensional Turbulence (ODT) model [1] is applied to a reactive flow in an open system represented by a lifted methane/air jet flame in a vitiated coflow. In the considered configuration, the Cabra burner, a jet flame issues from a central nozzle into a vitiated coflow of hot combustion products from lean premixed H2/air flames. ODT represents a map-based model for turbulent flow simulations, which uses a stochastic formulation to represent the effects of turbulent advection. Reaction and diffusion effects along the ODT domain are considered by deterministic evolution equations. This work is an effort to verify the applicability and efficiency of the model for a round lifted jet flame in a hot coflow. ODT simulations are performed with a temporal and a spatial formulation of the model using cylindrical coordinates [3]. In the talk, we will show radial profiles and centerline profiles compared against experimental results detailed in the work of Cabra et al. [2]. Additionally, two-dimensional renderings and scatter plots of the jet flame will be presented. The temporal ODT formulation gives a better match with the experimental results for the centerline profiles and the spatial formulation for the radial profiles. Although the simulation of reactive jet configurations by means of ODT is not novel, the representation of the subtle interactions between the hot coflow and cold unburnt jet represents a challenge for the model and is vital for the entire reaction process. Considering the reduced order of the model, ODT is able to predict the flow characteristics and is an efficient model for simulations of jet flames.

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