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Modeling combustion for burner-heat exchanger system in domestic boilers

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Domestic gas boilers employ combustion of fossil fuels in order to heat the fluid. However, with the changing energy scenario, fuel flexibility and reduction in emissions has become ever important in terms of designing such boilers. In this context, reliable combustion models are sought which can predict the whole combustion process accurately and efficiently. Experimentation and direct numerical simulations using detailed chemistry provide the most realistic option but their practical usage is limited by the high cost requirements. Reduced models can significantly decrease the cost for simulation resulting in further advancement towards optimizing the boilers for a given scenario.

Flamelet generated manifolds (FGM) technique has proven to be an efficient technique in terms of reducing chemistry and modelling combustion phenomenon in a variety of scenarios [1]. In the current study, we present CFD modelling of a three dimensional burner-heat exchanger setup using FGM. The combustion model is solved along with the Navier-Stokes equations in a commercial solver. Flame height, wall quenching, burner temperature, and burner edge effects are the most important parameters for which the model is studied with varying inlet velocities. The strengths and the drawbacks of the model are identified and recommendations for further improvement will be made in a systematic manner.

REFERENCES

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