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The effect of sub-grid scale straining in the laminar flamelet regime

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This paper presents and discusses a novel method for including Sub-Grid Straining (SGS) effects on the filtered reaction rate in LES. A reaction progress variable dissipation rate is used to parameterise the SGS strain effects. This method is tested on a fuel-lean turbulent premixed flame stabilised behind a bluff-body, and a turbulent premixed Bunsen flame, with two different grid sizes to show the significance of the inclusion of SGS effects. The results showed that coarsening the grid generally lowered accuracy of results compared to experimental data but including SGS straining had a larger improvement to the accuracy of the coarser grid than the finer grid. An optimisation between grid refinement and SGS straining inclusion should therefore be considered to maximise computational efficiency for reacting flow simulations. These results are consistent with past studies and are discussed with some physical insights. Including SGS effects would enable the use of coarser grids for elevated pressure combustion simulations whilst maintaining good accuracy with respect to experimental results. Follow up work is currently underway studying the effect of SGS for elevated pressure cases to study the relevance of SGS straining in these conditions.

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Biography

Kanishk Ganga is a PhD student studying combustion engineering in the University of Cambridge, UK. Though he originally started in the field of theoretical physics, his interests in space exploration directed his academic focus towards combustion and thermofluid dynamics with the long-term goal of developing novel propulsion systems for sustainable spaceflight.

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