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Direct Numerical simulation of premixed flame fronts FRANCESCO SALVADORE, CARLO MASSIMO CASCIOLA, University of Rome La Sapienza — Turbulent flames are the core of the major part of combustion devices for applications due to the fast energy release they realize. For premixed flames, the energy release is directly related to the global speed of the flame front propagating towards the fresh mixture. However, it is the local behavior which controls the overall dynamics. We employed the Direct Numerical Simulation of reacting Navier-Stokes equations to investigate in detail the physics of the turbulent premixed fronts. We specifically addressed the statistically planar configuration, due to the rich dynamics involved and to its numerical suitability. Spectral and compact discretization schemes have been adopted to accurately reproduce the whole spectrum of turbulent scales. On the other hand, the chemical modeling is a simple single-specie/single-reactant model. The stabilization of the mean position of the planar front has been studied in detail in order to obtain long-lasting simulations. We simulated two flames subjected to high turbulent stretching and having different Lewis numbers. The local analysis showed a high resistance of the thin front structure, compared to classical predictions. The correlations between the turbulent burning speed and the flame surface area show a complex dynamics of particular significance for closure modelling.

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