Adaptive algorithms for combustion problems

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In jet flames, convection, diffusion and chemical reactions take place. Combustion problems are characterized by turbulence and multiscaleness in space and time. A laminar non-premixed counterflow configuration (as a 1D problem) is considered. Here, fuel and oxidizer are fed separately into the combustor and, therefore, have to get mixed before reaction. There can be distinguished advective, diffusive and chemical time scales, which relate to the corresponding terms of the underlying differential equations. In this work, temporal adaptive algorithm based on the error estimate of Runge-Kutta-Fehlberg (RKF45) method has been implemented. Thereby the whole computational interval is divided into subintervals where different timesteps for RKF45 are applied. Also it is determined in which subintervals we can neglect chemistry in the calculations and a spatial adaptive strategy is developed. Due to that, a speed-up of calculation has been reached. The results obtained are presented and discussed.

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