Fully compressible reacting flow model for laminar and turbulent premixed flames

Nicolas Lesquoy

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$$\begin{cases} \dfrac{\partial \rho}{\partial t} + \dfrac{\partial \rho u_i}{\partial x_i} = 0 \\ \dfrac{\partial \rho u_i}{\partial t} + \dfrac{\partial \rho u_i u_j}{\partial x_j} = -\dfrac{\partial p}{\partial x_i} + \dfrac{\partial x_{ij}}{\partial x_j} + \rho f_i \\ \dfrac{\partial \rho Y_k}{\partial t} + \dfrac{\partial \rho u_j Y_k}{\partial x_j} = -\dfrac{\partial \mathcal{J}_{k,j}}{\partial x_j} + \dot{\omega}_k \\ \dfrac{\partial \rho h_s}{\partial t} + \dfrac{\partial \rho u_j h_s}{\partial x_j} + \dfrac{\partial \rho \mathcal{K}}{\partial t} + \dfrac{\partial \rho u_j \mathcal{K}}{\partial x_j} = -\dfrac{\partial q_j}{\partial x_j} + \dfrac{\partial p}{\partial t} + \rho u_i f_i + q_{\mathrm{rad}} - \sum_{l=1}^{N} \dot{\omega}_l \Delta h^{\circ}_{f,l} + \dfrac{\partial \tau_{ij} u_i}{\partial x_j} \\ p = \rho R_u T \sum_{l=1}^{N} \dfrac{Y_l}{W_l} \end{cases} \tag{1}$$