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On the ignition of turbulent liquid fuel spray jets using direct numerical simulation YUNLIANG WANG, CHRISTOPHER RUTLAND, University of Wisconsin-Madison — Direct numerical simulation is used to simulate the ignition of the two-dimensional liquid fuel spray jets. The carrier fluid is solved using a compressible code with a fourth-order explicit Runge-Kutta scheme. The Lagrangian method is used to track the liquid fuel spray droplets. A chemistry mechanism for n-heptane fuel with 33 species and 65 reactions is adopted to describe the chemical reactions. The objective is to investigate the effect of mixing and evaporation cooling on the ignition and combustion processes. Some important parameters such as temperature, equivalence rate, heat release rate and the scalar dissipation rate are examined. From some samples of the results, we found that ignition first occurs at the edge of the liquid spray jet where the equivalence ratio is about 0.5 and the scalar dissipation rate is less 1.0 (1/s). In addition, for two initial spray droplet radiuses of 10 and 20 macron, the 20 macron case ignites earlier since the evaporation cooling is less than in the 10 macron case.

Yunliang Wang
University of Wisconsin-Madison

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