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A NUMERICAL STUDY OF RADIATION IN A SMALL-SCALE POOL FIRE

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ABSTRACT. A Monte Carlo Ray Tracing based radiation solver, in conjunction with detailed spectral models for gases and soot, is employed to study dynamic turbulence-radiation-soot interactions for a small-scale turbulent pool fire. The combustion kinetics is described using finite-rate chemistry with a skeletal chemical mechanism. A two-equation soot model is incorporated to capture soot dynamics. The coupled solver is developed within the OpenFOAM-5.x platform, and is employed to simulate a small n-heptane pool fire with 29% of radiant fraction. Comparison of the numerical simulations with experimental measurements is then presented, including the distribution of heat flux along the boundary and the overall radiant fraction. The strength of radiation source terms is compared to that of the chemical source terms along the central plane, and discussions on the effects of turbulence-radiation interactions are provided.