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Modeling Radiative Heat Transfer and Turbulence-Radiation Interactions Using PDF and FDF Methods DANIEL HAWORTH, The Pennsylvania State University — Honoring Ted OBrien. In 1974, Dopazo and OBrien proposed using a modeled equation for the probability density function of a set of scalar variables that describe the thermochemical state of a reacting medium (a transported composition joint PDF) to model mixing and reaction in chemically reacting turbulent ows. Since then, the benefits of PDF methods, including subsequent extension to large-eddy simulations (filtered density function – FDF) methods, for modeling turbulence-chemistry interactions have been well established. Those benefits are a consequence of the ability of PDF/FDF methods to represent the influences of unresolved turbulent fluctuations on one-point physical processes (such as chemical reactions) in a natural way. For the same reason, PDF/FDF methods have an advantage in dealing with the influences of unresolved turbulent fluctuations on radiative emission. And when coupled with a stochastic radiation solver, the benefits can be extended to radiative absorption, thereby capturing both emission and absorption turbulence-radiation interactions. A model that combines stochastic Lagrangian particle PDF/FDF methods and a photon Monte Carlo method for radiative transfer is presented. Results are presented for laboratory flames and high-pressure combustion systems.

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