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A Partially-Stirred Batch Reactor Model for Under-Ventilated Fire Dynamics RANDALL MCDERMOTT, CRAIG WEINSCHENK, National Institute of Standards and Technology, Gaithersburg, Maryland — A simple discrete quadrature method is developed for closure of the mean chemical source term in large-eddy simulations (LES) and implemented in the publicly available fire model, Fire Dynamics Simulator (FDS). The method is cast as a partially-stirred batch reactor model for each computational cell. The model has three distinct components: (1) a subgrid mixing environment, (2) a mixing model, and (3) a set of chemical rate laws. The subgrid probability density function (PDF) is described by a linear combination of Dirac delta functions with quadrature weights set to satisfy simple integral constraints for the computational cell. It is shown that under certain limiting assumptions, the present method reduces to the eddy dissipation concept (EDC). The model is used to predict carbon monoxide concentrations in direct numerical simulation (DNS) of a methane slot burner and in LES of an under-ventilated compartment fire.

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