Improved Radiation Calculation for Zone Model Prediction of Flashover

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ABSTRACT

Prediction of onset of flashover is essential for estimation of fire impact on structures, since structure collapse is possible during the post-flashover stage of fire. In real buildings, variety of combustible materials is distributed over space in a complicated manner, which makes application of modern computational techniques (for example, Computational Fluid Dynamics) very difficult. In the view of this fact, vast majority of computer models that are used to predict temperature history for post-flashover fires employ simplified (zone) considerations.

The model considered in the present paper treats the onset of flashover as a thermal instability for compartment. Thermal explosion theory is used to identify flashover conditions and predict flashover times. An additional model is developed to predict thermal radiation from hot smoke layer in a simple, yet reasonably accurate manner. This improves previously considered models, based on similar thermal explosion considerations. Also in contrast with the previous work, the smoke layer thickness is treated as a variable, rather than input parameter, which allows much more realistic predictions to be made.

The model is compared to available experimental data. Predictions are made for combustible materials with different sooting propensity, which result in different smoke concentrations in the ceiling jet.