Thesis Abstract cohort 2012-2014
The International Master of Science in Fire Safety Engineering

DAVOOD ZEINALI

Assessment of the thermal response of concrete by inverse modelling

This thesis utilizes an innovative inverse modeling technique to associate the thermal behavior of concrete with its basic thermal properties. The practice employs the free open-source Gpyro pyrolysis modeling program to arrive at the necessary thermal properties and reproduce the thermal behavior of concrete. This task has been accomplished using a component of this generalized model which utilizes genetic algorithm to optimize and facilitate the estimation of the material properties from laboratory test results. The experimental results were obtained by assessing the thermal response of several concrete samples in the Cone Calorimeter. Accordingly, samples were exposed to different radiant heat flux levels while their mass loss evolution and their through-thickness temperatures were measured. The inverse modeling practice identified the basic thermal properties successfully, and it was shown that the estimated material properties could be used to predict the thermal behavior at different heat flux levels with reasonable accuracy. It was also discovered that testing the concrete samples in heating regimes based on 'heat flux' rather than 'heating rate' offered a marked advantage. Namely, the obtained mass loss rates followed a distinctive exponential shift in their peaks which could allow decent replication of the cumulative loss of mass for other heating regimes.