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The International Master of Science in Fire Safety Engineering

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Characterisation of the far field temperature under the ceiling in the Travelling Fires framework

Nowadays, the structural stability of a building subjected to a fire is assessed by traditional fire design methods that consider the burning of the entire floor plate with uniform thermal atmospheres within the enclosure, for all types of compartments. For large compartments, it has been proved by experiments that the burning area tends to move across the floor plate, resulting in non-uniform temperature distribution inside the compartment. A new methodology of fire design called the Travelling Fires methodology has been created to take into account the travelling characteristic of the fire for structural analysis. In this new methodology, the temperature field of the gases under the ceiling above the burning area is at a constant value of 1200°C, and is defined by Alpert unconfined ceiling jet expression for the rest of the compartment. An investigation on the definition of this far field temperature will be carried out in this master thesis. Numerical simulations with the Fire Dynamics Simulator (NIST) have been performed in order to study the temperature distribution under the ceiling in large compartments and to determine the limitations of Alpert equation in this context. Finally, a new analytical method to characterise the temperature distribution within the studied compartment will be extracted from the simulations results and its limitations presented