2013-08-14

Simple model for calculation of fire temperature.

Fire protection in buildings.

Models for calculating fire temperature in different compartments are important when designing fire protection in buildings, both to save lives and to save money. There is a large amount of models that are good at to determine fire temperature in compartments with varying surrounding materials. However, there are very few simple calculation models for spaces with thin surrounding structures such as thin steel, with or without insulation.

The aim of the project was to show that it is possible to calculate the fire temperature within different types of surrounding structures, with simple models. The aim is also to present the result in a pedagogical way.

The project report presents simple calculation models where the fire temperature can be obtained with explicit analytical mathematical formulas for fire cells with half-infinite walls respectively, with thin walls, with or without insulation. These models have been developed in a similar manner. They indicate how various parameters like openings and surrounding materials influence the fire temperature development. A numerical solution algorithm for thermally thin structures has also been developed. These solutions are presented in an Excel sheet that allows the user to calculate fire temperatures with specified parameter values as a function of time.

The new model for half-infinite structures resulting in fire temperature curves similar to parametric fire curves according to EN 1991-1-2 (Eurocode 1) as well as for certain properties on fire cell known as standard fire curve according to ISO-834/EN 1363-1. The new model for thermally thin structures, with or without insulation, results in fire temperatures consistent with the experimentally measured fire temperatures. The new model gave good results. There are, however, still items that need be further developed. The various parameters in the model need a closer examination, especially the combustion efficiency, in order to be able to enter the correct values for each parameter. The model should also be compared with a wider variation of experiments to determine its limits and accuracy. (Funding has been applied for and granted by the Swedish fire Research Board to perform just such experiments)

Keywords: Analytical solution and numerical solutions, Thermally thin, half-infinite, fire temperature

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Rapport kan laddas ned från www.brandforsk.se.

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