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Evaluation of Strategies for the Integration of Building Information Modelling (BIM) with Simulation of Fires in Enclosures

## **Abstract**

Computational Fluid Dynamics (CFD) is the study of fluid flows for the analysis of phenomena by scenarios simulated in a computer-based environment. One of the most well-known CFD simulation packages in the fire safety field is Fire Dynamic Simulator (FDS). The tasks of setting up an FDS input file can be time-consuming especially for complex building geometries. Pyrosim is a pre-processor for FDS which facilitates the job of creating geometries and selecting the correct parameters and measurements required for a fire simulation.

Building Information Modelling (BIM) allows the creation of three-dimensional representations of buildings with realistic graphics and with a high level of detail. Additionally, properties of the materials and other data should be contained in a BIM model. This information is required for performing fire simulations, so BIM can help to avoid manually re-inserting data for setting an FDS input file.

This thesis evaluates the strategies for using the relevant information contained in a BIM model for the simulation of fires using FDS, which requires the analysis of Industry Foundation Classes (IFC) as a data-exchange format. It was identified that IFC files contain data regarding the thermal properties of materials in BIM models, though Pyrosim does not read this information from the IFC file during the import process. A scripting tool was written in the Python programming language for enhancing the FDS input file obtained from Pyrosim with thermal data from the IFC file. Fire simulations were performed in three different building models, starting from a basic building to analyse parametric data exchange. Finally, a more complex model was used to check the overall implementation of strategies. It was confirmed that once the Python script enhances the FDS input file, this can be read accordingly by FDS and used for the calculation of heat transfer through boundaries.

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