

Quality assurance and the simulation of fires

Fire simulations are often applied in performing different sorts of risk assessments, for example when evaluating the fire safety of buildings. The models used to perform these simulations are advanced and place high requirements on the users. A software application designed to aid the quality assurance process related to the use of one such model has been developed and evaluated by studying simulations from actual building projects.

FDS (Fire Dynamics Simulator) is a model for simulating fires, which is often used in the context of performing different sorts of risk assessments. One common application is in the verification of compliance with governmental requirements in the design of fire protection for buildings. Simulations of fires in FDS are based on user-generated input data in the form of text files, which are crucial to the quality of the results obtained by running the simulations. For this reason, undiscovered errors in input data present a problem in that the risk assessments may be based on incorrect information.

In this project, for the purpose of providing better foundations for risk assessments where the results of FDS simulations constitute the decision basis, the process for performing quality controls of user-generated FDS input data has been further developed. A software application designed to automate parts of the quality control process has been developed and evaluated by studying the occurrence of user related errors in FDS input data.

Results have been presented in the form of checklists, one intended to be checked manually by the user and one intended to be checked using the developed software application. Further, the actual application has been produced, published (available at beta.kristofferhermannsson.se), and evaluated. The evaluation was performed by studying a set of input data from actual building projects. Notably, the application was capable of identifying errors in all of the input files. Hence, it has been concluded that it is a useful tool in discovering such errors, thereby also providing a means of reducing their occurrence. The actual frequencies with which different errors occurred in the study have also been presented, and while these results might not be generally representative, they could serve as an indication of certain areas which should be handled with care in producing FDS input data. The errors most frequently occurring in the study were either of the kind where an intended parameter value was not correctly specified or closely related to the mesh.

The main objectives of the project were to determine to which extent the quality control process for FDS input data can be simplified by using an automated software application and to determine whether the occurrence of user related errors can be reduced by using such an application. The project was performed in three main steps. First, a literature review was performed to determine which checks should be part of the quality control process. Second, an evaluation of whether each respective identified check could be automated and performed the application was made and, in case deemed possible, implemented. Third, a case study where the application was used to evaluate input data from actual building projects was performed, in order to determine whether the application could be used to reduce the number of errors in input data and to determine which errors are most commonly occurring.

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