Fire Engineering Platform - A New Tool Package
Addressing the Needs of Fire Protection Engineers, AHJs and Educators

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Abstract

The availability of fire engineering tools is an important factor shaping the discipline of fire protection engineering. Currently in fire protection engineering a large number of calculation tools is available. It does not mean however that the process of using them is always smooth and comfortable. Some tools are quite old with archaic or impractical user interface, which does not mean that their calculation algorithms are bad, but it makes it harder to use them and they become unpopular while other tools take their place. The multitude of available tools is not a good thing for everyone because it makes the design verification harder for AHJs, which are usually less familiar with the tools than engineers are. The same problem exists in fire science and engineering education. It is not convenient to teach many different tools that are disconnected and the level of integration is very low. The time needed to build a model and see the results should be very fast for the student to understand various interrelations. The selection of the right tool for a job is a separate problem, but in general the variety of ways a problem can be analyzed can be considered as a confusing aspect of fire engineering for many outsiders. In practice most engineers keep many tools for various occasions including self-made spreadsheets. The aggregation of useful tools seems like a reasonable idea and in fact it happened in the past that some good packages were developed [1-3].

The concept of this paper is to describe the philosophy for a multi-module integrated calculation tool package which is proposed in a form of FEP and the vision for it in the future. The current capabilities and those available soon will be presented. The benefits of the FEP for fire science education and the concept of a smooth fire protection engineer’s workflow will be discussed.

INTRODUCTION

What are the important factors for fire engineering tools? Among others: availability, cost, speed of use, user friendliness, learning curve, time to see results, number of potential uses, effectiveness in addressing the main purpose, visual appeal and attractiveness of results, interactivity, integration with other tools, variety of input and output options, scalability, reporting capabilities, varied use of computational resources, multi scenario capabilities, addressing probabilistic aspects, validation and credibility of sub-models, ongoing maintenance, support and continued development, recognition and acceptability in the field. The problem with many existing tools consists in not addressing some of the above important factors. The common inconvenience includes the necessity to use separate tools for calculation and presentation of data which requires various data transfers. The time aspect is one of most critical because calculation tools should support the work of fire protection engineer in a smooth way. Ideally a quick initial analysis should
be performed within few minutes or even quicker. Short time of single calculation setup allows engineer to quickly test various design options or scenarios. If a more complex calculation is needed the time to setup the model is as important as the calculation time.

**FIRE PLATFORM**

Many of the abovementioned needs are addressed in a variety of ways in a new software package – Fire Platform. FirePlatform consists of a number of modules addressing various aspects of a fire protection engineer’s workflow. It is being actively developed to include a growing number of features. The current set of modules includes the following modules: FireRad, QuickZone, FDS Designer, FDS Cloud, QuickStandards.

The QuickZone model can be used for many initial assessments for compartment fires, while FireRad [1] is a tool to study external fire spread by radiation. FDS Designer is a tool for building FDS models and the FDS Cloud is a facility to run any number of FDS simulations directly on the cloud resources, making the process very easy to start and monitor. QuickStandards is a tool making calculations based on technical standards very fast and easy. Some other modules are under development and they involve egress and structural response analysis.

**QuickZone**

QuickZone is a zone modelling program which allows quick and interactive model building with the capability of immediate results visualisation (numerical and visual). The whole modeling process is usually a matter of seconds. Effect of any change to the model to the results can be seen instantly. The calculations are based on the reliable and well known CFAST model. The QuickZone is currently being improved to allow probabilistic analysis.

![Fig 1. Snapshot of QuickZone module with the view of the model and numerical results browser](image)
FireRad

FireRad is a module for thermal radiation calculations in arbitrary geometries which may also include obstructions. It is based on fundamental view factor calculations and it provides results that are theoretically exact. The user can build the model manually or import the model from CAD or BIM programs like Autodesk Revit. FireRad provides

Fig 2. Snapshot of FireRad module with the view of the model and the heat flux distribution on the façade and the plot presenting heat flux level along the selected line
FDS Designer

FDS Designer is a module for building FDS models. The user can build the model interactively or import CAD files to speed up model preparation. The FDS input file can be monitored all the time by providing code preview on side of the screen. At the end of preparation the user can start the simulation locally or choose FDS Cloud to run simulation in the provided cloud resources.

![Fig. 3. Snapshots of FDS Designer with perspective and orthogonal view of the model](image-url)
FDS Cloud

FDS Cloud Client is a module for managing and monitoring FDS simulations running in a cloud which is integrated with the FEP. The user can use the model built using FDS Designer or any input file and start a simulation using virtual machine with desired specification. Completed and well compressed results package can be downloaded to the local machine.

Fig. 4. Snapshots of FDS Cloud Client and the FDS Cloud internet service
FireStandards

FireStandards is a module for quick and easy use of key fire related standards like NFPA, BS, Eurocodes, SFPE and others. Currently this module includes NFPA 204, NFPA 92 and Eurocodes.

Fig. 5. Snapshots of FireStandards module with an interactive version of a) NFPA 204 b) Eurocodes
SimpleModels

SimpleModels module offers interactive simple models available in handbooks and textbooks. The literature offers a large number such models and correlations which are gradually implemented on FirePlatform. Currently it is fire plumes, detection models and pool radiation models.

Fig. 6. Snapshots of SimpleModels module with simple models of a) fire plumes, b) detection models c) pool radiation models
Conclusions

FirePlatform is a tool package designed and actively developed to provide a set of everyday tools to be used by fire protection engineers and educators. FirePlatform tools range from simple models and correlations to zone models and CFD simulations. It is designed to provide convenient conditions where students or engineers can quickly study a fire modeling problem starting from simplest formulation before proceeding to more complex methods. Accumulation of many calculation methods, models and correlations in one computer program is expected to facilitate the work of engineer, AHJ official, academic teacher and the student.

References

[1] Mowrer, F., Spreadsheet Templates For Fire Dynamics Calculations  
http://iafsses.brunamal.is/Excel%20Fire%20Calc%20F%20Mowrer%20Templates%20%20REV%202.0.xls

