Lecture fire simulation

Lukas Arnold

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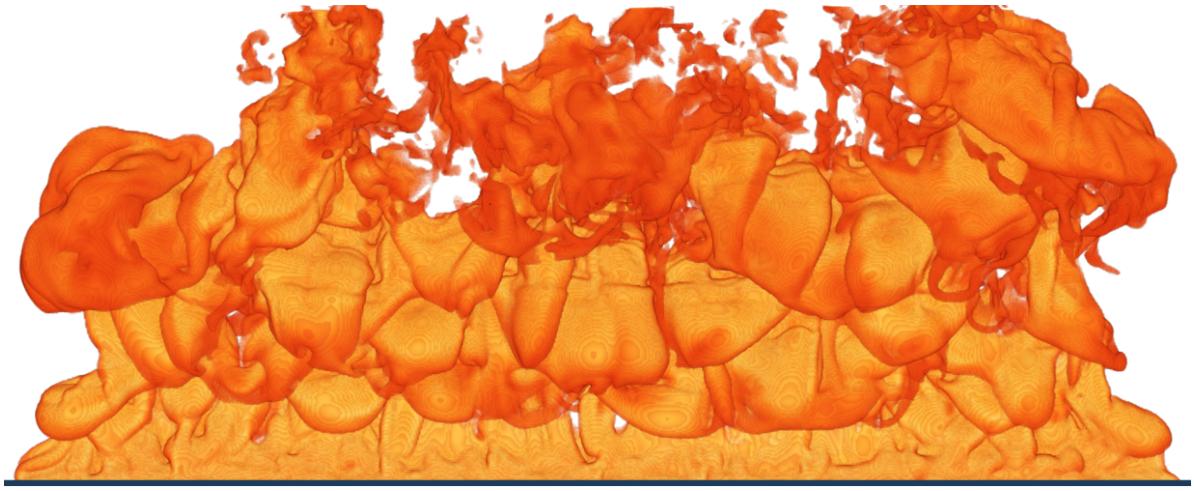
Overview

General Information

The lecture *Fire Simulations* at the University of Wuppertal is organised by the chair of Computational Civil Engineering (CCE). The 2019 founded chair is mainly concerned with the research and development of new computer-based models. The focus of the application is the numerical simulation of fire and smoke propagation in buildings.



This is the first year that we offer this script. The motivation to create this script is on the one hand to give the participants of the lecture a possibility to read the contents. And on the other hand, to make this content freely available to external or former participants.

However, this script is very short and will remain so. Much of the content is already available in greater depth, so that reference is made to the relevant passages - instead of simply copying them.

As the script is under development, we welcome constructive suggestions and your feedback. This way you can support our whole fire science community.

For the University of Wuppertal students: All organisational information on the procedure can be found on the CCE website on the fire simulations lecture.

Contents of the Lecture Notes

- It is planned, that this script will not only contain the contents of the lecture *Fire Simulations* but also other contents linked to this lecture, such as *FDS Data Analysis* and *Using High Performance Computers for Fire Simulations*. In the course of the lecture, we will announce the contents relevant for you accordingly.
- The script also contains exercises for all topics, with and without solution paths, but always with a result or the possibility of validating your solution.
- Do not print out the script or save it elsewhere. This way you have the latest version, which is continuously improved and supplemented with content.
- The script will always remain freely accessible.
- The lecture notes and exercises are designed for **FDS version 6.7.5**, and thus may not be valid / reproducible for other versions.

Contributors

Contributors to the development of the script and the exercises are (in alphabetical order):

- Lukas Arnold
- Kristian Börger
- Tristan Hehnen
- Lilli Klein
- Karen de Lannoye
- Keyvan Najarian
- Tássia Quaresma
- Jan Vogelsang
- My Linh Würzburger

Theses

We offer theses (BA, MA, PhD) on many different topics.

- an overview of topics and previously supervised theses can be found on the thesis website
- The overview of our publications can also help you find
- If you are interested, please contact Lukas Arnold @ University of Wuppertal or @ Forschungszentrum Jülich

Acknowledgements

The software tools used in the lecture and the creation of the materials are mostly freely available, open source and developed by volunteers. In particular, we would like to thank the following teams for their work

- Team of FDS
- Team of Jupyter
- Team of JupyterLab
- Team of Jupter Book

Contact

How to reach us:

- As a participant of the lecture: best via the associated moodle course
- External interested parties best used our email list.
- Contact details for individuals can be found on the staff website

License

Part I

Introduction

Team Fire Dynamics

The *Team Fire Dynamics* is a joint team of members of the chair of Computational Civil Engineering (CCE) at the University of Wuppertal (BUW) and the Fire Dynamics division, which is part of the Institute for Advanced Simulation (IAS-7) at the Forschungszentrum Jülich (FZJ).

The CCE chair is mainly concerned with the research and development of new computer-based models. The focus of the application here is fire and smoke propagation in buildings.

In teaching, we focus on computer science and numerics. The main lectures we offer are Computer Science and Fire Simulations. In addition to this, we regularly offer workshops on *data analysis* and *Raspberry Pi*.

The simulation models we develop and use are mostly based on computational fluid dynamics (CFD). In addition, we use genetic optimisation algorithms and image processing methods. What they all have in common is the use of parallel computers, such as the supercomputer JURECA at the Forschungszentrum Jülich.

Figure 1: JURECA supercomputer. Source: Forschungszentrum Jülich

Our research activities include the use and further development of FDS (Fire Dynamics Simulator), which can be used to calculate the spread of smoke and fire in buildings. On the other