TECHNISCHE UNIVERSITÄT DARMSTADT

Bachelor-/Master-Thesis

Numerical Prediction of Soot Formation in a Turbulent Sooting Flame using Large Eddy Simulation

Motivation:

Carbon particulate produced by the combustion of hydrocarbon fuels is not only one of the major causes of global warming and accelerated process of ice melting, but also an increased risk for human health due to particle inhalation. Therefore, the predictions of particle number concentration as well as size distribution are required, in order to meet stringent pollutant regulations and develop potential ways to reduce the health effects of particulate matter.

However, modeling soot particle formation and growth pathways in turbulent reacting flows still represents a challenge due to the complex multiscale interaction between turbulence, chemical reactions, and particle evolution that is characterized by a particle density function (NDF).

The aim of this work is to apply the modeling framework developed at the department of simulations of reactive thermo-fluid systems to simulate a turbulent sooting flame. For this purpose, the open-source C++ library OpenFOAM is used. Thereby the modeling approach will be validated for a complex turbulent flame by comparing the simulation results with available experimental data and the sensitivity of the soot prediction to the modeling strategy will be investigated. Ideally, the results obtained will be used to identify the main mechanisms that lead to the production of soot in a turbulent flame.

This topic is well suited for a Bachelor- or Master-Thesis. The depth of the research will be adapted accordingly.

Requirements:

- You are a motivated and curious student, who would like to learn more on the topic of reactive simulations.
- You like working with computers.
- Affinity to Linux-based operating systems and command line interface (terminal).
- Affinity to programming (programming in OpenFOAM is done in C++, Processing of the data can be done using python, R or Octave).
- Theoretical knowledge on numerical simulations and combustion physics is nice to have.

Interested? Feel free to contact us!
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