Bachelor-/Master-Thesis

TECHNISCHE UNIVERSITÄT DARMSTADT

Evaluation of the soot particle size distribution in a model aero engine combustor using Large Eddy Simulations

Numerical simulations of aero-engine combustors are extremely challenging due to the complex multiscale and multi-physics phenomena involved. Currently, reliable modeling and prediction of soot particle formation produced during incomplete hydrocarbon combustion is one of the major issues in combustion research. The next generation of gas turbines for more sustainable aircraft engines must meet strict limitations for soot particle mass and size distribution. Therefore, a comprehensive understanding of the processes leading to soot particle formation and its precise prediction in practical combustion systems is crucial.

A frequently used principle for reducing the emission of soot particles in today's engine combustion chambers is known as RQL (rich burn, quick quench, lean burn). The soot formed in the first zone is oxidized as completely as possible so that as few pollutants as possible leave the combustion chamber. To investigate this combustion principle, such a model combustion chamber was built by DLR as part of the SOPRANO project.

In the present work, this combustor will be numerically investigated using Large Eddy Simulations (LES) combined with the Quadrature Method of Moments within the OpenFOAM toolbox. The results will be compared with the experimental data available, as well as other simulation results. The characteristic properties of the flow field and their influence on the soot formation of the flame will be investigated. Furthermore, the particle size distribution will be reconstructed and analyzed at different operating points.

Requirements:

- Interest in fluid mechanics and CFD
- Affinity for working with computers and Linux command line
- Affinity to programming (C++, python)
- Theoretical knowledge on numerical simulations and combustion physics is nice to have.

Interested? Get in touch with me to learn more about the thesis topic in a personal meeting or video call.

Federica Ferraro

Simulation reaktiver Thermo-Fluid Systeme

Simulation of reactive Thermo-Fluid Systems

STFS

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