University of Stuttgart
Institute for Combustion Technology (ITV)

Master Thesis

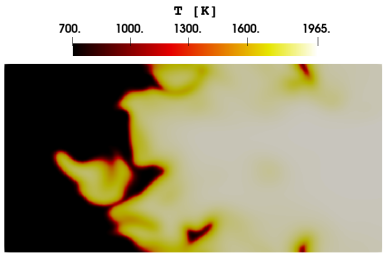
Parameter study of a freely-propagating turbulent premixed flame

Motivation

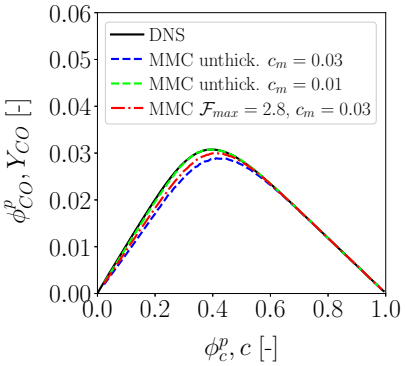
Minimizing production of pollutants such as NO_x and soot is one of the main objectives in modern combustion research, and one of the ways to achieve the pollution reduction is by lean premixed combustion. Numerical models that accurately capture all aspects of such combustion processes including non-linear interactions of chemistry with the turbulence often help to design advanced combustion devices.

Project description and research goals

Numerical simulations of the reacting turbulent flows combine fluid dynamics, thermodynamics and chemistry. Due to their relative complexity simulations require modelling and various assumptions. Some of the model parameters and constants may have crucial effect on the flame propagation and characteristics, and others may be less significant. In the scope of the project an effect of the flow properties and turbulence model constants variation is to be evaluated, analysed and interpreted based on the theoretical knowledge.



(a) Planar cut of a 3D configurations of statistically 1D turbulent premixed methane-air flame.



(b) Weighted mean of the CO mass fraction versus the progress variable obtained in simulations with different modelling parameters.

Tasks

- Do a literature review to learn about turbulent premixed combustion and numerical simulations with OpenFOAM
- Simulate the freely-propagating turbulent premixed methane-air flame using OpenFOAM
- Investigate an influence of multiple simulation parameters on the flame characteristics
- Evaluate and analyse the simulation results
- Write a thesis and present your results

Prerequisites

- Basic knowledge in fluid dynamics, programming with Matlab, Python or similar
- Beneficial: knowledge in C/C++, experience with computational fluid dynamics (CFD), OpenFOAM
- This project is offered in English only

Contact

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