Funded by the European Union

Bochum, 07.02.2024
Advisor J. Donndorf
MB

Masterarbeit/Master Thesis

Thema:

Kaltströmungssimulation in einer Triebwerksbrennkammer
(Cold Flow Simulation of an aero-engine combustion chamber)

Within the context of the European project MYTHOS, the main components of an aero-engine will be designed and simulated at the Chair.

The development of aero-engine components requires multiple detail levels. After a preliminary design and low-dimensional analysis, numerical simulations are the necessary step to gain a broader understanding of the underlying phenomena and to deliver optimization approaches.

To test a preliminary design of an aero-engine combustion chamber, cold flow simulations are carried out to understand its flow characteristics and hence the prevailing mixing and stabilization patterns. Especially, the analysis of streams with different temperatures will provide valuable information on the effectiveness and viability of cooling strategies.

The tasks of this work consist in a critical review of the preliminary combustion chamber design based on the state-of-the-art technology in the literature, the possible adjustment of the geometry based on the new information gained through the literature research, the generation of a computational mesh for the geometry and the choice of appropriate boundary conditions and physical models for cold flow and combustion simulations.

The subsequently flow simulation within the combustion chamber is intended to provide further insights into a better design of the combustion chamber geometry. The conclusion of the thesis should contain a differentiated statement on the critical combustion chamber design features.

Your tasks & what you will learn:

- Literature research on combustion chamber design and simulation
- Mesh generation for the combustion chamber geometry
- Cold flow simulation of the combustion chamber with unsteady RANS (U-RANS) and possibly also hybrid (RANS-LES) approaches using OpenFOAM
- (possibly) Validation of the simulations results against literature reference(s)
- Evaluation of the initial geometry
- Improvement suggestions and modification of the geometry

General conditions:

The framework for the project work is set out in the examination regulations applicable to the candidate.
Reports on the completed work must be submitted to the supervisor at the Ruhr-Universität Bochum at intervals of at least 4 weeks (1 page form). These reports must indicate any significant findings and any difficulties which might jeopardize the achievement of the objective and the deadline. If the maximum time allowed by the examination regulations is exceeded, the chair reserves the right to withdraw the assignment.
Two copies of the thesis and a data carrier containing the documentation remain at the Chair of Thermal Turbomachinery and Aero Engines.

University professor:	Prof. Dr. Francesca di Mare
Second auditor:	Dr.-Ing. David Engelmann
Advisor:	Jan Donndorf, M.Sc.

Prof. Dr. Francesca di Mare