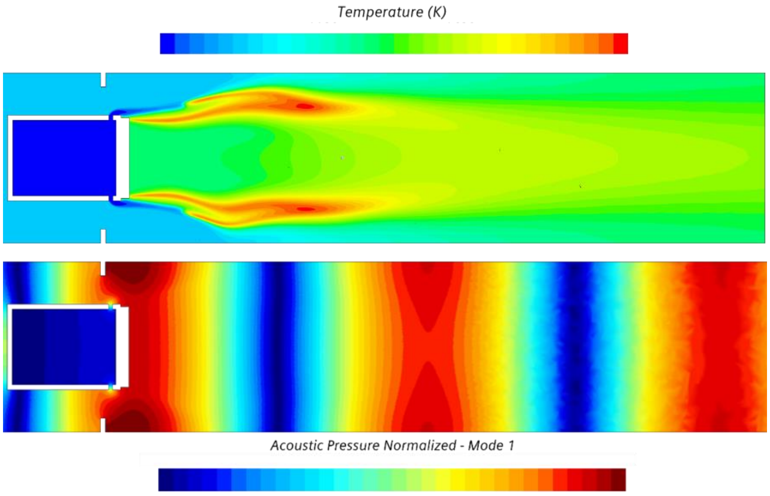
Master Thesis

Numerical study for the prediction of the thermoacoustic behavior of a hydrogen gas turbine combustor



Segment of a MicroMix gas turbine combustion chamber

Background:

The growing share of renewable energies in the German and European grid is leading to increasing volatility in the power supply. To compensate so-called "Dunkelflauten" and to cover peak loads, gas turbines have established themselves due to their high power density, the load gradients that can be achieved and their quick-start capability. In the future, hydrogen additionally represents a carbon-free fuel alternative, which is already the subject of intensive research and development. However, due to its physical properties (including high flame speeds, wide ignition limits, shorter ignition delay), hydrogen combustion tends to generate high-frequency thermoacoustic instabilities which, when resonating with the natural frequencies of the combustion chamber, generate high pressure oscillations and can ultimately lead to material failure. For that reason, the prediction and specific optimization of the thermoacoustic behavior is essential in the early development phase of a combustion chamber.

Scope:

Within the scope of the Master's thesis, the applicability of various numerically based prediction methods is to be investigated using the example of a generic hydrogen gas turbine combustion chamber.

Tasks:

- Execution / evaluation of 3D CFD flow simulations (RANS, URANS und LES)
- Application of an „in-house" 0D thermoacoustic tool (Combustor Stability Code; CSC)
- Comparison and assessment of the results
- Derivation of measures to optimize the prediction methods.

What we offer:

- Support during familiarization phase and close mentoring
- Insights into project work for partners from industry and research

If you are interested, please send us your CV incl. the performance record to the e-mail address below.

Start: May 2025

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