Professur für
Thermofluiddynamik

Semester/MSc Thesis

Start: As soon as possible

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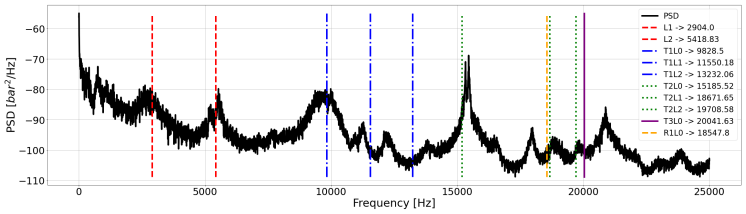
☒ theoretical
☒ numerical
☐ experimental
☐ constructional

Thermoacoustic Simulation of Rocket Engine Combustors: Implementation & Validation of Novel State-Space Models

Thermoacoustic instabilities are a highly unwanted phenomenon caused by the constructive feedback of acoustic oscillations with the flame's fluctuating heat release rate in combustion chambers. These instabilities reduce performance and make safe operation of combustion systems very difficult.



In rocket engines, there are key aspects that have a strong influence on the thermoacoustic behavior, such as the length of the flame and the strong gradients in the background flow. The acoustic oscillations are relevant in all three axis, with radial and tangential oscillations often being the ones to become unstable in rocket engines.

On previous work, a series of new models were developed to capture the nuances of rocket engine thermoacoustic behavior. These models were validated against three different combustion chambers from DLR. The objective of this thesis is to implement a new version of these models, in what is known as state-space, in hopes of reducing their computational cost. The student will need to understand and implement these models into code and validate the results of the simulation against the previous models and the experimental data provided by DLR.

Requirements:

Experience with coding & model validation
Knowledge of thermo/fluid mechanics & rocket engines

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