Technische Universität Braunschweig

Studien-/Masterarbeit

(englisch)

Numerical Investigation of the Heat Release Mechanism in Resonance Tubes

At the Institute of Space Systems (IRAS) at the Technische Universität Braunschweig, research is focused on sustainable in-space propulsion systems. Novel ignition methods for these systems such as resonance ignition are of high interest for this application. The flow inside and in front of the resonator is characterized by highly transient processes, a high degree of turbulence, and interactions of supersonic flow structures with the resonator. In the scope of this thesis, a baseline simulation setup is expanded to numerically investigate the flow behaviour and thermal effects in these resonance tubes. The results of the numerical analysis shall be correlated with test data from literature as well as experimental data that is to be generated with the institute's resonance heating test rig. Using the validated setup, parametric studies shall focus on the investigation of the heat release location within the resonance tube, contributing to advancing the understanding in this field.

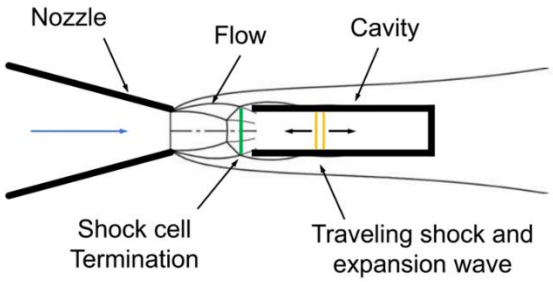

Figure 1: Schematic representation of a nozzle and a resonance cavity with a shock structure (Jakob, 2023)

Tasks and Deliveries Include:

1. Conduct a literature review, familiarise with the topic and software (Ansys Fluent)
2. Build upon and expand the existing numerical setup for the resonator simulation
3. Generate validation data from literature (and own experiments - *optional*)
4. Evaluate the numerical setup against the validation data
5. Conduct parametric studies to investigate the heat release mechanism in resonance tubes
6. Document the outcomes in a comprehensive report and presentation.

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