Professur für
Thermofluiddynamik

Semester / Master Thesis

Start: 01.02.2026 Date of application: 20.01.2026

☒ theoretical
☒ numerical
☐ experimental
☐ constructional

Evaluation of the influence of expansion ratio on the dynamics of premixed flames

Thermo-acoustic instabilities are a crucial problem in modern turbine / rocket engine design, which could lead to malfunctioning or destruction of the system. In order to mitigate these instabilities it becomes necessary to understand the response of flames to their acoustic environment. In recent studies several methods have been used to model the flame dynamics based on a purely kinematic flame sheet approach. Neglecting the feedback between flame and flow, such ansatzes merely depend on geometrical parameters of flame and flow specific quantities. Especially, the desnity ratio of burnt and unburnt gases quantifying the expansion mechanism of the flame is disregarded.

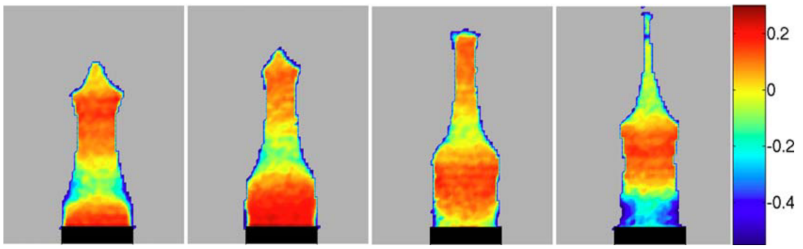

Figure 1: Velocity fluctuations of a conical flame, adopted from *Birbaud et al., Comb. and Flame, 2006*

The main goal of this thesis is to evaluate whether accounting for volume expansion effects is necessary to describe the physical mechanisms of the feedback loop. For this, important parameters for the flame dynamics are altered in CFD simulations.

If you are interested in this thesis or have any more questions regarding the topic, feel free to contact me either via mail or simply come by my office.

Requirements

Experience with CFD (OpenFOAM)
Experience with MATLAB and/or Python
Good analytical skills
Interest in combustion dynamics

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