Professur für Thermofluiddynamik

TUM

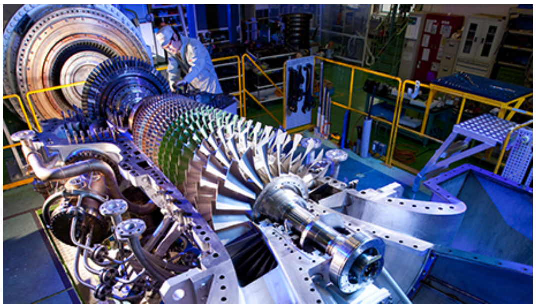
Masterarbeit

Start: Spring ’25

Date of application: Now

☒ theoretical
☒ numerical
☐ experimental
☐ constructional

Investigation of intrinsic flame instabilities via the Linearized Reactive Flow



Kawasaki gas-turbine.

Combustion instabilities occur in gas turbines or domestic boilers and impair the development of low-emission combustion technologies based on lean premixed combustion, and H_2-enriched fuels. This thesis will focus on combustion instabilities caused by the imbalance of heat-conduction and species diffusion close to the flame; the so-called *intrinsic flame instabilities*. These instabilities wrinkle the flame, which increases consumption speed. Understanding intrinsic flame instabilities is necessary to developing predictive models which are key to the design of new combustion systems.

This thesis will investigate intrinsic flame instabilities via a global linear stability analysis based on the Linearized Reactive Flow (LRF) equations. LRF equations provide a monolithic description of all interactions within the flame and already proved to be useful for stability computation. The student will first derive the equations for the linear stability of a planar flame. He/she will then implement those equations in a Finite-Element code developed at the Professorship for Thermofluid Dynamics. The stability results will be compared against experimental data and will pave the way to investigating the destabilizing mechanisms triggered by intrinsic flame instabilities. Depending on the advancement, the student will explore the influence of pressure and more realistic cases.

This thesis is the opportunity to expand your knowledge in both numerical methods (global linear analysis) and combustion physics. You will develop code in an object-oriented Python tool and manipulate state-of-the-art libraries for solving large linear systems.

Requirements:

Fluid dynamics
Python
Stability analysis

Contact person:

Philipp Brokof/Grégoire Varillon
Room: 07-25
Tel.: +498928916237
E-Mail: brokof.tfd/gregoire.varillon@tum.de