Professur für
Thermofluiddynamik

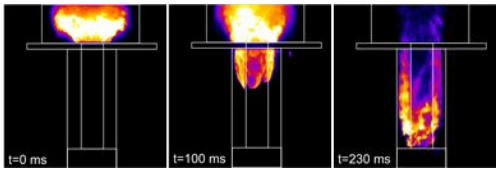
Master thesis / Masterarbeit

Start: 01 or 02/2025

Date of application: immediately

☒ theoretical
☒ numerical
☐ experimental
☐ constructional

Flashback prediction with Conjugate heat-transfer for H_2 enriched fuels



Flashback event (Raman et al., 2014).

Combustion devices for power generation or transportation, such as gas turbines and aeroengines, evolve toward the use of H_2-enriched fuels in order to reduce the emissions of pollutants.The combustion of H_2 poses severe challenges since its higher reactivity increases the propensity to flashback: the flame suddenly propagates upstream from the combustion chamber, close to materials not designed to sustain high temperatures. Such a behaviour induces severe safety challenges and hampers the reliable operations of combustion engines.

Thermal exchanges at the combustor walls are critical to study flashback events. In that view, a new simulation tool has been developed at the chair of Thermofluid Dynamics, with the aim to couple the the simulations of the reactive fluid and heat conduction within the walls of the combustor using Conjugate Heat-Transfer (CHT). Preliminary results have been obtained on a recent work, including meshing, cold flow, flame stabilization and first flashback results. The goal of this master thesis is to reproduce experimental flashback scenarios with CHT, to assess the potential of CHT for flashback prediction. CHT will then allow to investigate the underlying physics of flashback, something which is not accessible with classical simulation.

This semester thesis is the opportunity to apply basic knowledge in fluid mechanics and turbulent combustion, both from the theoretical and numerical side. The student will have the opportunity to discover a CFD code from the inside and to get to know C++.

Requirements:

Fluid dynamics
LES
OpenFOAM
Ideally: C++

Contact person:

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