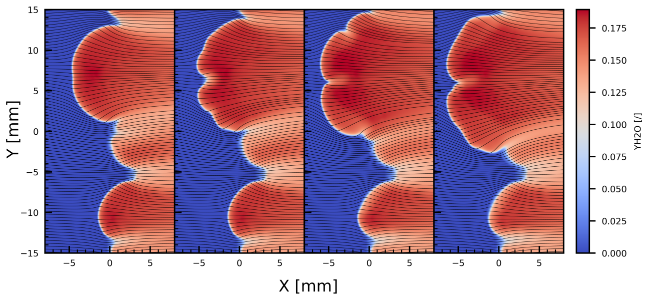
Bachelor/Master Thesis

Thermoacoustic Investigations of Hydrogen-Air Flames

Fossil fuels have been an essential energy source of the energy production process. However, due to the ongoing environmental crisis and the associated ever-growing concern about greenhouse gas emissions, they are slowly phased out in favor of clean energy sources. Moreover, switching to renewable energy production to supply the power is complex and poses many technical challenges due to the intermittent nature of current renewable energy sources. Hydrogen gas combustion is clean as to carbon-related greenhouse gas emissions and is one possible solution to this problem.

However, hydrogen-air flames are prone to develop instabilities due to the distinctly bigger diffusion of the hydrogen molecules compared to the oxygen molecule into the mixture, resulting in local fluctuations of the equivalence ratio near the flame front. This could in theory lead to higher thermoacoustic emissions, which have to be taken into account during the design process of many technical applications. Combustion instabilities can develop due to the coupling of heat release oscillations with the acoustic modes of the burner. In turn, failing to correctly predict the acoustic response of the flame can lead to structural failure of the combustion chamber. Therefore, the complex transport phenomena at the flame front have to be correctly captured by the combustion model. Numerical simulations are performed by the in-house developed, high-performance CFD code m-AIA. A splitting technique is used to couple the fluid mechanics solution with the chemistry library CANTERA. This approach allows for the efficient computation of coupled multi-demensional transport and reaction phenomena with a high degree of accuracy.

If you are interested in this research field and have ideas for a bachelor or master thesis, or want to check current offers, do not doubt to contact me.



Unstable growth of the flame front and cellular formation due to non-equidiffusion effects.

You ...

- are interested in CFD (Computational Fluid Dynamics).
- are interested in coding in C++ and postprocesing the results with Python.
- are able to work independently.
- BONUS: have some knowledge on technical combustion.

If you are interested, please contact:

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