Technische Universität Braunschweig

IFAS Institut für Flugantriebe und Strömungsmaschinen

Master Thesis

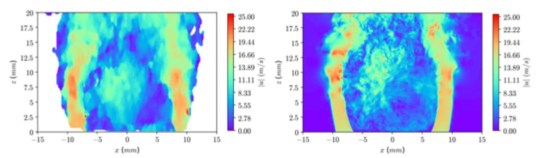
Large Eddy Simulations of a hydrogen-fueled Gas-Turbine combustor for future aviation propulsion systems

Duration: 6 Months

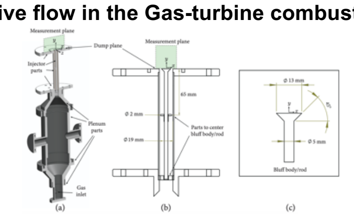
One of the major challenges of our time is climate change. A promising route toward a sustainable future lies in the rapid transition to carbon-free fuels, particularly in hard-to-electrify sectors such as aviation, heavy-duty, and maritime transportation. Among the most promising candidates is green hydrogen. However, hydrogen combustion in industrial applications remains a complex task due to the intricate coupled interaction between turbulence and preferential diffusion. Numerical simulations can play a crucial role in accelerating the development and optimization of these technologies.

To fully understand the physical processes, Direct Numerical Simulations (DNS) are essential. Nevertheless, due to their high computational cost, Large-Eddy Simulations (LES) represent a valuable investigation instrument, as they can already resolve most of the turbulent structures generated by the complex burner geometry and capture the main turbulence–combustion interactions. During the thesis work, the student will explore different simulation and modeling strategies to perform LES of gas turbine combustors, working on mesh generation, simulation setup, and turbulence–combustion modeling. The project benefits from exceptional computational resources, including access to the Phoenix cluster and recently awarded CPU hours on the JUWELS HPC system at the Jülich Research Center.

The student will join an international and research-oriented environment, collaborating closely with experienced researchers already working on the same setup. This context promotes scientific curiosity, critical thinking, and self-motivation, while offering excellent opportunities for future research and collaboration.



Experimental and numerical instantaneous velocity fields for a non-reactive flow in the Gas-turbine combustion chamber



Representation of the Gas-Turbine combustion chamber

Requirements:
- Interest in fluid mechanics and CFD
- Affinity for working with computers and Linux command line
- Affinity to programming (C++, python)
- Proficient in English.

Contact:
Dr.-Ing. Riccardo Concetti
Room 225
Tel: 0531 391-94221
E-Mail: riccardo.concetti@tu-braunschweig.de

Institut für Flugantriebe und Strömungsmaschinen
Hermann-Blenk-Straße 37 ▪ D-38108 Braunschweig
Telefon (0531) 391-94202 ▪ Telefax (0531) 391-94222
www.tu-bs.de/ifas ▪ info-ifas@tu-bs.de