

Ph.D. Position in the field of Computational Simulations of Turbulent Reacting Flows

Institute for Combustion Technology:

The Institute for Combustion Technology (ITV) at RWTH Aachen University, directed by Prof. Dr.-Ing. Heinz Pitsch, aims to address the current challenges in energy transition enhancing sustainable energy technologies that involve renewable fuels, innovative carbon-free fuel blends, efficient energy conversion, and control of pollutant emission. The ITV focuses its research on the fields of turbulent combustion and its various applications, such as engines, gas turbines and furnaces. The research includes chemical kinetics, turbulence theory, multiphase flows and electrochemistry. Test engines are operated in the institute and measurements are conducted in different flow reactors, high-pressure combustion chambers and open flames. For the numerical simulations, in-house codes for Direct Numerical Simulation (DNS), Large Eddy Simulation (LES), Reynolds-Averaged Navier-Stokes (RANS), and 1D flame calculations are available and constantly further developed.

Among many research initiatives, the ITV is part of the Cluster of Excellence "The Fuel Science Center" and has won an "European Research Advanced Grant" by Prof. Pitsch. Several national and international collaborations with industrial and academic partners exist (Melbourne University, Polytechnic University of Milan, Princeton University, Stanford University, etc.).

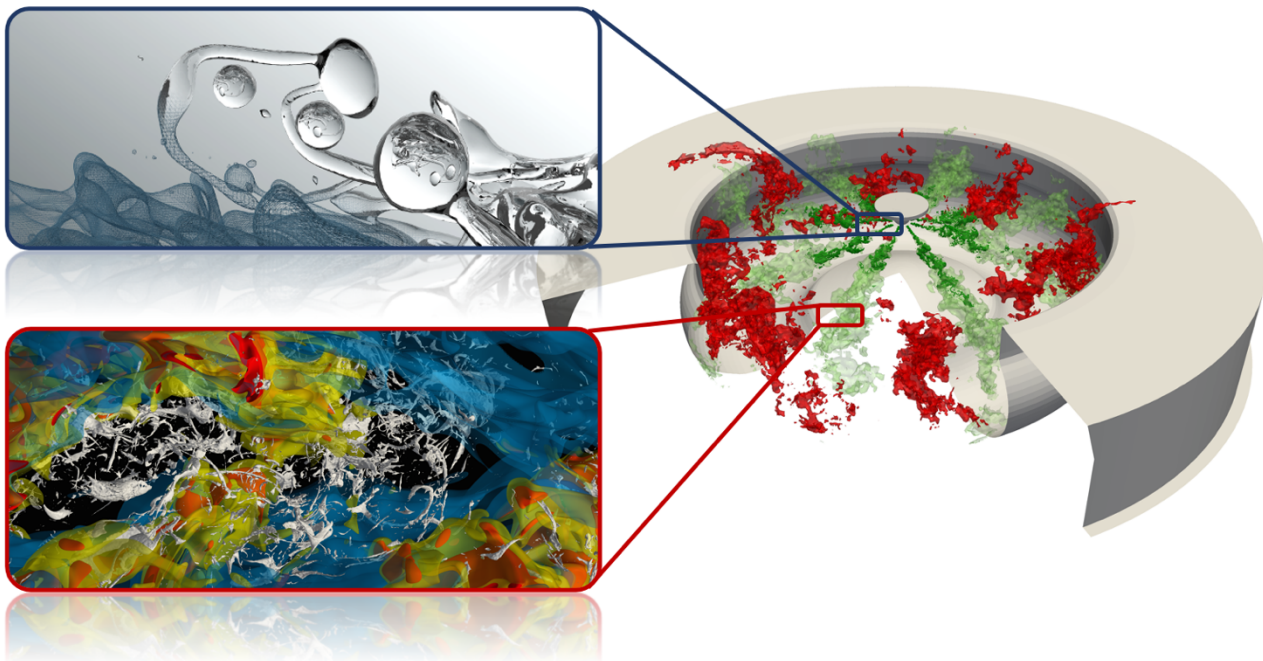


Figure: LES of a compression ignition engine operated with a novel bio fuel (Dibutyl ether), DNS of the primary breakup close at the nozzle, and DNS of soot formation at high jet Reynolds numbers.

Computational research at ITV

The numerical group of ITV engages in many different kinds of simulations from 1D simulations to RANS approaches with the aim to gain deep insights into the underlying physics of reacting flows that occur in relevant energy conversion systems. The research interest focuses on the reduction of pollutant emissions, the assessment and design of next-generation fuels (hydrogen, bio-fuels, and E-fuels), flame-turbulence interactions, the simulation of reactive sprays etc. Our approach comprises simulations of the full energy conversion systems and only parts of it to allow for a rigorous model development and validation. The computational research at the ITV embraces a wide area of projects:

- Development of in-house codes (CIAO, FlameMaster) for high-fidelity predictive simulations;
- DNS of turbulent fields and consequent theoretical investigation for the development of closure models of turbulence;
- DNS of combustion instabilities and theoretical characterization;
- DNS and LES of multiphase flows for the investigation, characterization and modeling of the mechanisms driving the breakup and evaporation phenomena;
- Soot modeling;
- Machine learning: development of physics guided neural networks;
- Machine learning: use of artificial neural network as model into predictive simulations;
- Simulation of combustion systems (e.g. internal combustion engines, nano-particle synthesis burner, heating devices)

These projects are carried out using state-of-the-art High Performance Computing facilities at RWTH Aachen University and other supercomputers, such as Juwels, SuperMUC, and HLRS-Stuttgart.

Requirements:

- Master Degree (or equivalent) in Mechanical Engineering or close related field with above-average results
- Basic knowledge of fluid dynamics, thermodynamics and combustion
- Good English
- Programming skills
- Self-motivated & Strong learning ability
- Good communication & interpersonal skills

Characteristics of the position:

- The hiring takes place in the employment relationship
- This is a full-time position
- The position is rated TV-L 13

RWTH is certified as a family-friendly university. We particularly want to promote the careers of women at RWTH Aachen University and therefore look forward to applicants. In case of equivalent qualification, women will be preferred, provided that they are underrepresented in the Organizational unit. Applications from severely disabled people are expressly welcome.

Contacts available for further information:

Mr. Lukas Berger
Tel. +49 241 80 93544
l.berger@itv.rwth-aachen.de

Mr. Marco Davidovic
Tel. +49 241 80 94626
m.davidovic@itv.rwth-aachen.de

Dr. Temistocle Grenga
Tel. +49 241 80 94633
t.grenga@itv.rwth-aachen.de

Website for information:

www.itv.rwth-aachen.de