



The Combustion Institute

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Postdoctoral Position in “Numerical simulations of soot formation in aero engine combustors” - The Barcelona Supercomputing Center

The main objective of the project is to develop a modelling strategy using CFD simulations for the prediction of soot in terms of chemical evolution and particle formation in conditions relevant to aero engine operation. The model developments are based on the use of detailed chemical kinetics for kerosene surrogates, and advanced combustion and spray models validated with reference experiments. It includes the development of efficient algorithms for the coupling of soot particles with gas phase dynamics allowing the use of large-scale applications with high computational efficiency.

The candidate will be focused on the integration of soot models into a turbulent combustion model based on detailed chemistry and presume-shape PDF. The work departs from the validation of the turbulent combustion model at conditions representative of aero engine operation up to the simulation of the spray flame with soot generation in complex geometries. The project is defined in order to use high-fidelity numerical simulations to predict complex fluid phenomena in modern and new generation combustion systems. It takes place in the context of a scientific and industrial framework aiming to enhance the accuracy, flexibility, user decision and applicability of numerical tools for industrial design.

Research group description

The research team that the applicant will be involved is the High-Performance Computational Mechanics Group at CASE Department of BSC. The team is a multidisciplinary group with more than 30 researchers from all disciplines and with strong background in Computational Fluid Dynamics (CFD). The team is involved in many EU and industrial projects related to this topic, where the successful activities and the publications on highly ranked scientific journals give the proved expertise. The applicant will be based at BSC, but will also interact with the project partners: Karlsruhe Institute of Technology (Germany), Technische Universität Berlin (Germany), Technische Universiteit Eindhoven (the Netherlands), CMT-Motores Térmicos (Spain), Technische Universität Darmstadt (Germany) and Universität Stuttgart (Germany).

Job position description

The offered position is a Postdoctoral position for three years to investigate the formation of soot in spray flames. The expected work can be divided into three main stages:

- Validation of the Conditional Moment Closure for LES using detailed and reduced chemistry for kerosene.

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- Integration of a Lagrangian atomization model.
- Coupling with existing soot models.

The work conducted in the project will be performed with the parallel multiphysics code Alya, which is an inhouse finite-element solver developed at BSC. The applicant is expected to get familiar with the code running benchmarking cases and developing physical models that will be integrated in the multiphysics platform of Alya.

Qualifications

The candidate should hold a PhD in Aerospace, Aeronautics or Mechanical Engineering degree with concentration on turbulence and combustion. General knowledge on fluid mechanics, LES, numerical methods, soot, combustion chemistry are expected. Computational skills and parallel programming for HPC are not necessary, but will be considered an asset. Some familiarity with the Conditional Moment Closure will be a plus.

How to Apply

Application instructions for candidates: <https://www.bsc.es/join-us/job-opportunities/228casehpcmr2>

Deadline for application: November 30th, 2018

Employer's name and contact information: Barcelona Supercomputing Center, Dr. Daniel Mira (daniel.mira@bsc.es).

Location of the open position: Barcelona, Spain

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