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POST-DOC PROPOSAL - Fixed-term contract

Analysis of an aerospike engine acting as a heat shield during atmospheric re-entry

Reference: CFD-2024-DAV-05
Team: CFD
Research unit: Advanced Aerodynamics and Multi-Physics
Employer: Cerfacs
Starting date: September 2024

Location: 42 avenue Gaspard Coriolis – 31057 Toulouse
Contact person: Guillaume Daviller
E-mail: daviller@cerfacs.fr
Duration: 1 year
Level of education required: PhD

HOST LABORATORY

The **Cerfacs** is a fundamental and applied research center specializing in modeling and digital simulation. Through its resources and expertise in high-performance computing, it addresses major scientific and technical problems in public and industrial research. The Cerfacs teams develop innovative methods and software solutions to meet the needs of the aeronautics, space, climate, energy, and environment sectors. Cerfacs works in close interaction with its seven associates: **Airbus**, **Cnes**, **EDF**, **Météo France**, **Onera**, **Safran**, and **TotalEnergies**.

HOSTING TEAM

The CFD (Computational Fluid Dynamics) team is the largest team at CERFACS. It focuses on the simulation of flows by developing advanced numerical methods and applying them to aircraft, rockets, helicopters, car engines, turbines, etc. This team develops essential tools in many application fields with a well-known leitmotiv in the industry today: let's calculate systems (aircraft, engines, etc.) before building them.

JOB DESCRIPTION

Topic(s): Aerodynamics Combustion High Performance Computing

Context: The complete reuse of a rocket is currently a major challenge in today's competitive environment when it comes to launching low-cost payloads. In particular, the reuse of a rocket's upper stage must meet even more stringent technical challenges than the reuse of the first stage. This post-doctoral study aims to investigate the use of a truncated aerospike engine as a heat shield thanks to the regenerative cooling system already present in the engine. Indeed, this type of engine would protect the structure of the upper stage during the reentry phase by generating a large-diameter normal bow shock thanks to its wide base. In this context, Cerfacs and Pangea Aerospace are working together with CNES.

Mission: The objective of this work is to use numerical simulations to characterize the heat flux that occurs during reentry flight. This particular phase of flight requires solving the equations of compressible Navier-Stokes equations, with thermodynamics adapted to rarefied gases out of chemical equilibrium. The thermal stress profiles undergone by the engine and its structure during the various mission profiles will be obtained using Large-eddy simulations (LES). The final goal is to contribute to the design of an efficient cooling system for the heat shield of the aerospike engine. For this numerical study, the CERFACS AVBP code will be used for simulations and the Antares library for post-processing.

DESIRED PROFILE

Background required: Numerical simulation Fluid dynamics Fortran & Python Languages: French or English

Abilities:Capacity for analysis and synthesis Innovation capacity Ability to work independently Relational qualities Rigorous

PLEASE SEND CV + COVER LETTER