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POST-DOC PROPOSAL - Fixed-term contract

Large-Eddy Simulation of film cooling in HP turbine

Reference: CFD-2022-DOM-01
Team: CFD
Research unit: Advanced Aerodynamics and Multi-Physics
Salary: 40 K€/year (gross)
Starting date: june 2022

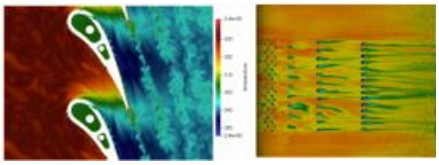
Location: 42 avenue Gaspard Coriolis – 31057 Toulouse
Contact person: Jérôme Dombard
E-mail: dombard@cerfacs.fr
Duration: 1 year
Level of education required: PhD

HOST LABORATORY

The **Cerfacs** is a fundamental and applied research center specializing in modelling 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 industry today: let's calculate systems (aircraft, engines, etc.) before building them.



JOB DESCRIPTION

Topic(s): Turbomachines Aerodynamics Numerical Methods

Context: An efficient way to maintain at acceptable temperatures the turbine blades of aeronautical engines located just downstream of the combustion chambers is to cool them with fresh gas films taken from the compressor. Taking air from the thermodynamic cycle, improving the efficiency of these cooling systems has a direct impact on the performance of gas turbines, which explains the numerous industrial and academic studies on this subject. The methods mainly used to conduct these studies are based on numerical simulation, in particular via RANS approaches (Reynolds averaged Navier-Stokes equations). Several research groups, including CERFACS, have shown that Large Eddy Simulation (LES), which captures the dynamics of large flow structures, provides accurate results on the aerothermics of film cooling..

Mission: Unfortunately, the simulation of these technological effects (i.e. their meshing) with a compressible and explicit code can lead to a significant increase in the computational cost, and thus make its use in complex industrial-type configurations prohibitive. Recent works of Aurélien Perrot's thesis and Dorian Dupuis's post-doctoral work have allowed to setup the building blocks to realize the modeling of cooling film ventilation by a projected approach on static and rotating blades for cylindrical holes. This approach allows to relax this mesh constraint and has shown a significant cost reduction potential, sometimes by a ratio close to 10. These advances are of great interest to SAFRAN, which uses the CERFACS LES code for the design of its combustion chambers and turbines.

DESIRED PROFILE

Background required:

Numerical simulation | Fluid dynamics | Programming in Python and/or Fortran90

Turbomachinery | Languages: French or English

Abilities:

Capacity for analysis and synthesis | Innovation capacity | Ability to work independently

Relational qualities | Rigorous

PLEASE SEND CV + COVER LETTER