ESR8: Continuous adjoint OpenFOAM, Numerical Robustness, Turbulence Models, Optimisation in Unsteady Flows

Parallel CFD & Optimization Unit, Laboratory of Thermal Turbomachines,
Fluids Section, School of Mechanical Engineering,
National Technical University of Athens (NTUA)

The hosting group

NTUA is a leading university in both theoretical and experimental research. There are approximately 10,000 graduate and post-graduate students participating in several scientific projects. There exists a wide range of computational facilities including almost 500 high-perfomance CPU and GPU cores.

The Parallel CFD & Optimisation Unit of NTUA, headed by Prof. K.C. Giannakoglou, has participated in several scientific projects sponsored by industries and the EC (FP5, FP6 and FP7 grants), concerned with CFD and optimization of aero/hydrodynamic bodies. The research focuses on the development of novel optimization methods for shape optimisation, topology optimization, optimal flow control, robust design, etc, based mainly on the adjoint approach. Both continuous and discrete adjoint methods have been developed, even for higher order derivatives.

The work

This ESR will work on the improvement of numerical robustness in the continuous adjoint to OpenFOAM, for steady and unsteady flows. This work will also partially be used by NTUA's ESR 9 and includes secondment to VW and ENGYS.

- M1-6: Familiarisation with the existing primal and adjoint OpenFOAM codes for steady flows, relevant numerical stability problems and theoretical aspects of checkpointing techniques. 1M secondment to ENGYS to exchange know-how on numerical issues of OpenFOAM.
- M7-13: Perform modifications to the discretisation schemes of adjoint PDEs for the purpose of increasing numerical stability while maintaining accuracy in sensitivity derivatives. Any progress will directly be transferred to unsteady adjoints.
- M14-20: Development-contributions to the optimally handling of unsteady optimization methods using adjoints and checkpointing.
- M21-36: Adjoints to turbulence models (hybrid DES-RANS) required by automotive industry for bluff body separation; coupling with steady adjoint. 2M secondment to VW. Research on the use of adjoint to RANS along with a LES model as primal solver.

Required background

Essential: You need to have
- a Masters degree (or equivalent) in Mechanical/Aerospace Engineering. Candidates with a Masters-level background in Applied Mathematics, Physics

or Computer Science will also be considered if they have an acceptable background in fluid flow modelling,
- experience with CFD code development (programming; not only usage),
- the ability to give presentations and write scientific publications (in English),
- the willingness and ability to attend the regular network training events in the EU and to spend 3 month secondments at network partners,
- the ability to program computational methods in C++

Desired: it would be good if you had experience with
- Linux operating systems,
- programming in OpenFOAM,
- numerical optimisation, adjoint methods,
- turbulence models (use of).

Language requirements

A very good knowledge of English is required.

Salary, conditions and environment

The renumeration is 36.000 Euro per annum (living allowance), of which taxes, social contributions and pension payments have to be paid. Over and above, mobility allowance of about 9500 Euro per annum (at minimum; the exact amount depends on marital status) is foreseen.

The network will provide a range of workshops on scientific aspects relevant to adjoint-based optimisation that will be directly or indirectly relevant to the work in this research position, see the About Flow webpage for details. You will also be offered a range of skills complementary to your core research area such as project management, thesis writing and entrepreneurial skills.

NTUA and the About Flow project are committed to Equal Opportunities for all candidates and will follow the principles of the European Charter for Researchers.

How to inquire and apply

Applications for the position are open. For informal enquiries about this position please contact:

Professor Kyriakos C. Giannakoglou
Tel: +30-210-7721636
E-mail: kgianna@central.ntua.gr

To apply please send a CV and two signed reference letters to the following address:

National Technical University of Athens (NTUA),
Attn: Prof. K. Giannakoglou
School of Mechanical Engineering,
Zografou Campus,
9 Heroon Polytechniou,
15780 Athens, GREECE

or by email to kgianna@central.ntua.gr

Closing Date for applications: February, 28 2013 New Extended Deadline
Estimated date for starting the PhD: April, 1 2013