

# **Adjoint optimisation of cavitating flows with real-fluid EoS (MFLOPS-DC8)**

**MARIE CURIE GRANT / AGREEMENT NUMBER / 101072851**

The Doctoral Candidate (DC8) will be hired for 36 months as part of the *Multiphase Flow Optimisation Strategies (MFLOPS)* project being funded through the Horizon Europe Marie Skłodowska-Curie Actions (MSCA) Doctoral Networks. DC8 will be enrolled in the PhD program of the School of Mechanical Engineering of the National Technical University of Athens (NTUA), Greece. The DC8 individual project will be realized at the NTUA (into the Parallel CFD & Optimization Unit or PCOpt, headed by Prof. K. Giannakoglou). Main activities of the PCOpt/NTUA Unit are the development of CFD and optimization methods and tools in the general field of fluid mechanics, in the field of turbomachines etc (see <http://147.102.55.162/research/> for more details). Two secondments are scheduled: (a) at the Otto von Guericke Universität Magdeburg, OVGU ([www.ovgu.de](http://www.ovgu.de)) starting at the 9<sup>th</sup> month of the project, with a duration of 4 months, (b) at OPTIMAD (an SME offering stand-alone and integrated CFD/HPC tools, [www.optimad.it](http://www.optimad.it)) starting at the 25<sup>th</sup> month of the project, with a duration of 2 months.

The first objective of DC8 is the development and programming of a continuous adjoint method targeting at cavitation suppression when working with compressible fluid flows and real-fluid state equations. This development will be performed in the OpenFOAM environment, by extending the open-source, publicly available adjointOptimisationFoam library, developed by NTUA. Then, DC8 will verify the computed sensitivity derivatives, incorporate the adjoint solver into an optimization workflow and demonstrate its use in optimization loops reducing cavitation in simplified geometries of e-fuel injection processes.

## **ADDITIONAL INFORMATION**

### **Benefits**

The selected candidate will receive a salary in accordance with the MSCA regulations for DCs. The gross salary includes a living allowance (€2774.40 per month), a mobility allowance (€600 per month) and a family allowance (€660 per month), if the researcher has family ('Family' means persons linked to the researcher by (i) marriage or (ii) a relationship with equivalent status to a marriage recognized by the legislation of the country where this relationship was formalized or (iii) dependent children who are actually being maintained by the researcher). The guaranteed (EC) funding is for 36 months.

### **Eligibility criteria**

Applicants can be of any nationality and must hold a Master of Science degree (or equivalent) in engineering. They need to fully respect the following eligibility criteria:

- (a) Must be doctoral candidates, i.e. not already in possession of a doctoral degree at the date of the recruitment
- (b) Must undertake transnational mobility. Researchers must not have resided or carried out their main activity (work, studies, etc.) in Greece for more than 12 months within the 36 months immediately before their date of recruitment. Compulsory national service, short

stays such as holidays, and time spent as part of a procedure for obtaining refugee status under the Geneva Convention are not taken into account.

### **Other Information**

DC8 will be working (excluding the secondment) at the Zografou Campus of NTUA in Athens, Greece. The PCOpt/NTUA group consists of about 15 people, including 4 experienced researchers, among which the developers of the open-source, publicly available adjointOptimisationFoam library. Apart from the PhD thesis supervisor (Prof. K. Giannakoglou), researchers of the PCOpt/NTUA Unit with previous experience in similar tasks (OpenFOAM, adjoint methods, shape parameterization) will support DC8 in her/his project/PhD. The PCOpt/NTUA Unit possesses a powerful multiprocessor platform, including both CPU and GPU clusters, which is expected to be upgraded during the project life; this will support research to be performed by the DC8.

## **REQUIREMENTS**

### **Required Educational Level**

Engineering: Master Degree or equivalent

### **Skills/Qualifications**

Candidates should have a strong background in CFD. In order of importance, they should possess good programming skills in C++ (mandatory) (i.e. the programming language of OpenFOAM) and experience in using high-performance computing centers (HPC). Experience in using/developing adjoint-based optimization methods will be very helpful. Knowledge on cavitation models and using/programming in OpenFOAM is welcome. This is a position in the field of CFD for compressible/cavitating flows, which is not based on commercial CFD s/w. Though experience from using commercial CFD s/w is welcome and surely helps, this position requires good programming skills and is addressed to programmers, rather than just users, of CFD s/w. Excellent knowledge of written and spoken English (working language) is required.

## **DEADLINES - APPLICATIONS**

Applications should be received by **30 April 2023, at 20:00 CET**, at the latest.

The candidates should send a CV, cover letter (in which the applicant's experience in CFD development should become clear), BSc and MSc degrees (certified copies plus translation in English), and two letters of recommendation are necessary. Copies of publications could be sent later on, upon request. Personal interviews might be asked.

All applications should be mailed to [kgianna@mail.ntua.gr](mailto:kgianna@mail.ntua.gr) (email subject: "MFLOPS-DC8-Application").

The outcome of the evaluation process will be announced by mid of May 2023. The three-year contract is expected to start in the period May 2023-September 2023.