Post-doc propositon: « ***Large-scale inequality optimization algorithms for parallel computing (HPC) applied in CFD simulations*** »

IMT Lille Douai
Département Energétique Industrielle
941, rue Charles Bourseul
CS 10838
59508 Douai Cedex

Type de contrat :	12 months contract
Employer:	IMT Lille Douai, Douai Research Campus: 941 rue Charles Bourseul, CS 10838, 59508 Douai
Key words:	Optimization, Parallel Programming, C++, MPI, OpenMPI, CFD, Applied Mathematics, Fluid Mechanics, Heat Transfer
Type :	Research and Development

IMT Lille Douai represents the largest engineering school in the north of Paris. In partnership with Lille University, each year the IMT Lille Douai, of the IMT (Institut Mines-Télécom), graduates PhD students and many talented engineers trained to overcome the engineering, economic and social challenges.

This postdoc research proposal will be hosted by the Energy Engineering Department of the IMT Lille Douai situated at the research center in Douai city (around 40 km from Lille metropole). This postdoc program will be financed (for one year, extendable) by VALEO® group (thermal systems division). The postdoc candidate will work on the research and development topic entitled "**Large-scale inequality optimization algorithms for parallel computing (HPC) applied in CFD simulations**".

POSTDOC MISSIONS:

The Energy Engineering Department at IMT Lille Douai has been developing a pioneering code for topology optimization problems in the open source C++ CFD library OpenFOAM® **[1]**. For example the **MMA** (Method of Moving Asymptotes **[2, 3]**) topology optimization algorithm had been developed in the OpenFOAM® library/architecture but in series (for topology optimization computations over one single processor).

During this one year postdoc, it is required to

Conduct parallel-programming implementation, compilation, debugging and validation of an **inequality constrained optimization algorithm** in OpenFOAM® in C++ over **multi CPU or multi GPU** profiting from the domain decomposition techniques and the parallel computing classes available in OpenFOAM® (**i.e. Pstream, MPI, OpenMPI**).

The major tasks will be to solve the matrices, derived/assembled within the **inequality constrained optimization algorithm** algorithm applied to CFD problems, using the parallel decomposition techniques/methods/solvers of OpenFOAM®. A topology optimization case in CFD will be solved at the end, both in series and in parallel over multi CPU or multi GPU inorder to validate the parallel solver in OpenFOAM®.

REQUIRED PROFILES:

The successful candidate should have excellent background in applied mathematics related to the fields of non-linear programming (**NLP**) and inequality/equality constrained large scale optimization problems solving.

She/he must own experience and very good parallel-programming skills in **C++** (**MPI**, **OpenMPI**) and **domain-decomposition techniques** which are usually applied in large scale **CFD** problems.

Knowledge and experience within **OpenFOAM®**, programming over **multi-CPU** or **multi-GPU** and Linux® system mastering are required. Basic knowledge of Fluid mechanics and Heat Transfer in CFD simulations is also necessary.

The successful candidate should be highly motivated for research, and keen to work as part of a team and in a multidisciplinary environment.

SALARY:

The successful candidate will get a net salary of about 2200 euros per month over a total period of 12 months.
This postdoc might be extended after completion of 12 months as further recruitment depending on the scientific achievements/competences of the successful candidate.

APPLICATION:

Candidates must send a CV (and a motivation letter) by email to:

Assoc. Prof. Dr. Talib DBOUK
talib.dbouk@imt-lille-douai.fr
tel. (0033)327712390

REFERENCES:

[1] https://openfoam.org/

[2] K. Svanberg, The method of moving asymptotes – a new method for structural optimization, Int. J. Numer. Methods Eng. 24 (1987) 359–373.

[3] K. Svanberg, A class of globally convergent optimization methods based on conservative convex separable approximations, SIAM J. Optimiz. 12 (2002) 555–573.