IMT Lille Douai
École Mines-Télécom
IMT-Université de Lille

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

Affiliation: IMT Lille Douai, Research and Education Center in Energy Environment (CERI EE)

The administrative residence: Douai

Discipline : Optimisation, Programmation en parallèle, MPI, OpenMPI, CFD, Mathématique Appliquée, Mécanique des Fluides, Transferts thermiques

Contexte :

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 Research and Education Center in Energy Environment (CERI EE) 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”.

Missions :

The Research and Education Center in Energy Environment 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.

Conditions :

The successful candidate will get a gross salary of about 2 700 euros per month over a total period of 12 months.

Application :

Candidates must send a CV (and a motivation letter) by email to **Assoc. Prof. Dr. Talib DBOUK** talib.dbouk@imt-lille-douai.fr (Tél : (0033)327712390) and **the Human Ressources Department** (jobs@imt-lille-douai.fr).

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.