CERFACS

JOB OFFER – STAGE

Development of an AI coupling tool for high-performance scientific computation: improvement of the PhyDLL library

OFFER INFORMATION

Reference: COOP-25-JL-02
Location: 42 Avenue Gaspard Coriolis – 31057 Toulouse
Team: COOP

Supervisors:

- Joeffrey Legaux
- Luciano Drozda

Gratification: 800€ net per month - M2 level or last year at engineering school

Period: 6 months - from: 09/02/2026

Key words: Deep Learning , Scientific computing, Parallel programming, High Performance Computing (HPC)

CERFACS

Cerfacs is a private research, development, transfer and training center for modeling, simulation and high-performance computing. Cerfacs designs, develops and proposes innovative software methods and solutions to meet the needs of its partners in the aeronautics, space, climate, environment and energy sectors. Cerfacs trains students, researchers and engineers in simulation and high-performance computing.
Cerfacs works closely with its seven partners: Airbus, Cnes, EDF, Météo France, Onera, Safran et TotalEnergies.

AIRBUS cnes CENTRE NATIONAL D'ÉTUDES SPATIALES EDF METEO FRANCE ONERA THE FRENCH AEROSPACE LAB SAFRAN TotalEnergies

HOSTING TEAM - COOP

The COOP team focuses on cross-disciplinary activities aimed at improving, optimizing, and deploying scientific codes at a pace compatible with team life. It collaborates with scientific groups partnering on European projects, Cerfacs associate research offices, and Cerfacs teams themselves. Most of our projects are developed in open source and are available on Cerfacs' GitLab: https://gitlab.com/cerfacs. You can learn more about the COOP group's objectives on our blog: https://cerfacs.fr/coop.

CONTEXT

The development of AI models for numerical simulation is a promising path that is currently investigated at CERFACS, hoping it might provide either performance improvements through more efficient surrogate models that can leverage the power of GPUs that are broadly available nowadays, or precision improvements by devising models that avoid some constraining hypothesis of current physics models.

CERFACS develops the *PhyDLL* coupling tool (https://gitlab.com/cerfacs/phydll), an open-source library that aims at setting up communication between distributed scientific codes and deep learning frameworks, in order to either conduct training on the data generated by the simulation or inferring new data through a generative AI model and injecting it into the simulation.

PhyDLL is notably used at CERFACS for coupling the AVBP solver (turbulent combustion) with learning and inference engins in projects aiming and creating surrogates for combustion and turbulence. The library is also used by other European computing centers and labs partners of CERFACS (Météo-France, RWTH, BSC).

PhyDLL is written in C, has interfaces for Fortran, C and Python and handles communications through MPI.

MISSION

During this internship, the candidate will be developing the *PhyDLL* library in order to improve its capabilities and performances, especially for usage inside the Horizon Europe **ROSAS** project (https://www.rosas-project.eu/).

Several development axis are currently considered :

- **Coupling for large-scale distributed simulations**
- **Simultaneous coupling with multiples instance of running scientific computation codes**
- Scripts and tool for placement and execution of coupled processes
- Management of distributed data (mesh partitioning) on the deep learning side

DESIRED PROFILE

- Academic background: Currently pursuing a Master's degree (M2) or engineering school in the domain of scientific computing, ideally in an HPC specialized track.
- You possess a solid experience or training in imperative languages (Fortran, C/C++ or Python)
- Experience in interfacing multiple languages in a single program would be an advantage.
- Experience in distributed parallel programming through MPI would be an advantage.
- Fluency in technical English is highly recommended.

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- A structure accessible to people with disabilities.
- Possibility of benefiting from 1.83 days of reduced working hours per month, linked to your choice of a 39-hour rather than 35-hour working week.
- 50% reimbursement of public transport costs.

HOW TO APPLY ?

To apply, please send your CV and covering letter to legaux@cerfacs.fr and drozda@cerfacs.fr, applications are open until 13/01/2025.

See you soon at CERFACS!