| | Postdoctoral position |
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| **Title of post** | **Advanced simulation of turbulent flows: application to novel evolutions of turbines for hydropower** |
| **General information** | **Research engineer position at LEGI, Grenoble, chair ANR NETHUNS**<br><br>**June 2022 – June 2024 (24 months)**<br><br>**Advisor: G. Balarac (guillaume.balarac@legi.grenoble-inp.fr)**<br><br>**Collaboration: P.M. Congedo and O. Le Maître (Equipe-projet Inria PLATON, Centre de Mathématiques Appliquées, Ecole Polytechnique)**<br><br>**Keywords: turbulence modeling, high-performance commuting, uncertainties quantification** |
| **Missions** | The MOST team at LEGI contributes on the development of YALES2 (http://www.coria-cfd.fr/index.php/YALES2), a simulation tool for incompressible flows which aims to model turbulent flows with large meshes size on massively parallel supercomputers. In particular, the MOST team develops YALES2HYDRO, a version of YALES2 specifically dedicated to hydropower.<br><br>The mission of the recruited person will be to contribute to the development of this tool. In particular, the challenge is to find the best compromise between reliability of the simulation, level of description of the flow, and return time. It is thus a question of considering all the steps of the simulation process and evaluating its impact on the prediction and on the return time. This concerns both the process of statistical convergence in an unsteady simulation, and the parameterization of iterative processes in the resolution algorithms.<br><br>This work will be carried out in collaboration with the PLATON project-team (INRIA) which aims to propose advanced numerical methods for the management of uncertainties, and in particular to measure the impact of uncertainties (physical or numerical) in the massively parallel simulations of industrial applications. |
| **Activities** | To carry out its mission, the main activity of the recruited person will be the development of the YALES2 code and its version dedicated to hydropower, YALES2HYDRO.<br><br>The YALES2 code is initially designed to perform “large eddy simulations” (LES) of turbulent flows. However, LES of a complete hydro turbine are not yet feasible with the computing power currently available. The LES approach is thus being coupled with classical statistical approaches (RANS).<br><br>When LES are conducted, beyond the establishment of the flow, an expensive step is the accumulation of instantaneous states to obtain converged statistical information. The first objective of the project will aim to answer various questions around this statistical accumulation procedure: (i) the impact of this convergence according to the use made of the statistics generated, (ii) the determination of an objective measurement of this convergence, or even (iii) a procedure for accelerating this convergence. |
| **Work context (activities of LEGI)** | Joint Research Unit (UMR 5519) of the Centre National de la Recherche Scientifique (CNRS), the Institut National Polytechnique de Grenoble (Grenoble INP) and the University Grenoble-Alpes (UGA). LEGI carries out a wide range of research activities with a common ground: fluid mechanics and related transport phenomena.<br><br>The recruited person will be assigned to the MOST team. The research activities of the MOST (Modelling and Simulation of Turbulence) team focus on the numerical prediction of turbulent and multiphase flows with a broad range of objectives from fundamental understanding of flow properties to technologies optimization. The research team has the ambition to address all the needed scientific fields to understand turbulent and multiphase flows from simulation: numerical methods, turbulence models, physics of fluids, flow control...<br><br>The main objective is to develop numerical tools to efficiently predict and to deeply understand flows in more and more physically and geometrically complex configurations. This activity is inherently multidisciplinary with strong collaborations with other scientific fields, as applied mathematics or statistical physics. Fluid |

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| | mechanics is ubiquitous in geophysical and industrial applications. Better understanding of flows will help to address major challenges to deal with new energy and environmental constraints. Collaborations with experts in geosciences and in renewable energy development have been set-up to respond to these societal issues. |
| **Constraints and risks** | None identified |
| **Supplementary information** | The candidate must have a doctorate in fluid mechanics or applied mathematics.<br><br>Expected skills:<br>Computational fluid mechanics, analysis and numerical methods, object-oriented programming. Expertise in methods for uncertainties quantification will be a plus.<br><br>Language skills<br>Writing quality in English, ability to formulate and conduct a scientific project<br><br>Ability to work in a team<br><br>Applications should include a detailed CV.<br><br>Remuneration: around 2600 € gross monthly. |