The developed methodology will be validated on several industrial problems in the LibMesh library.

The postdoc will first learn all the concepts related to mesh adaptation. He/she will perform several 3D adaptive simulations of inviscid and viscous flows to become familiar with the Inria solution-adaptive simulation platform involving a flow solver, an adaptive mesh generator, an error estimate code and an interpolation code. Once familiar with the mesh adaptation platform, the postdoc will work on the parallelization with MPI of the flow solver, the error estimate and the solution interpolation software. For each tool, we will analyze in detail the obtained strong parallelization with MPI of the flow solver, the error estimate and the solution adaptive mesh generator, an error estimate code and an interpolation code.

The postdoc will then learn the design and implementation of parallel solution-adaptive simulations using the shared-memory parallelization library developed in the team: the LPlib. An overall (real time) strong parallelization of each stage of the mesh adaptation loop and to design optimal parallelization for the full adaptation technology.

The aim of mesh adaptation is to generate the best mesh to perform a specific numerical simulation. It results in a powerful methodology that reduces significantly the size of the mesh required to reach the desired accuracy. Thus, it impacts favorably the simulation CPU time and memory requirements. Moreover, as the generated adapted mesh is in agreement with the physics of the flow, for some applications, this is the only way to obtain an accurate prediction of the flow. Nowadays, mesh adaptation is a mature tool which is well-posed mathematically. And, as it is fully automatic, it has started to be used in industrial R&D departments. Indeed, it has already proved, throughout many publications and applications, its superiority with respect to fixed mesh. However, simulating complex physical phenomena on complex geometries (such as high-lift applications or turbomachinery applications), which is more and more required by industry, still remains a challenge. Indeed, high-fidelity prediction for such numerical simulations requires large size meshes (hundreds of million elements) even if anisotropic mesh adaptation is considered.

A quicker response of the adaptative process requires a parallelization of the full adaptation technology. This also requires a proper mesh partitioning which is optimal for each stage of the mesh adaptation loop.

The goal of this Post Doctoral position is to finalize the distributed-memory parallelization of each stage of the mesh adaptation loop and to design optimal transition between each stage as mesh repartitioning will be required to obtain balance work load at each step.

The postdoc will work on the development of parallel IO’s in the LibMesh library.
aeronautics and turbomachinery and will be run on Inria Saclay Ile-de-France cluster composed of 1000 processors. In aeronautics, in collaboration with Boeing, we will focus on drag and high-lift prediction applications. In turbomachinery, in collaboration with Safran, we will focus on compressor and stator simulations.

As one can see, in this work, the postdoc will be confronted to advanced scientific computing issues (numerical schemes, fast and efficient implementation of the numerical methods, parallel computing,...).

**Principales activités**
Main activities (5 maximum):

- Develop distributed memory parallelization in the flow solver, the error estimate and the interpolation tools
- Pursue the development of the mesh partitioning tool
- Set-up the full distributed memory solution-adaptive simulation platform
- Analyze the strong scalability of the full distributed memory solution-adaptive simulation platform
- Participate to the collaboration with Boeing and Safran

Further information below:
https://zimbra.inria.fr/service/home/~/?auth=co&loc=fr&id=403116&part=2

**Compétences**
A PhD in scientific computing is required to apply for this position.
Good knowledge in C and shell programming is required.
Knowledge on MPI and finite volume methods is also mandatory.

**Avantages**
- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

**Rémunération**
Monthly gross salary: 2,653 euros