Mission confiée

**Work Plan:**

**Task 1:** We intend to conceive schemes that will simplify the numerical approximation of problems involving complex unsteady multimaterials [2-4] together with multi-scale physical phenomena. The core idea is to use an octree [1] background grid for the field solution and an overset body-fitted mesh near the relevant boundaries. The geometries of interest will be captured by level set functions and Cartesian grid methods. A first goal of the PhD is to generate this grid using a divergence-free ray-tracing technique based on the distance function equation and the surface triangulation.

**Task 2:** As for the models to be solved, the thesis will be focused on the common modelling issues of compressible [5] and incompressible materials [4], in particular for the transmission conditions at the octree/body-fitted mesh interfaces and their efficient parallel implementation. A second task will be to carefully investigate these transmission conditions at the octree/body-fitted mesh using appropriate interpolation (possibly conservative) methods that can be derived as a starting point from our previous experience in non-body fitted boundary conditions.

**Task 3:** The octree/overset approach modeling will be applied to multi-material models that are fully Eulerian and where the hyperelastic constitutive laws are classical (Neo-Hookean/Mooney-Rivlin). There are applications where the different physical phenomena are affected by drastic changes of the sound speed or, in general, of elastic waves speeds. These waves can travel at different speeds due to the local stiffness of the material. We are currently developing multimaterial schemes capable of dealing with such difficulties and the last task of the thesis will be to extend these approaches on non-uniform overset meshes.
This work plan will be adjusted with the PhD student.

The developments will be perpetuated in a unified computational framework that has recently been developed within the Memphis team at Inria (please see examples of realizations at https://team.inria.fr/memphis/).

**Principales activités**

**Keywords:** Hierarchical meshes, overset meshes, multimaterial models

**References:**


**Compétences**

**Required knowledge:** master in applied mathematics, engineering with scientific computing background.

**Avantages sociaux**

- Subsidised catering service
- Partially-reimbursed public transport

**Rémunération**

1982€ / month (before taxes) during the first 2 years, 2085€ / month (before taxes) during the third year.