

**Postdoctoral position at the « Institut Français du Pétrole » and the
« Laboratoire Jacques-Louis Lions »**

The present postdoctoral position is aimed at the study of a posteriori error estimation and adaptive refinement strategies and their application to numerical approximation of problems displaying steep fronts with complex physics. Two major applications will be considered.

Firstly, the simulation of enhanced thermal oil recovery (EOR) (SADG, air injection, in-situ combustion) requires to locate the interface of the oil fluidified by the injected fluids and thermal effect. The production estimates as well as the monitoring of the site are heavily influenced by the quality of the numerical solution, which must come at an acceptable computational cost. Secondly, in the framework of CO₂ storage in saline aquifer or subsoil reservoirs, chemical reactions take place in the neighbourhood of the front between CO₂ and water. A good approximation of the front is thus required to carefully estimate the feasibility of the operation and the integrity of the site. In these two applications, the position of the front varies in time and its width is typically several orders of magnitude smaller than the mesh size (a few metres vs. hundreds of meters). Global uniform mesh refinement is not viable due to computational cost, and local refinement techniques must be devised.

The candidate will be asked to use the latest advancements in robust a posteriori error estimation applied to multi-point finite volume schemes (MPFV) for the approximation of heterogeneous and anisotropic diffusion operators on general meshes. In a practical part, the work will focus on the extension of such techniques to CO₂ injection and thermal EOR modelling. In particular, the following points will be considered: 1) the development of a posteriori estimators adapted to the physical problems; 2) the definition of dynamic front tracking and local refinement strategies; 3) a prototype code development for the simulation of thermal black oil models on adaptive meshes. In a theoretical part, rigorous a posteriori error estimates certifying the discretization error for a simplified problem will be derived, with the intention of the publication of the results in the highest-quality numerical analysis journals.

The candidate will join a collaborative project between the Institut Français du Pétrole and the Laboratoire Jacques-Louis Lions.

- Opening: 2008, as soon as possible (September optimally).
- Location: Applied Mathematics Department of the Institut Français du Pétrole, <http://www.ifp.fr/competences/les-directions-de-recherche/direction-technologie-informatique-et-mathematiques-appliquees>, and the Laboratoire Jacques-Louis Lions of the Université Paris VI, <http://www.ann.jussieu.fr/>, Paris, France.
- Salary of the Ph.D. candidate will start at approx. 2400 euros net per month (for the applicants having accomplished their Ph.D. abroad, there is a 400 euros supplement).
- The position is for 12 months, renewable up to 18 months.
- The knowledge of French language is welcome but not compulsory.
- To apply, send your CV highlighting your background in numerical analysis, discretization methods, and scientific computing, a short motivation letter, and a list of your publications to girault@ann.jussieu.fr, vohralik@ann.jussieu.fr, daniele-antonio.di-pietro@ifp.fr, and roland.masson@ifp.fr. Recommendation letters are welcomed.