PhD position at IFP Energies nouvelles (IFPEN)
in *Earth Sciences and Physical Sciences*

Multiscale study of reactive transport processes : Numerical modeling using Adaptative Mesh Refinement for CO_2 leakage in a carbonate aquifer

This PhD position is part of the Aquifer-CO2Leak project, that aims at evaluating the impact of a CO_2 leak from a geological storage site.

In this context, reactive transport modeling is a dedicated tool for simulating CO_2 migration in subsurface and its geochemical consequences (pH variation, mineral dissolution / precipitation,…). However, solving this complex and nonlinear mathematical system with coupled fluid flow and chemical reactions, leads to high computational costs. Adaptive Mesh Refinement (AMR) is a promising solution for this drawback. This technique consists in local mesh refinement or coarsening based on a numerical criterion. It would precisely track reactive fronts while reducing the computational effort. Its adaptation to reactive transport remains a challenging task, and especially raises the problem of effective properties calculation for upscaled cells.

The objective of this PhD project is to model reactive transport at different scales (corefloods experiments, aquifer injection experiments, industrial pilot), at different refinement levels (fine-mesh simulations as baseline models, coarser models with AMR), and of different complexity (heterogeneities degree, diffuse or abrupt leak scenarios,…) to define an adapted upscaling methodology. These numerical simulations will be based on experiments performed by the PhD student in the lab or on the field at Saint-Emilion, where several CO_2 injections in an aquifer will be monitored. At the end of this project, the defined methodology will be applied to a larger scale model, representative of an industrial CO_2 storage pilot.

Keywords: Reactive transport, geological CO_2 storage, upscaling, dynamic mesh, numerical modeling

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PhD location	IFP Energies nouvelles, Rueil-Malmaison and EA 4592 Géoressources et Environnement, Pessac, France
Duration and start date	3 years, starting preferably on October 1, 2019
Employer	Université Bordeaux Montaigne, Pessac, France
Academic requirements	University Master degree. Knowledge in multiphase flow in porous media. Interest in numerical modelling, statistical methods and optimization. Knowledge in thermochemistry would be an advantage.
Language requirements	Fluency in English, willingness to learn French

For more information or to submit an application, see theses.ifpen.fr or contact the IFPEN supervisor.

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