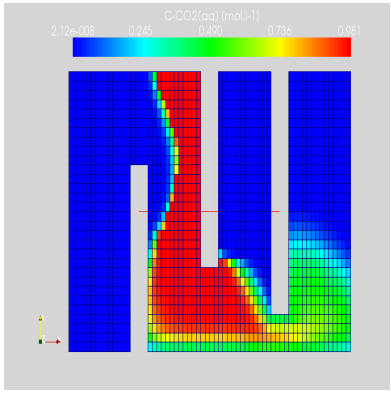
INRIA 2010 post-doctoral fellowship

High Performance Simulation of Geological CO_2 Storage

Research context

Geological CO2 storage is among the solutions widely studied to reduce greenhouse gas emissions and hence represents a major environmental issue. As usual in subsurface technologies, numerical simulation, coupled with parameter estimation and uncertainty analysis, plays a key role in CO2 storage studies and risk assessment, in order to cope with the locality and sparsity in space and time of the data.



The SHPCO2 project sponsored by the French Agence Nationale de la Recherche brings together IFP, Ecole des Mines de St Etienne, University Paris 13, BRGM and INRIA .

The objective of the project is to solve the difficulties arising in such simulations in order to handle real test cases for the study and risk assessment of CO2 storage sites. These simulations at reservoir and basin scales involve dozens of chemical species, a few millions of cells over a time range of roughly 1000 years. They couple the compositional Darcy flow of the three aqueous, oil and gas phases together with the kinetic reactions of precipitation dissolution of the minerals, and the chemical equilibrium of the species in aqueous phase.

Postdoctoral researcher work description

The postdoctoral fellowship is concerned with the algorithmic and numerical aspects of the simulation of reactive transport. This translates into the solution of a convection-diffusion PDEs, coupled with ordinary differential, and algebraic, equations. The system will be solved by a Newton-Krylov method, The postdoctoral fellow will

- implement a parallel version of the advection--diffusion code, using the LifeV library (developed jointly by EPFL and INRIA);
- extend a coupled formulation designed for chemical equilibrium problems to the case of chemical kinetics. Particular care is needed to handle precipitation-dissolution equations;
- implement the Newton-Krylov method in a parallel framework, in connection with a (separately developed) space-time domain decomposition method.
- study a globalization strategy based on trust region methods, in the context of inexact Newton methods;

Desired profile

PhD in scientific computing, applied mathematics or numerical fluid mechanics. A prior experience with parallel computing and good programming skills (C++) are strongly desired.

Location: Estime Team, CRI INRIA Paris-Rocquencourt, Yvelines (78), France

Salary: 2,376 euros gross per month (including medical expenses).

Duration: 12 months, starting January 2010.

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