XVIII International Conference on Water Resources
CMWR 2010
J. Carrera (Ed)
CIMNE, Barcelona 2010

TIME SPACE DOMAIN DECOMPOSITION AND REACTIVE TRANSPORT IN POROUS MEDIA

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In this paper we present some results concerning the application of time-space domain decomposition methods for reactive transport problems. This work is a part of the French ANR SHPCO2 project concerning high performance simulation of CO_2 geological storage. One of the main objectives of our study is to design local time stepping strategies in order to concentrate numerical efforts on the most reactive part of the domain.

In a first time, we present a synthetic test case including several geometrical configurations in 1D, 2D and 3D. All the provided data can be directly used in prototype models, nevertheless we tried to consider dimensions and scenarios allowing to compare the result to realistic field data. Concerning geochemistry, we decided to use a simplified system with only a dozen of species allowing to control the behaviour of the reactive terms in the models. The main objective is to design a challenging problem that is accessible to mathematical analysis.

Up to now, there are few theoretical results concerning time space domain decomposition methods applied to coupled multi species reactive transport problems.

In a second time, we present some results concerning the extension of the theory of optimised interface conditions developed for linear advection diffusion reaction problems. In this part, we focus on a simplified problem coupling two equations. By applying Fourier transform analysis, we can find an upper-bound for the convergence rate of iterative subdomain coupling algorithms. One recover for example some results concerning optimised Robin boundary condition which have shown to be efficient for scalar equations. Anyway, this is a larger class of methods that can be studied using this formalism, nevertheless only some of them might be affordable for numerical modelling.