Contribution ID: **718** Type: **Poster (+) Presentation**

Global implicit solver for multiphase multicomponent flow in porous media with multiple gas components and general reactions

Tuesday, 1 June 2021 19:00 (1 hour)

In order to study the efficacy of mineral trapping scenarios for CO_2 storage behaviour in deep layers, demanding highly nonlinear coupled diffusion-advection-reaction partial differential equations (PDEs) have to be solved.
The chemistry includes both general kinetic and equilibrium reactions.
Realistic scenarios further ask to simulate the inflow of various gases into the deep layers.
We solve the multiphase multicomponent flow equations by means of a fully globally implicit PDE reduction method (PDERM) for the case of an arbitrary number of species in gaseous phase which are injected into a deep layer.
The Finite Element discretized / Finite Volume stabilized equations are split into a local and a global system coupled by the resolution function and evaluated with the aid of a nested semismooth Newton solver.
Our methods are implemented within the free open source software M++.
We present realistic scenarios of gas injection into deep layers and study the mineral trapping effects of the storage technique.
Finally, the PDERM reduction method can be applied not only to CO_2 storage processes, but also to e.g. oil recovery and nuclear waste storage.

Time Block Preference

Time Block C (18:00-21:00 CET)

References

M.M. Knodel, S. Kräutle, P. Knabner: Global implicit solver for multiphase multicomponent flow in porous media with multiple gas phases and general reactions. In: Finite Volumes for Complex Applications IX - Volume I and Volume II; FVCA 9, Bergen, Norway, June 15-19, 2020. Editors: R. Klöfkorn, E. Keilegavlen, A.F. Radu, J. Fuhrmann. Springer Proceedings in Mathematics and Statistics.

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F. Brunner, P. Knabner.: A global implicit solver for miscible reactive multiphase multicomponent flow in porous media.
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S. Kräutle: The semismooth Newton method for multicomponent reactive transport with minerals, Advances Water Res., 34, 137-151, 2011.

C. Wieners: A geometric data structure for parallel finite elements and the application to multigrid methods with block smoothing. Computing and Visualization on Science, Vol.13, (2010) 161-175

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