DuMu\textsuperscript{x} in a Flash: Capabilities and hands-on Explanations

DuMu\textsuperscript{x}

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About DuMu\textsuperscript{x}
- started in 2007
- more than 100,000 lines of code, cf. http://www.chloh.net/p/dumux/
- open source under GPL 2
- runs with Linux and OS X
- is written in C++ with heavy use of templates
- profits from many features of DUNE solvers and grids
- discretizes mostly with cell-centered FVM or box scheme
- is separated into a public stable and an internal development part
- the project has an issue tracker, mailing list, class documentation, regular releases, version control, regression tests, cf. http://www.dumux.org/

CO\textsubscript{2} Storage
- simulation of (non-)compositional, (non-)isothermal two phase flow
- two-phase model, extension to include geom-mechanics possible
- parallelisation, uses MPI
- algebraic Multigrid (AMG) linear solver
- fugacity/activity coefficients for the CO\textsubscript{2}/Brine system calculated according to Spycher and Pruess 2005
- vapor pressure, density and enthalpy of CO\textsubscript{2} with relations according to Span and Wagner 1996
- dynamic viscosity of CO\textsubscript{2} according to Fennoir et al. 1998

Fuel Cell
Modeling flow and transport processes across complex interfaces separating a free-flow (1p3cm) and a porous-medium (2p3cm) region
- focus on interface structure and processes

- water management in fuel cells influenced by the gas-channel (GC)/diffusion layer (GDL) interface
- drop volume over time for different drop detachment rules
- saturation and mass fraction in GDL and GC
- simulation domain with interface drop concept

Multi-Scale Modeling
Combination of upscaling and adaptive grid methods, controlled by refinement criteria (e.g. $V_S$, $Ca$, etc.)
- intermediate scale
- fine scale
- multi-scale grid (level 0, ..., $f_{max}$)
- coarse-scale grid (level 0)
- Model 2 of SPE 10 benchmark, Christie and Blunt, 2001:

- Saturation distributions and adapted grids at an early (left) and an advanced injection stage (right)

Current Developments
- adaptivity scheme switching
- mixed-wettability
- root-soil coupling
- coupling with RANS
- geomechanics

Get it & Try it
- Get a flash drive with a Linux live-system including DuMu\textsuperscript{x}
- Just plug it in and give it a try
- No modifications to your installed system
- Complete version, no stripped-down trial version
- Open source: you can copy, modify and re-distribute it
- Get hands-on explanations from the authors here and now

DuMu\textsuperscript{x} on a flash drive