

DuMu^x in a Flash: Capabilities and hands-on Explanations

DuMu^x

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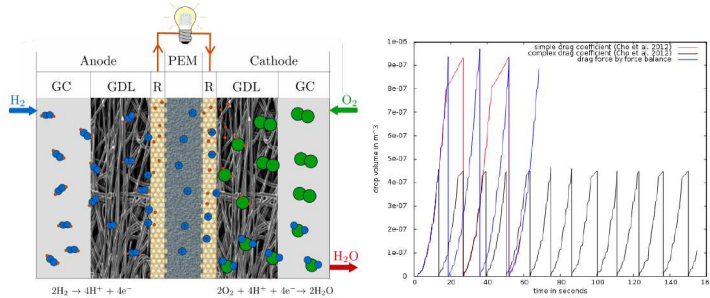
About DuMu^x

- started in 2007
- more than 100 000 lines of code, cf. <http://www.ohloh.net/p/dumux/>
- open source under GPL 2
- runs with Linux and OS X
- is written in C++ with heavy use of templates <http://dune-project.org/>
- 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/>



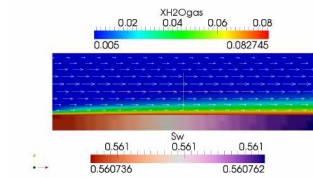
Fuel Cell

Modeling flow and transport processes across complex interfaces separating a free-flow (1p3cni) and a porous-medium (2p3cni) region
⇒ focus on interface structure and processes

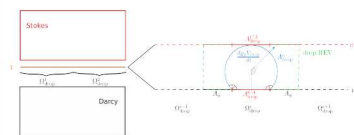


water management in fuel cells influenced by the gas-channel (GC)/diffusion-layer (GDL) interface

drop volume over time for different drop detachment rules



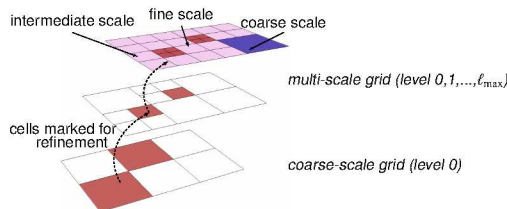
saturation and mass fraction in GDL and GC



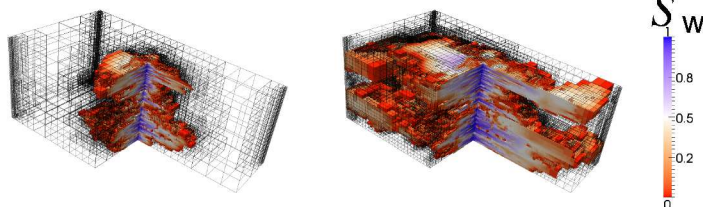
simulation domain with interface drop concept

Multi-Scale Modeling

Combination of upscaling and adaptive grid methods, controlled by refinement criteria (e.g. ∇S , Ca, etc.)



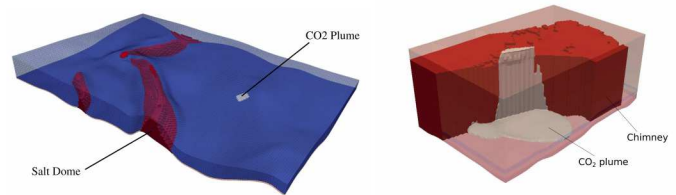
Model 2 of SPE 10 benchmark, *Christie and Blunt, 2001*:



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

CO₂ Storage

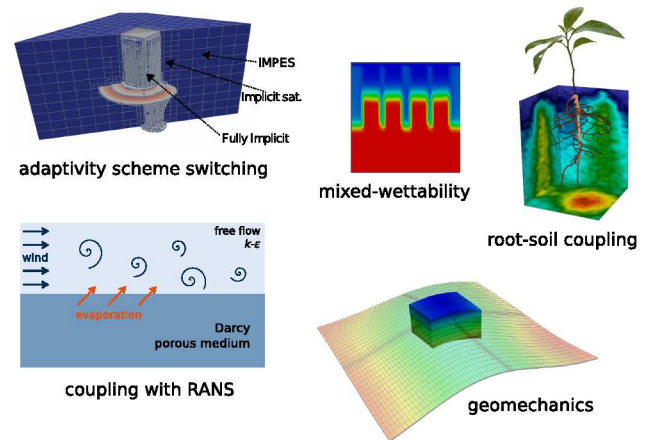
- simulation of (non-)compositional, (non-)isothermal two phase flow
- two-phase model, extension to include geom-mechanics possible
- parallelisation, uses MPI
- algebraic Multigrid (AMG) linear solver
- fugacity/activity coefficients for the CO₂/Brine system calculated according to *Spycher and Pruess 2005*
- vapor pressure, density and enthalpy of CO₂ with relations according to *Span and Wagner 1996*
- dynamic viscosity of CO₂ according to *Fenhour et al. 1998*



Analyzing brine displacement along a salt dome due to the injection of CO₂.

Investigation of CO₂ leakage through chimneys.

Current Developments



Get it & Try it

- Get a **flash drive** with a Linux live-system including DuMu^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^x on a flash drive