

Time: May 11th, 13:00, refreshments will be served from 12:30.

Place: Auditorium 4, Realfagbygget.

Numerical Models for Evaluating the Competitive Use of the Subsurface: The Influence of Energy Storage and Production in Groundwater

2015 Darcy lecture by Rainer Helmig

How advanced numerical models may be used to analyze and predict the mutual influence of subsurface projects and their impact on groundwater reservoirs, and the increasing need to do so.

While historically there have been few issues of concern related to competition between resources, with groundwater contamination being an exception, the subsurface is being increasingly utilized both as a resource, and as an energy and waste repository. With increasing exploitation, resource conflicts are becoming increasingly common and complex such as the long-range impact of mechanical, chemical, and thermal energy storage on groundwater resources, and the effects surrounding hydraulic fracturing in both geothermal and shale gas production.

In general, subsurface systems include processes of varying complexity occurring in different parts of the domain of interest. These processes mostly take place on different spatial and temporal scales making it extremely challenging to model such systems in an adequate way. During this lecture you will learn about:

- Possible utilization conflicts in subsurface systems and how the groundwater is affected
- Model coupling concepts with a focus on the author's work in this field; the concepts are divided into temporal and spatial coupling concepts, where the latter are subdivided into multiprocess, multiscale, multidimensional, and multicompartment coupling strategies
- Fundamental properties and functions of a compositional multiphase system in a porous medium; basic multiscale and multiphysics concepts will be introduced and conservation laws formulated
- Numerical solution procedures for both decoupled and coupled model formulations; two applications of multiphysics and multiscale algorithms will be presented and discussed
- Large-scale simulation that shows the general applicability of the modeling concepts of such complicated natural systems, especially the impact on the groundwater of simultaneously using geothermal energy and storing chemical and thermal energy, and how such real large-scale systems provide a good environment for balancing the efficiency potential and possible weaknesses of the approaches discussed.