Modeling Flow and Transport during Enhancement in EGS Reservoirs

Dimitrios Karvounis, Institute of Fluid Dynamics, ETH Zurich, +41 44 632 6072, karvounis@ifd.mavt.ethz.ch

1. Karvounis Dimitrios, Institute of Fluid Dynamics, ETH Zurich
2. Patrick Jenny, Institute of Fluid Dynamics, ETH Zurich

In Enhanced Geothermal Systems cold working fluid (usually water or CO_2) is injected to a highly fractured reservoir and increases the efficiency of the geothermal power plants by enhancing the conductivity of existing fractures and by creating new ones. For the modeling of single phase flow and transport in such dynamically changing highly fractured reservoirs, a new approach is presented.

It is based on a hierarchical fracture representation that results in a network of multiple intersecting continua, i.e. large dominant fractures, through which most of the mass flow occurs, have a discrete representation; i.e. each fracture is represented by a lower dimensional continuum. A single continuum representation is also employed for the damaged matrix with many small and medium sized fractures. Anisotropy and heterogeneity within each continuum can be treated easily, consistent numerical methods can be used, the computationally expensive task of remeshing the domain for the addition of new fractures is avoided, and the use of large time steps during transport problems, such as heat advection and tracer transport, is inherently maintained.

Here it is explained how the coupling of flow and transport in discrete and continuous fracture representations in combination with heat conduction in the rock can be modeled. Validation of the modeling approach is presented and simulations from various EGS scenarios are discussed.