Numerical Modelling of Coupled Thermo-Hydraulic Problems for Long-Term Geothermal Reservoir Productivity

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ABSTRACT

The advent of geothermal energy has opened a new chapter in global energy demand, for clean, renewable, and sustainable sources. This energy form is harnessed by creating a reservoir in a formation that serves as a heat exchanger. Modelling provides a means of representing concepts and approaches in reservoir simulation. Several methods are proposed to simulate geothermal reservoir behaviour under long-term performance, but it is very hard to specify the most powerful and realistic approach in forecasting reservoir lifespan. The aim of this work is to evaluate two different approaches: equivalent porous media (EPM) and dual porosity-permeability (DPP) model, for simulating geothermal reservoir long-term performance and to assess the adequacy of these approaches. The finite element method is employed to develop and simulate the numerical models based on the two different approaches in forecasting the productivities of the reservoirs during exploitation period of 30 years. The parameters investigated are the temperature, density, and viscosity distribution under the influence of coupled thermal and hydraulic processes. The simulation results are analysed and compared with the different approaches using those parameters. The analysis indicates that both the approaches can efficiently estimate the long-term performance of a reservoir to some extent, but further investigations are required regarding the effect of other coupling terms.

Key words: Geothermal energy extraction, coupled thermo-hydraulic, finite element method, multiple phase, productivity simulations.

REFERENCE
