Productivity of a Geothermal Reservoir via the Extraction Well Using the Finite Element Method

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ABSTRACT

The major process in geothermal energy stimulation is the injection and extraction of fluid through wells to generate energy. However, limited numerical modelling tools are available in predicting the long-term simulation of a geothermal reservoir using a three-dimensional model that monitors the productivity via the wells [1, 2]. In this paper, a three-dimensional (3-D) thermo-hydro-mechanical (THM) coupled model of a geothermal reservoir is developed to probe the productivity of the reservoir via the extraction well at different location and orientation using a multiphysics Finite Element Method (FEM) application solver. A geometry of a doublet reservoir was created with one-dimension (1-D), two-dimension (2-D) and three dimension (3-D) elements for the wells, fracture and the matrix respectively. Also, the meshing comprises of line, triangular and tetrahedron mesh elements. Laws of conservation of mass and momentum were used in the modelling by applying constitutive models of Darcy's, Fourier's and Biot's (poroelasticity). Moreover, the coupling between the thermo-hydro (HT) processes was achieved through convective velocity term. Whilst thermo-mechanical (MT) coupling was also implemented in the model via temperature and thermal expansion coefficient. Therefore, the parameters analysed are the energy extraction rate, enthalpy, temperature and pressure using a probe boundary function and a parametric study step solver. The results showed that when the extraction well is placed near to the injection well the productivity was found to be lower in just after few years of production, in the other hand, the far placement of wells give higher productivity, likewise the well orientations.

References

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