Transient pressure analysis of geothermal wells fractured during well testing

ABSTRACT

Fracturing during injectivity testing can take place in geothermal wells when the reservoir has low permeability or when the well has significant skin damage. The transient behavior (pressure falloff) of these wells cannot be matched using existing well test analysis methods. At the same time, modelling fracturing in geothermal re-servoirs using rock mechanics and commercial finite element software is complicated due to several field uncertainties (e.g. formation height, reservoir permeability and porosity). In addition, rock mechanics data (rock stress, strain and Young's modulus) are normally unknown in geothermal fields. This makes it difficult to develop an appropriate fracture model that matches the field test data. This study attempts to develop a fracture model without integrating rock mechanics. The model is setup with a simple grid using the TOUGH2 geothermal reservoir simulator and validated using the advanced pressure derivative transient analysis. Multiple subsets of fracture geometries were developed to represent the different stages of fracture closure during pressure falloff. The PyTOUGH code was used to simplify the running of the different fracture stages. The results are very promising and provide a clear justification and explanation for the commonly encountered fractured well behavior. This model should be of use in matching data from geothermal wells with similar pressure response.