

Analyzing the Effects of Operating Conditions on Steam flood Performance Using Artificial Neural Networks

Nasr Nasser AL-Qassabi

Abstract

Predicting expected production profile is important for newly drilled wells to design pump size, tubing, and surface flow lines. Knowing how the well will perform and decline in the future is essential for reserves estimation. Also, knowing the parameters affecting the production profile will help in managing the production process and the available resources with more efficient approach.

Forecasting oil production response of a steam flood project with reasonable accuracy is a challenging task as there are many operational conditions, reservoir parameters and other processes involved in the production process. Moreover, the interrelation between these parameters is difficult to be modeled and represented precisely by mathematical models. Thermal reservoir simulation can be used to predict the response of oil production to steam drive. Nevertheless, it cannot quantify the interaction between the input parameters and how the interrelation between them will affect the oil production profile.

In this research, a neuro-simulation study was conducted by running several thermal simulation cases in which operational and reservoir properties are varied. Then the simulation input/output data sets were organized and fed to the constructed ANN for training and validation. Moreover, to evaluate the effect of reservoir and operational conditions on oil production profiles, other, relatively simple, ANNs were constructed to model the different production stages in steamflood process using same sets of reservoir simulation data.

The ANNs was able to assess the interrelation between the input parameters and re-produce the simulated oil production profiles in quick and efficient manner with reasonable accuracy. Oil profiles predicted by the ANN were cross checked and validated with actual field data. Operational parameters affecting the different production stages (peak production rate, peak time and the declining trends) were studied, analyzed and identified. It was found that the effect of some parameters is pronounced in some stages and limited in others. It was found also that the input parameters are highly depending on each other. The favorable effect of some parameters to sustain the production can be diminished by the condition of another parameter. In other cases, adjusting two or more parameters simultaneously can optimize the production process and sustain the production regardless of other paramete