World Academy of Science, Engineering and Technology
International Journal of Geological and Environmental Engineering
Vol:15, No:11, 2021

An Intelligent Prediction Method for Annular Pressure Driven by Mechanism and Data

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Abstract : Accurate calculation of wellbore pressure is of great significance to prevent wellbore risk during drilling. The traditional mechanism model needs a lot of iterative solving procedures in the calculation process, which reduces the calculation efficiency and is difficult to meet the demand of dynamic control of wellbore pressure. In recent years, many scholars have introduced artificial intelligence algorithms into wellbore pressure calculation, which significantly improves the calculation efficiency and accuracy of wellbore pressure. However, due to the 'black box' property of intelligent algorithm, the existing intelligent calculation model of wellbore pressure is difficult to play a role outside the scope of training data and overreacts to data noise, often resulting in abnormal calculation results. In this study, the multi-phase flow mechanism is embedded into the objective function of the neural network model as a constraint condition, and an intelligent prediction model of wellbore pressure under the constraint condition is established based on more than 400,000 sets of pressure measurement while drilling (MPD) data. The constraint of the multi-phase flow mechanism makes the prediction results of the neural network model more consistent with the distribution law of wellbore pressure, which overcomes the black-box attribute of the neural network model to some extent. The main performance is that the accuracy of the independent test data set is further improved, and the abnormal calculation values basically disappear. This method is a prediction method driven by MPD data and multi-phase flow mechanism, and it is the main way to predict wellbore pressure accurately and efficiently in the future.

Keywords : multiphase flow mechanism, pressure while drilling data, wellbore pressure, mechanism constraints, combined drive
Conference Title : ICOGPG 2021 : International Conference on Oil, Gas and Petroleum Geology
Conference Location : Amsterdam, Netherlands
Conference Dates : November 04-05, 2021