Hole cleaning assessment in horizontal foam drilling using artificial neural network and multiple linear regression

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Abstract

Foam drilling is increasingly used to develop low pressure reservoir or highly depleted mature reservoirs because of minimizing the formation damage and potential hazardous drilling problems. Prediction of the cuttings concentration in the wellbore annulus as a function of operational drilling parameters such as wellbore geometry, pumping rate, drilling fluid rheology and density, and maximum drilling rate is very important for optimizing these parameters. This paper describes a simple and more reliable artificial neural network (ANN) method and multiple linear regression (MLR) to predict cuttings concentration during foam drilling operation. This model is applicable for various borehole conditions using some critical parameters associated with foam velocity, foam quality, hole geometry, subsurface condition (pressure and temperature), and pipe rotation. The average absolute percent relative error (AAPE) between the experimental cuttings concentration and ANN model is less than 6%, and using MLR, AAPE is less than 9%. A comparison of the ANN and mechanistic model was done. The AAPE values for all datasets in this study were 3.2 % and 10.3 % for ANN model and mechanistic model respectively.

Keywords: Hole cleaning, Foam drilling, ANN, MLR