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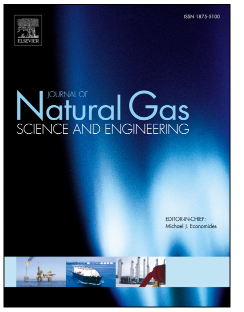

Predicting the pressure losses while the drillstring is buckled and rotating using artificial intelligence methods

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Abstract

The prediction of equivalent circulating density in realistic conditions is complex due to many parameters in effect. Drillstring configuration and motion can play a significant role on the pressure profile in the annulus. Eccentricity, rotation and axial position of the drillstring can cause distinct pressure losses. If an accurate prediction is desired, these effects need to be accounted for.

In this study, the pressure losses of Yield Power Law fluids with various drillstring rotation speeds and configurations are analyzed. These configurations include eccentricity and various buckling configurations and rotation speeds of the drillstring. Neural networks are used to predict the pressure losses and the results are compared with the experimental results and existing models from the literature.

The input to the neural networks is optimized by comparing using direct measurements and using dimensionless parameters derived from the measurements. The comparison shows that using direct measurements as input yield better results instead of using dimensionless parameters, considering the experimental data used in this study.

The results of this study showed that using neural networks to predict the pressure losses in complex geometries and motion showed a better precision compared to the existing models from the literature. The results analysis show that predicting with neural networks can yield as low as 5% absolute average percent error while predicting using existing models can yield as high as 115% absolute average percent error. Using neural networks shows a strong potential to accurately predict the pressure losses especially considering complex fluids and geometries.

1.1. Introduction

During drilling the pressure losses is affected by the diameter ratio, rotation rate, fluid properties and various other parameters. Some of the effects of these parameters on pressure losses are investigated in the literature, such as eccentricity or rotation rate (Erge et al., 2015; Escudier et al., 2002; Haciislamoglu and Langlinais, 1990; Kelessidis et al., 2011). Yet, there are other occurrences that can affect the pressure losses in the annulus, which can be more complex. For example, the rotation of the