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## A robust modeling approach for frictional pressure loss calculation of three phase flow in inclined eccentric annuli

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In underbalanced drilling (UBD) operation, the presence of three phases including, drilling fluid, air and cuttings, makes the estimation of equivalent circulation density more difficult. As, each of these phases flow with different local velocities, causing various flow patterns, which leads to fluctuations in hole cleaning performance as well as frictional pressure loss. Moreover, this hydrodynamic behavior of the drilling fluids is strongly influenced by geometry of well, hole inclination and presence of cuttings.

This study presents a novel computer-based model namely Lease Square Support Vector Machine (LSSVM), for frictional loss calculation of two-phase gas based drilling fluids with the presence of cuttings as the third phase in inclined section of wellbores. This model is based on extensive experimental data collected from published literature. This model is account for in-situ flow rate of each phase, rate of penetration (ROP), pipe rotation, and hole inclination.

The results showed that the proposed model is predicting frictional pressure losses in acceptable agreement with experimental data with very high correlation coefficient (>0.99) and small average relative error. Finally, a trend analysis was carried out to check whether the developed model is physically correct or not. For this purpose, synthetic sets were designed where in each set only one input parameter was changed while other parameters were kept constant. Results of present study show that implementation of developed model can be incorporated in drilling simulators for accurate estimation of frictional pressure loss of three phase flow.

## Biography

Arya Shahdi is now senior top student of Petroleum Engineering (Drilling and Extraction) at Islamic Azad University Science and Research Branch, Tehran, Iran. He works as the Head of drilling section in Bit journal and has published more than five papers regarding drilling fluids, semisubmersible offshore platforms and inclined wells and one of the papers was interesting to petroleum industry for perspective practical usages. His interests are drilling optimization, drilling fluids, environment, and drilling assemblies.

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