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Analytical model for predicting frictional pressure drop in upward vertical two-phase flowing wells (Article)

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Abstract

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In multiphase flow engineering operations, the pipelines that convey viscous fluids are subjected to interior friction where the pipe wall meets the fluid. The friction on the inner surface of the pipe causes energy losses. The losses are exhibited as a progressive pressure drop over the length of the pipe that varies with the fluid flow rate. This study develops a computational method to estimate the pressure change at any flow condition of multiphase flow (oil, gas, and water) inside a vertical pipe by developing fluid mechanics equations and using empirical correlations. Darcy and Colebrook friction factor correlations were used to ratify the predicted frictional pressure drop by computational method outcomes. OLGA dynamic simulation software was used to validate the accuracy of the computational method results. A sensitivity analysis was performed to evaluate the performance of the developed computational method, by using different well flow rate, pipe size diameter, and fluid properties. The frictional pressure drop estimation by computational method has acceptable accuracy and it is located within the accepted average relative error band (±20%). The overall performance of the method is satisfactory when compared with other observations. © 2019, Springer-Verlag GmbH Germany, part of Springer Nature.

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