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# The Effectiveness of Multiphase Flow in Well- Control Operations

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**Abstract :** Well control involves managing the circulating drilling fluid within the wells and avoiding kicks and blowouts as these can lead to losses in human life and drilling facilities. Current practices for good control incorporate predictions of pressure losses through computational models. Developing a realistic hydraulic model for a good control problem is a very complicated process due to the existence of a complex multiphase region, which usually contains a non-Newtonian drilling fluid and the miscibility of formation gas in drilling fluid. The current approaches assume an inaccurate flow fluid model within the well, which leads to incorrect pressure loss calculations. To overcome this problem, researchers have been considering the more complex two-phase fluid flow models. However, even these more sophisticated two-phase models are unsuitable for applications where pressure dynamics are important, such as in managed pressure drilling. This study aims to develop and implement new fluid flow models that take into consideration the miscibility of fluids as well as their non-Newtonian properties for enabling realistic kick treatment. furthermore, a corresponding numerical solution method is built with an enriched data bank. The research work considers and implements models that take into consideration the effect of two phases in kick treatment for well control in conventional drilling. In this work, a corresponding numerical solution method is built with an enriched data bank. Software STARCCM+ for the computational studies to study the important parameters to describe wellbore multiphase flow, the mass flow rate, volumetric fraction, and velocity of each phase. Results showed that based on the analysis of these simulation studies, a coarser full-scale model of the wellbore, including chemical modeling established. The focus of the investigations was put on the near drill bit section. This inflow area shows certain characteristics that are dominated by the inflow conditions of the gas as well as by the configuration of the mud stream entering the annulus. Without considering the gas solubility effect, the bottom hole pressure could be underestimated by 4.2%, while the bottom hole temperature is overestimated by 3.2%. and without considering the heat transfer effect, the bottom hole pressure could be overestimated by 11.4% under steady flow conditions. Besides, larger reservoir pressure leads to a larger gas fraction in the wellbore. However, reservoir pressure has a minor effect on the steady wellbore temperature. Also as choke pressure increases, less gas will exist in the annulus in the form of free gas.

**Keywords :** multiphase flow, well- control, STARCCM+, petroleum engineering and gas technology, computational fluid dynamic
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