

Abstract

Specifying the pressure drop is very complex task in the oil drilling industry. In addition to that, the ability of drilling fluids to clean the borehole considers an important factor in choosing drilling mud. These terms effected by many parameters such as mud type, cutting size, cutting concentration in the mud, drill pipe rotation speed, and mud inlet velocity. In this study, the affect of different types of drilling fluids that flow inside the rotating pipe and exit from the annulus are investigated with the effect of the above parameters on the cutting transport ratio (CTR). A Computational Fluid Dynamics (CFD) software ANSYS FLUENT has been utilized to simulate a model of 3-D two phase (solid-liquid) turbulent flow, steady-state, with stander $k-\epsilon$ in a vertical wellbore. The simulation for the vertical wellbore is performed by applying the laws of conservation of mass and momentum. The results are presented as follows: graphic charts, stream line, and contours. The effect of rheological properties of drilling fluids on pressure drop and shear stress is studied by a CFD model for several types of mud to determine which mud gave the best results for pressure drop and shear stress. The results showed that type 2 oil based mud gives the best results. The effect of mud inlet velocity and drill pipe rotation speed is studied separately, and the results showed that with increasing mud inlet velocity, pressure drop and shear stress would increase. While the pressure drop decreases as the pipe rotation speed increases. Slight increase in shear stress at pipe rotation speed less than 200 rpm happened at the same inlet velocity. Moreover, a significantly increase in shear stress can be observed at the rotational speed equal to or greater than 200 rpm. In addition to that, the effect of several parameters on CTR are studied and the results showed that with a decrease in each of the cutting diameter, cutting concentration in the mud, and cutting density, the CTR by mud will increase. Moreover, as the drill pipe

rotation speed increases and the mud inlet speed increases, the cutting transport ratio will increase.