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CFD Study of Cuttings Transport in Vertical Rotation Drill Pipe for Multi Muds

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Abstract: The ability of drilling fluids to clean the borehole is considered an important factor in choosing drilling mud. Which is affected by many parameters such as mud type, cutting size, cutting concentration in the mud, drill pipe rotation speed, and mud inlet velocity. The present research investigated the influence of drilling fluid that flow into the rotary pipe and coming out of the annulus with the influence of the above mentioned parameters on the cutting transport ratio (CTR). A Computational Fluid Dynamics (CFD) software ANSYS FLUENT 18.2 has been utilized to simulate a model of 3-D two phase (solid-liquid) turbulent flow, steady-state, with stander k-ε in a vertical wellbore. The momentum and continuity equations, which are the governing equations, are numerically resolved using CFD with fluent soft package. The results are presented as follows: streamline , contours.
The results show 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.

Keywords: CFD; mud; cuttings transport ratio; vertical drill pipe; rotation

1. Introduction

Current developments in well drilling present unique challenges to drilling fluid design and applications. Drilling fluids perform many functions: removing cutting from the wellbore, cooling and lubricating the drill bit, transferring hydraulic power to the dawn hole, etc. The most important function of drilling fluid is their ability to clean the well, which considering very important factor in choosing drilling mud. The cleaning ability of the drilling mud is affected by many parameters such as the type of mud, the size of the cut, the concentration of the pieces in the mud, the rotation speed of the drill pipe and the inlet speed of the mud.

Numerous researchers have labored in the field of removing cuttings at last years. Many remarkable results were obtained from this non-exclusive bibliography, which it were be utilized to progress field practices, particularly amongst the working companies most participatory in event-related desynchronization (ERD) improvement. Regardless of the phenomenological method, there is no available foretelling model that may be utilized in pre-engineering. The model should consider many parameters , to name just a few, cuttings shape, drilling mud rheological properties and its development during the flow through the well's bit, inclination, rotation speed and drill pipe eccentricity. At the latest years, well monitoring technologies have been sophisticated in real time: CFD (Computational Fluid Dynamics) and PWD (Pressure While Drilling) are presently utilized as a criterion to supply a better assessment of the well circumstances. These new instruments are never utilized as foretelling instruments. CFD for example, affirm, in an amiable way, the cuttings amount