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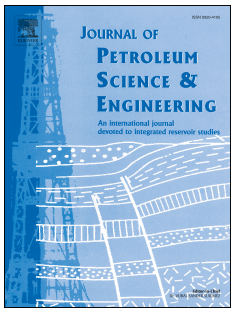

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Fluid hammer analysis with unsteady flow friction model in coiled tubing drilling

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Abstract: Hydraulic vibrator is a useful tool to reduce the mechanical friction and increase the lateral-reach in coiled tubing drilling (CTD). This paper proposes an unsteady friction model to study the interaction between the fluid hammer and the axial vibration of CT with multi-boundary conditions. The proposed model considers the unsteady friction term and comprises the continuity and momentum conserve equations, which are solved by the method of characteristics. Then a series of laboratory experiments with a hydraulic pulse cavitation vibration tool was conducted to validate the model, the simulated results are in good agreement with the experimental measurement. Finally, the characteristic of periodic flow generation and propagation, as well as the effect of crucial flow parameters on the axial vibration are analyzed with the proposed model. The results show that the actual pressure pulse at different positions is the sum of the forward-traveling wave and return wave. Although the magnitude of drag force induced by hydraulic vibrator is not affected by the frequency of flow area, it increases exponentially with flow rate while decreases exponentially with minimum flow area ratio.

Keywords: hydraulic vibrator; fluid hammer; flow rate; drag force; periodic flow

1 Introduction

For recent decades, coiled tubing drilling (CTD) has been proved to be a successful technology all over the world, not only in the un-swept portions of old oil field development but also in composite plugs drilling out in shale gas multistage

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