SPE/IADC-194133-MS

Modeling the Effect of Axial Oscillation Tools in Torque and Drag Computations

Mohamed Mahjoub, Ngoc-Ha Dao, and Stéphane Menand, Drillscan

Abstract

When drilling complex wells, such as those with long lateral sections, the friction forces become significantly high, which can impede advancement of the drill string and reduce drilling performance. In these situations, Axial Oscillation Tools (AOT) could be used to introduce an axial vibration to the drillstring. By locally reducing the friction forces, better transmission of weight to the drill bit is possible and an increase in the rate of penetration occurs. However, to optimize the use of these tools, predictive modeling is necessary to assess their effect on drilling characteristics.

A new modeling approach is proposed to accurately model the effect of the AOT on drilling operations without the need to carry out resource-intensive and time-consuming dynamic computations. To estimate the influence length (i.e. the extent of the axial vibrations) and the maximum displacement at the AOT, a study was performed to determine the most important parameters. Based on this study and on the theory of wave propagation, new analytic expressions are proposed. Once the influence length and the maximum displacement are calculated, an effective friction coefficient is estimated as the mean value of the instantaneous friction coefficient and used in a stiff-string torque and drag model.

The model was applied to a real case study, and an agreement between the modeling results and field measurements regarding the influence of the AOT was obtained. Moreover, the effect of the excitation force and rate of penetration on the drill string tension profile was investigated. This work should enable drilling engineers to better optimize the position of AOT along the drill string and to maximize its efficiency.