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How the Bit Profile and Gages Affect the Well Trajectory

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Abstract

The importance of wellbore deviation is well recognized by the drilling industry. An analysis of the directional behavior of a drilling system must include the directional characteristics of the drilling bit. A comprehensive analysis of the directional behavior of PDC bits is presented in this paper, including the effect of bit profile, gage cutters and gage length. Numerical simulations as well as laboratory tests have been carried out in order to better understand the mechanisms of PDC bits deviation and to evaluate the most important parameters affecting the directional behavior of PDC Bits.

The analysis of the directional behavior of PDC bits presented in this paper shows that each part of the PDC bit (bit profile, active and passive gages) plays a major role on the walking tendency and steerability of the bit. A quantitative evaluation of the contribution of these factors on the well trajectory (inclination and azimuth) is given.

A full-scale directional drilling bench was built to measure, for the first time, the walking tendency and the steerability of PDC bits. The results obtained demonstrate that the bit profile, the gage cutters and the gage length have a significant effect on the walking tendency and on the steerability of the PDC bits. A 3D theoretical rock-bit interaction model was developed to reproduce the drilling tests results.



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