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Fatigue Tracking for Mud Motors and MWDs in Unconventional Wells

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Abstract

As the industry continues to drill increasingly complex wells, the demand put on drilling equipment has increased and will continue to increase. Preventive maintenance often falls to the wayside in favor of keeping the same equipment operational for longer until a failure occurs, which can be very costly and potentially catastrophic to the equipment provider. Fatigue tracking makes it possible to predict failures ahead of time and prevent such incidents. However, the most commonly used fatigue tracking methods are based only on rotating hours and do not take the bending stress into account. Electronic drilling recorders (EDR)coupled with bottom hole assembly (BHA) models allow for better estimation of the fatigue performance by calculating the actual bending stress along each piece of equipment, such as the mud motor or measurement while drilling (MWD) tool, leading to a more reliable fatigue tracking method.

A case study of fatigue on a common motor and MWD over the drilling life of a well provides valuable information on how to monitor and react to different fatigue scenarios. By using an advanced stiff string model to calculate stress distribution along the motor or MWD coupled with standard fatigue prediction models, valuable information can be learned about the motor and MWD conditions.

One case that will be examined involves a typical well trajectory such as those drilled in the US land market today which involve a high dogleg curve to reach a target formation, with dog leg severity (DLS)locally reaching 18 (deg/100') generating high bending stress and thus fatigue. The consequence on fatigue life can be dramatic through the BHA for even just one exceptionally high dogleg. By using the continuous surveys taken by an MWD tool, to account for the actual tortuosity of the well, the potential fatigue becomes even more significant. Another decision that is commonly made without much regard for fatigue consequences is that of stabilizer placement along the BHA which can dramatically shift the distribution of bending moment and thus extend the life of a mud motor. Simulations will show how wellbore tortuosity can affect dramatically the fatigue life of mud motor and MWDs.

By illustrating several common examples of fatigue influencers, engineers will be better equipped to determine the impact of different decisions on the potential motor and BHA fatigue. Better understanding of the nature of fatigue and the consequences of larger bend motors, higher doglegs, and better surveying practices, for example, can lead to better decision making and the reduction of fatigue failures.