A-172

Analyzing the Effect of Torque on Stick Slip Drilling Vibrations: A Numerical Simulation Study

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Stick-slip vibrations continue to be a serious problem in drilling operations, affecting productivity, the life of the equipment, and safety. This study explores the relationship between stick-slip vibrations within the drillstring and torque, a critical operational parameter. A thorough series of numerical simulations were carried out using the adaptable DrillScan simulator to clarify the principles underlying this complex phenomenon and its consequences for drilling practices. Our research provided compelling new understandings into the intricate interaction between torque and stick-slip vibrations. A clear link between the onset, length, and severity of sticking episodes and torque values was found. Variations in rotation speed at the surface intensified this dynamic interaction, highlighting the significance of parameter optimization in reducing or enhancing sticking. The results highlight the importance of manipulating torque as a key lever for improving drilling operations' effectiveness, safety, and equipment integrity. Our findings have ramifications for the drilling industry as a whole. Understanding the significant impact of torque motivates drilling operators to take proactive action to prevent sticking, ultimately boosting operating productivity and protecting priceless equipment. These insights not only guide drillstring design but also support the creation of real-time monitoring systems and adaptive drilling controllers.