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**Experimental simulation of bit-rock interaction to study and analyze the effect of stick-slip vibrations on a drillstring**

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Stick-slip is a drilling dysfunction in which the bottom-hole-assembly (BHA) periodically stops rotating whereas the surface RPM is still operating at the set point. This results in a torque build up followed by release of energy during which the bit RPM can shoot up to ten times the RPM at the surface. This phenomenon is very harmful to the drilling equipment specially to the drill bit and greatly increases the non-productive time (NPT).

In this paper an experimental lab scale setup to study stick-slip is described. The setup is one of the largest in the world among its type and is equipped with multiple sensors and actuators and a high speed data acquisition system to help analyze stick-slip in a controlled laboratory setup. To simulate the bit-rock interaction a unique arrangement of electro-mechanical actuators and rotary encoders is designed and used in conjunction with the mathematical bit-rock models available in literature. This novel setup opens a new era towards digital twins and drilling digitalization.