TECH BRIEF

ROD GUIDE PLACEMENT BASED ON HIGH-RESOLUTION TORTUOSITY ANALYSIS OF PRODUCTION TUBING

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PUBLICATION

- Society of Petroleum Engineers
- SPE-190935-MS

INDUSTRY CHALLENGE + OBJECTIVE

Rod-driven pumping is the most common method of artificial lift. The rod string is operated within the production tubing inside the wellbore, with some annular space between the inner wall of the tubing and the rod spring. But the inevitable bending of these components means that the rod string will touch its inner walls at various depths, causing wear over time from repetitive friction.

To reduce tubing and rod wear, side loads are estimated from low-resolution data, and additional rod guides are installed on rod sections where the side loads exceed a predetermined threshold. This low-resolution data does not accurately represent the trajectory of the rod string, suggesting estimated side forces are less accurate. To demonstrate the effectiveness of analyzing the tortuosity of a wellbore from high-resolution survey data as a means to more accurate rod guide placement, two case studies were undertaken.

TECHNOLOGY + SERVICE SOLUTION

- By estimating points along the wellbore where the rod string is expected to make contact with the tubing and estimating its trajectory using high-resolution data, greater accuracy in the calculated side forces is expected, leading to better recommendations on rod guide placement.
- The analysis entails a comprehensive study of the geometry of the tubing. The analysis yields an estimate of the expected points of contact of the rod string and the tubing. Next, a minimum energy curve is fitted through the calculated contact points. The resulting curve now represents the shape of the rod string inside the tubing. It is believed that this curve is a closer approximation of the trajectory of the rod string than the centerline of the tubing. The trajectory of the curve is used as input into the formula used to calculate the side load exerted by the rod on the tubing.
- The two main components of this methodology are determining the contact points, then estimating the rod trajectory within the tubing. That estimated trajectory is then used to calculate the side forces.

RESULT + VALUE DELIVERED

- This proposed method for estimating the physical shape of a rod string within production tubing requires high-resolution survey data to determine contact points, then fitting a curve through those points to estimate the rod string's shape.
- Using high-resolution data within commercially available software shows a similar trend to the geometric methodology used to inform these estimated contact points, verifying side load calculations. Differences between these data are attributable to the different trajectories used, as well as to varying assumptions and implementation details. Overall, methodologies employing high-resolution data present a significant advantage over those using low-resolution survey data, which has consistently proved less accurate when estimating the rod string trajectory.
- By estimating the shape of the rod string within the tubing using high resolution survey data, the proposed method may lead to better decisions on the placement of rod - reducing failure rates, saving energy, and reducing costs by minimizing workovers and production losses.

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