Conceptual Real-Time Digital Twin-Driven Sucker Rod Pumping Unit for Academic Learning and Commercial Applications

Catalin Teodoriu*, *The University of Oklahoma

In spite of Sucker rod pumps (SRP) being one of the most popular solutions for an artificial lift since their inception in the 19th century, Sucker rod pump failures are a common occurrence in oil and gas applications. Regrettably, the industry still lacks a system that can provide SRP health condition monitoring with the added capability of accurately predicting impending SRP failures. Presently, several industries are exploring the application of digital twins (DT) to optimize their process, make data-driven decisions in real-time, improve operational services, development and enhancement of new/old products and to have more efficient and safer operations. Digital twin technology is one of the main technologies related to Industry 4.0; an enhanced digital representation of a real system. This technology represents the biggest opportunity available today for performance optimization, avoidance of NPT, and hazard prevention.

Despite DT considerable attention from the oil and gas field operators due to lower oil prices to reduce the downtime due to planned or unplanned preventive maintenance in the production field resulting to high operational cost (OPEX). The application and development of DTs for artificial lift systems are still in the early stages. Furthermore, digital twin technology is still not available and yet to researched, causing a technological and technical gap for petroleum engineering students and researchers. It is vital in engineering education that the curricula and the contents of the education are kept up-to-date including the educational environments.

This study presents a novel conceptual framework through application of a digital twin for sucker rod pump system intended for educational learning and commercial applications. The proposed SRP digital twin (DT) encompasses the physical

component of a sucker rod field replica unit: our existing SRP oil field simulated well at MPGE-OU, digital versions of the SRP string, well fluids, among others, computational model, field senor data analytics by evaluating the occurrence and monitoring behavior SRP unit and failure prediction.

The broader impact of this proposed project will enhance the knowledge understanding of petroleum students to accurately and automatically diagnose SRP operating conditions through digital learning. Furthermore, the results from this proposal will contribute and helps the industry to increase safety, improve efficiency and gain the best economic-value-based decision as well as reduce operational cost.