VFD Autonomous Control Abstract

Title: Autonomous VSD Setpoint Optimization for Sucker Rod Artificially Lifted Oil and Gas Wells

Objectives/Scope (800 Character Max): Utilizing a Variable Frequency Drive (VFD) is a more sophisticated method to allow operators to increase their runtime by detecting when there is less fluid to produce and slowing the unit down, accordingly. Optimizing VFD setpoints is not necessarily challenging, but in many cases requires many iterations of user intervention which takes time, and with the ever-changing nature of some reservoirs, that job may never be complete for a given well. By identifying issues like excessive cycling, lost production, unnecessary speed changes, and poor pump fillage, the algorithms implement changes that improve the performance of the well and help operators leverage the full capabilities of their VFD.

Methods/Procedures/Process (800 Character Max): Algorithms were developed in a host software and were intentionally as equipment agnostic as possible. Algorithms were developed and iterated on to solve common problems that rod pump wells with VFDs experience that can be remedied by optimizing the setpoints in the VFD. Strategically the goal of operating a VFD is to maximize production without harming equipment reliability. Three primary problems were identified with wells running VFDs sub optimally, poor fillage, poor runtime, and undersize design. Solutions for these problems were the developed and tested on wells across numerous basins to validate the algorithms to mitigate these problems and optimize the VFD controlling the artificial lift equipment.

Results/Observations/Conclusions (800 Character Max): Several iterations of VFD optimization algorithms were required until wells were seeing benefits from the autonomous VFD setpoint optimization. However, it was observed that wells experiencing poor fillage, poor runtime, and having undersized designs were able to be optimized using a host software solution. Wells experiencing poor runtime due to improper fillage and speed setpoints were able to increase runtime. Wells with VFDs that experienced poor fillage were also significantly optimized increasing fillage and decreasing speed cycles on the VFD equipment, so the VFD speed was more consistent, helping improve the fillage. In all these cases the well was optimized by utilizing the existing field equipment and a host software algorithm. Wells experiencing VFD setpoint issues were optimized resulting in improvements in production, pump fillage, and runtime.

Applications Significance/Novelty (800 Character Max): The algorithms that were developed are able to optimize the VFDs that were controlling many rod pump wells. Utilizing the full power of the VFD allows rod pump wells to have longer run life, be more efficient while running, and increase production where relevant. This allows operators to monitor and optimize wells in much greater numbers. By generating a solution like this and implementing in host software it allows operators to focus on wells with nuanced problems, instead of spending all their time optimizing VFDs and solving problems that are not as nuanced that generalized algorithms running in a host software application offer. This the first step of many steps into true autonomous control and advanced automation for the oil and gas industry.