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PETROLEUM ENGINEERING DEPARTMENT

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# *A Review of Onset of Liquid Accumulation and Pseudo-slug Flow*


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## *Abstract:*

Accumulation of oil and/or water at the bottom of an upward inclined/vertical pipe is known to be the source of many industrial problems, such as pipeline internal corrosion. After the onset of liquid accumulation, liquid holdup increases sharply, which increases the overall pressure drop and reduces production as a consequence. Due to the intermittent nature of the two-phase flow after liquid loading, the oscillations of pressure gradient and liquid production could also cause fatigue of the flowline and disruptions in the operation of downstream facilities. Liquid loading is one of the big challenges in gas wells, which can induce system instability that kills the well. Therefore, accurate prediction of the onset of liquid loading is of great importance for operational purposes.

Liquid loading occurs when the amount of momentum transfer from the gas phase to the liquid film is not sufficient to overcome the opposing forces of gravity and wall friction. The corresponding minimum gas velocity that can continuously move upward all the liquid phase (without any reversal) is called the critical gas velocity. The critical gas velocity is a function of inclinations, liquid production rate, pipe diameter, and fluid properties. In this seminar, the speaker will explain how these parameters impact the onset of liquid loading, and review the state-of-the-art experimental and modeling studies on the onset of liquid accumulation.

Right after the onset of liquid accumulation occurs, a coherent flow structure has been observed, which is classified as pseudo-slug flow. The nature of pseudo-slug flow was not well understood until recent years for the sake of the emergence of the advanced instrument. Although pseudo-slug flow shows similar intermittent behavior to conventional slug flow, their characteristics are quite different. This flow pattern was treated as conventional slug flow before which resulted in significant discrepancies in terms of pressure gradient and average liquid holdup prediction. This problem excites the study of pseudo-slug flow, especially in recent years. In this seminar, the speaker will talk about what pseudo-slug flow is and how it is related to the onset of liquid loading, what the differences are between pseudo-slug and conventional slug flows, as well as the most recent modeling studies of pseudo-slug flow.


## *Biography:*

Dr. Yilin Fan is an assistant professor at Colorado School of Mines. She holds a B.S. degree in Oil and Gas Storage and Transportation Engineering from China University of Petroleum, China, and received her both Master and Ph.D. degrees in Petroleum Engineering from the University of Tulsa. Before joining Colorado School of Mines, she worked as a post-doc research associate at the University of Tulsa for 1 year. Her research interests include, but are not limited to, steady-state and transient multiphase flow in pipelines and wellbores, gas well deliquification, artificial lift design and optimization, multiphase flow related flow assurance issues, as well as the application of fiber optic sensor in production logging and optimization. Dr. Fan received the Best Paper Award in the 17th International Conference on Multiphase Technology, and was recently awarded the 2020 ACS Petroleum Research Fund. She is currently serving as associated editor for SPE Production & Operation, and technical reviewer for several peer-reviewed journals.


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