

A Comprehensive Review of Pseudo-Slug Flow

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Abstract

Pseudo-slug flow is a subset of intermittent flow. It is commonly encountered in oil and gas production operations of deviated natural gas wells or pipelines with liquid accumulation issues. However, it was typically assumed to behave as slug flow resulting in significant uncertainties in the design and operation practices of large offshore production systems. Therefore, it has recently drawn significant attention from the multiphase flow community.

Several studies have reported a more dominant presence of short pseudo-slugs in favor of typical stable slug structures with increasing pressure and liquid viscosity. It has also been found that the range where pseudo-slugs dominate expands with increasing pipe diameter and is a strong function of pipe inclination angle. Pseudo-slugs also show strong similarities with churn flow, indicating that these two flow patterns can be considered analogous.

It is critical to understand pseudo-slug flow behavior for upscaling purposes. There has been a significant amount of systematic experimental and theoretical research conducted recently, and the subject matter is reaching maturity. It is evident that pseudo-slug is hydrodynamically different from traditional slug flow and should not be treated as such. This talk will review publicly available studies and provide a state of the art of physics-based predictive modeling. Furthermore, future research and development directions will be discussed.