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Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

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Air/gas is often entrapped in water delivery pipes of petrochemical rigs, blocking the flow and thereby increasing operational energy demands or idle downtimes. Hence, the efficient liquid transport that minimizes the blockage through long pipelines would reduce costs in oil industry. The entrapment belongs to the category of two- (e.g. air/water) or multi-phase (e.g. air/oil/water) flows, the difficult and well-studied topics. The long bubbles on top of thin water layers, known as slugging flow, are particularly relevant in oil recovery.

We present a stochastic grey-box model which combine the physical (mechanistic) knowledge with the (incomplete) measurements of an actual, experimental slugging flow. In particular, stochastic (random) component is introduced to quantify both the missing information and the statistical nature of the complicated flow data.