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Please fill in your manuscript title.	Development of Fast Multiphase Wellbore Simulator for Virtual Flow Metering and Production Optimisation

Please fill in your author name(s) and company affiliation.

Given Name	Surname	Company
Anton	Gryzlov	Aramco Innovations
Sergey	Safonov	Aramco Innovations
Boris	Krasnopolsky	Institute of Mechanics
Muhammad	Arsalan	Saudi Aramco

Abstract

Virtual flow metering is a technology for indirect estimation of multiphase production rates, which is essential for reservoir management, history matching, and production optimization. The most common approach to obtain virtual measurements is to apply machine learning models, which enable fast but not necessarily accurate prediction of flow rates. One approach to overcome such problems is to combine machine learning methods with physical conservation laws of mass, momentum and energy. The hybrid virtual flow metering strongly relies on the capabilities of underlying physical simulator.

In this work various approaches of combining measurements with multiphase flow models are investigated. It is demonstrated that a wellbore flow model has a central role in any type of hybridization scheme which connects the available measurements to the target flow rates. Due to specific requirements of the virtual flow metering applications, this simulator has to be fast and accurate enough to qualitatively describe flow in wellbores and pipelines. In this work, such developed simulator is presented, which is based on a one-dimensional formulation for mass and momentum conservation, but contrary to other commercially available options, the current development is based on a drift-flux approach, which is less demanding on the interfacial closure terms and can be more easily tuned with field data. The performance of the simulator has been evaluated using a set of transient benchmark scenarios, where the reasonable match against the reference data has been demonstrated.

The simulator is applicable to a wide range of multiphase flow problems of practical interest and uses advanced numerical algorithms to ensure robustness and performance. The closure relationships used in the simulator can be adjusted to improve the performance for a particular well. In addition, a dedicated graphical user interphase enables user-friendly interaction for setting up the computational case and processing the output production data.