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PROCEEDINGS

A Process Simulation Model of Oil and Gas Gathering System for Digital Requirements

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ABSTRACT

Characteristic parameters of oil and gas gathering system (OGGS), such as the liquid holdup, flow rate and pressure of wells, fluctuate dynamically during the production cycle. Furthermore, with the call for energy transition and digitalization, it is critical to grasp the operation status of OGGS in real time. A generalized process simulation model for multi-phase gathering system was established by coupling several models (mass balance, pressure balance, hydraulic and thermal model of a single pipe, power and thermal equipment model, etc.). Because the hydraulic equation of the pipe contains nonlinear terms, the hydraulic model of pipe was linearized, and the linear approximation method was employed to solve the process simulation model. In addition, several multiphase fluids will flow into the same node in the pipe network, and the liquid holdup varies from pipe to pipe. As a result, the node matrix described the process topology of OGGS, and the path-finding algorithm found the optimal solution sequence of node temperature and liquid holdup. The equivalent flow rate was introduced to adaptively adjust the distance steps of each pipe section by comparing each pipe's equivalent flow rate with the reference value. With the same number of pipe sections, the adaptive step method had higher calculation accuracy than the fixed step method. Under different boundary conditions, the results of the process simulation model were in good agreement with the results calculated by commercial software. The model can effectively guide the operational management of the site and offer a reference for the digital transition of OGGS.

KEYWORDS

Oil and gas gathering system; multi-phase flow; adaptive step method; process simulation

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