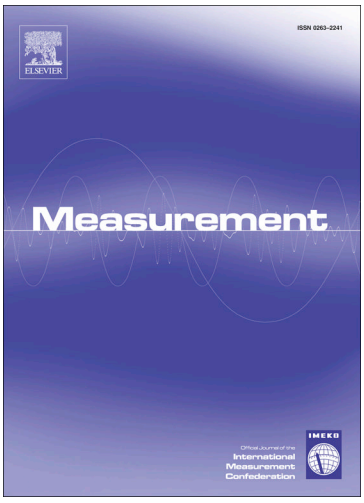

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A Model for Predicting Thermophysical Properties of Water at Supercritical State in Offshore CDTW

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ABSTRACT

Huge amount of efforts were done on saturated/superheated steam flow in wellbores. At present, the study on supercritical water (SCW) flow in wellbores, especially offshore concentric dual-tubing wells (OCDTW), is very limited.

In this paper, a series of works are done on SCW flow in OCDTW. A comprehensive mathematical model comprised of pipe flow model, supercritical fluid model and seawater model is developed. Heat exchange between the integral joint tubing (IJT) and annuli in OCDTW is fully considered in the model. Type curves of SCW flow in OCDTW are obtained with straight forward numerical method. Then, sensitivity analysis is conducted. It is found that: (a) Seawater and the thermal exchange between IJT and annuli are two main factors contributing to the profile change of thermophysical properties in IJT and annuli. (b) SCW pressure decreases with increasing of mass flow rate in IJT. SCW density decreases with increasing of mass flow rate in IJT. SCW temperature increases with increasing of mass flow rate in IJT. (c) when the injection temperature in IJT is smaller than that in annuli, SCW density decreases at first and then turns to increase with well depth.

Keywords:

Wellbore hydraulics; water flow; supercritical state; offshore concentric dual-tubing wells; thermophysical properties

1. Introduction

With the development of economy and development technology, heavy oil is gaining attention [1, 2]. In order to obtain a better development effect, practicing engineers are suggested to estimate