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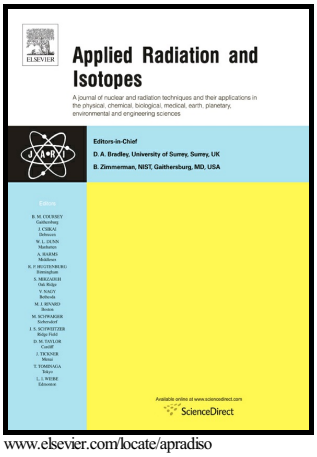

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The capability of radial basis function to forecast the volume fractions of the annular three-phase flow of gas-oil-water

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Abstract

The problem of how to precisely measure the volume fractions of oil–gas–water mixtures in a pipeline remains as one of the main challenges in the petroleum industry. This paper reports the capability of Radial Basis Function (RBF) in forecasting the volume fractions in a gas-oil-water multiphase system. Indeed, in the present research, the volume fractions in the annular three-phase flow are measured based on a dual energy metering system including the ^{152}Eu and ^{137}Cs and one NaI detector, and then modeled by a RBF model. Since the summation of volume fractions are constant (equal to 100%), therefore it is enough for the RBF model to forecast only two volume fractions. In this investigation, three RBF models are employed. The first model is used to forecast the oil and water volume fractions. The next one is utilized to forecast the water and gas volume fractions, and the last one to forecast the gas and oil volume fractions. In the next stage, the numerical data obtained from MCNP-X code must be introduced to the RBF models. Then, the average errors of these three models are calculated and compared. The model which has the least error is picked up as the best predictive model. Based on the results, the best RBF model, forecasts the oil and water volume fractions with the mean relative error of less than 0.5%, which indicates that the RBF model introduced in this study ensures an effective enough mechanism to forecast the results.

Keywords: Annular regime, Forecasting, Radial basis function, Three-phase flow, Volume fraction.