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ABSTRACT

Numerical simulations and experimental investigations have reported the impact of scale on the dynamic capillary pressure for two-phase flow. But this is often achieved at significant computational cost and time. In view of this, alternative platform for prediction of this factor is investigated in this work. We present an artificial neural network (ANN) model for the prediction of scale dependency of the dynamic coefficient (τ) in an oil-water system. The input parameters consist of the phase saturation, media permeability, capillary entry pressure, viscosity ratio, density ratio, and temperature, pore size distribution index, porosity and domain volume with correspondent τ obtained at different domain scale. Good generalization of the model was achieved by acquiring data from independent sources comprising experiments and numerical simulations. Different ANN network model configurations as well as linear and non-linear regression models were tested using a number of performance testing criteria. Findings showed that double hidden layers ANN network models perform better than other. Particularly, the ANN configuration with 13 neurons in the first layer and 15 in the second layer performs best. Using this configuration, effects of increased domain size were predicted for three independent experimental results obtained from literature and our laboratory with different magnitude of viscosity ratios and domain scales. Results showed increased magnitude of τ as the domain size increases for all the independent experimental data considered. This work shows applicability and techniques of using ANN in the prediction of two-phase flow parameters.