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Numerical Based Optimization for Natural Gas Dehydration and Glycol Regeneration

Emmanuel E. Okoro ; Samuel E. Sanni ; David I. Olatunji ; Paul Igbinedion ; Babalola Oni ; Oyinkepreye D. Orodu
Paper presented at the SPE Nigeria Annual International Conference and Exhibition, Virtual, August 2020.
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Abstract
Exergy is a simultaneous measure of the quantity and quality of energy. This helps to identify the inefficiency of the process and allows engineers to determine the cause and magnitude of the loss for each operating unit. Natural gas dehydration via absorption using glycol is the most economically attractive approach, and this advantage can only stand if lower energy consuption relative to adsorption process can be obtained; thus, timely prediction and identification of energy consumption is vital. In this study, an energy utilization predictive model for natural gas dehydration unit energy consumption was developed. This numeric approach will increase accuracy and reduce the high simulation time often encountered in using other simulation software. To achieve this novel idea, a multilayer perceptron approach which is a deep learning neural network model built on python using Tensorflow was adopted. The model used for this study is implemented to further increase the accuracy of the output set variables which are matched with simulation result. Since we are dealing with a non-linear function, rectified linear unit (ReLU) function was used to activate the neurons in hidden layers so as to strengthen the model to be more flexible in finding relationships which are arbitrary in the input parameter. These input parameters are fed into the steady state model and sent to various branches of fully connected neural network models using a linear activation function. Each branch produces a result for each output parameter thereby fitting the model by reducing the mean squared error loss. The training data were not normalized but left in their original form. Results showed that the adopted double hidden layer with 5 branches are uniquely branched in such a way that it predicts values for a single output variable, which is an upgrade to the former work done with a single hidden layer in literature. The accuracy analysis showed that the proposed double hidden layer approach in this study out-performed the single hidden layer.

Keywords:upstream oil & gas, neural network model, artificial intelligence, dehydration system, energy consumption, neural network, midstream oil & gas, input parameter, output variable, gas dehydration unit energy consumption
Subjects:Processing Systems and Design, Information Management and Systems, Dehydration, Neural networks

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