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Artificial Neural Network Modeling of a Closed Loop Pulsating Heat Pipe

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Abstract : Technological innovations in electronic world demand novel, compact, simple in design, less costly and effective heat transfer devices. Closed Loop Pulsating Heat Pipe (CLPHP) is a passive phase change heat transfer device and has potential to transfer heat quickly and efficiently from source to sink. Thermal performance of a CLPHP is governed by various parameters such as number of U-turns, orientations, input heat, working fluids and filling ratio. The present paper is an attempt to predict the thermal performance of a CLPHP using Artificial Neural Network (ANN). Filling ratio and heat input are considered as input parameters while thermal resistance is set as target parameter. Types of neural networks considered in the present paper are radial basis, generalized regression, linear layer, cascade forward back propagation, feed forward back propagation; feed forward distributed time delay, layer recurrent and Elman back propagation. Linear, logistic sigmoid, tangent sigmoid and Radial Basis Gaussian Function are used as transfer functions. Prediction accuracy is measured based on the experimental data reported by the researchers in open literature as a function of Mean Absolute Relative Deviation (MARD). The prediction of a generalized regression ANN model with spread constant of 4.8 is found in agreement with the experimental data for MARD in the range of ±1.81%.

Keywords : ANN models, CLPHP, filling ratio, generalized regression, spread constant
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