



Uncertainty analysis of COP prediction in a water purification system integrated into a heat transformer using several artificial neural networks

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ABSTRACT

Numerous authors have reported the prediction of performance of heat pumps using artificial neural networks. However, the accuracy of the calculation is generally unknown. Four feedforward networks with one hidden layer are developed and used in order to obtain coefficient of performance (COP) prediction. COP permitted us to evaluate a water purification process integrated into a heat transformer. For the networks, the logarithmic sigmoid (LOG-SIG), the hyperbolic tangent sigmoid (TANSIG) and the linear (PURELIN) transfer function were used. In the validation process, effects over regression coefficient, slope and intercepts with different input normalization ranges were evaluated. Input normalization range from -1 to 1 with TANSIG in hidden layer and without uncertainty in the input variables presented better results in comparison with other normalization ranges. However, Monte Carlo method was also applied in order to obtain error propagation COP prediction (using relative standard deviation, $\%RSD_{COP}$), with the aim to determine confidence level of models. Effects over $\%RSD_{COP}$ with different input normalization ranges were evaluated for the development of four neural network models. Input normalization range from 0 to 1 with TANSIG in hidden layer and with uncertainty in the input variables presented better results in comparison with other normalization ranges.

Keywords: Error propagation; Monte Carlo method; Logarithmic sigmoid; Hyperbolic tangential

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