ABSTRACT

Sensor linearization is a vital aspect of measuring system at it enhances the efficiency of instrument by minimizing the errors, power consumption and memory usage. In this work, Artificial Neural Network (ANN) based linearization technique is adopted to linearize the negative temperature coefficient (NTC) thermistor sensor with nominal resistance of 10k having lower β value. The network is optimized for number of hidden neurons, training algorithm, activation function and training time. The optimum architecture, consisted of a multilayer perceptron (MLP) with five hidden neurons having log-sigmoid as an activation function using bayesian regularization (BR) training algorithm, is found to produce a non-linearity error (%FSS) of $< 1\%$ for the temperature range from 0 ^{O}C to 100 ^{O}C. The effects of uniformly and clustered data distribution on the performance of the optimized network are also explored. It is observed that total epochs in case of clustered data are significantly higher than uniformly distributed data which results into increased training time. The minimal features of the optimized model allows it to directly install in resource-constrained commercially available low-cost microcontrollers. With the availability of on-board training options, these low-cost systems would be able to employ on-field auto-calibration.