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RESEARCH PAPER

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Development of thermal conductivity measuring device using single operational amplifier and its modeling by artificial neural network (ANN)

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SUMMARY :

Thermal conductivity is one of the important thermal properties of food materials. It is essential during the calculation of heat transfer process through conduction. The setup was constructed by installing a single operational amplifier LM741, precision centigrade temperature sensors LM35, series 3-terminal negative regulators LM7915C, series voltage regulators LM7815C and LM7805C. LM741. The input to the setup was AC mains supplies 220V, 50 Hz which is transformed to 24V by step-down transformer. LM35 were used as a temperature sensor which gives output of 10mV/^{o}C. To convert mV into V inverting amplifier LM741 has been used. The required voltage values can be read from digital multi-meter by connecting the positive and negative terminal. After successful development, calibration and testing of the setup, it has been utilized to calculate the thermal conductivity of wheat, sorghum and rice. The initial moisture content of all three different grains was found 7.88, 10.33 and 14 per cent wet basis, respectively. Thermal conductivity of wheat, sorghum and rice was found in the range of 0.199-0.115W/mK, 0.202-0.139 W/m K and 0.53-0.48 W/m K, respectively at the temperature range from 40 to 60^{0}C. The performance of the optimal neural network with 15 hidden layers and 20 neurons in each hiiden layer was done by using a different data set. It was found that the sorghum grain gives the minimum M.S.E 1.791×10^{-12} with R^2 value is 0.999.

KEY WORDS : Thermal conductivity, ANN modeling, Operational amplifier

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