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Application of Artificial Neural Network for Single Horizontal Bare Tube and Bare Tube Bundles (Staggered) of Large Particles: Heat Transfer Prediction

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Abstract : This paper presents heat transfer analysis of single horizontal bare tube and heat transfer analysis of staggered arrangement of bare tube bundles bare tube bundles in gas-solid (air-solid) fluidized bed and predictions are done by using Artificial Neural Network (ANN) based on experimental data. Fluidized bed provide nearly isothermal environment with high heat transfer rate to submerged objects i.e. due to through mixing and large contact area between the gas and the particle, a fully fluidized bed has little temperature variation and gas leaves at a temperature which is close to that of the bed. Measurement of average heat transfer coefficient was made by local thermal simulation technique in a cold bubbling air-fluidized bed of size 0.305 m. x 0.305 m. Studies were conducted for single horizontal Bare Tube of length 305mm and 28.6mm outer diameter and for bare tube bundles of staggered arrangement using beds of large (average particle diameter greater than 1 mm) particle (raagi and mustard). Within the range of experimental conditions influence of bed particle diameter (Dp), Fluidizing Velocity (U) were studied, which are significant parameters affecting heat transfer. Artificial Neural Networks (ANNs) have been receiving an increasing attention for simulating engineering systems due to some interesting characteristics such as learning capability, fault tolerance, and non-linearity. Here, feed-forward architecture and trained by back-propagation technique is adopted to predict heat transfer analysis found from experimental results. The ANN is designed to suit the present system which has 3 inputs and 2 out puts. The network predictions are found to be in very good agreement with the experimental observed values of bare heat transfer coefficient (hb) and nusselt number of bare tube (Nub).

Keywords : fluidized bed, large particles, particle diameter, ANN
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