Improved performance of an artificial neural network pattern recognizer using design of experiments technique

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ABSTRACT

In the field of bivariate quality control (BQC), artificial neural network (ANN)-based pattern recognition schemes have been developed for monitoring and diagnosis of process variation pattern. In order to achieve efficient recognition performance (RP), proper design of an ANN-based model recognizer is essential. Extensive literature review revealed that the recognizers were mainly designed empirically. In this study, design of experiments technique was utilized for determining the suitable design parameters. Based on raw data input representation for a generalized-model ANN recognizer, four design parameters were investigated, i.e., size of recognition window, number of training data, quality of training data and number of hidden neuron.The process variation patterns were focused on bivariate process mean shifts with linear correlation function, $\rho = 0.1 \sim 0.9$ and mean shifts, $\mu = \pm 0.75 \sim 3.00$ standard deviations.The findings suggested that improved RP could be achieved by setting specific design parameters into the specialized-model ANN recognizer (RP = 98.85%). This model gave superior result compared to a single generalized-model ANN (RP = 96.5%. This study has provided a new perspective in designing a specialized-model ANN pattern recognition scheme.

Keywords: Artificial neural network, design of experiments, generalized-model recognizer, specialized-model recognizer, bivariate quality control

Numerical stress-deformation analyses of composite material using Finite Element Method

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ABSTRACT

This paper is to investigate the effect of finite element discretization or mesh density on the stress and deformation of the composite material subjected to concentrated load. The simulation was performed using commercially available finite element software LUSAS and the composite material were modelled by plane stress elements QPM8. The study result revealed that the numerical prediction of the deformation was in good agreement with theoretical based on Euler-Bernoulli theory. Furthermore this study demonstrates that the effect of mesh density on stresses were significant regardless type of model or stress element used in the analysis

Keywords: Euler-beam, FEM, deflection, linear elastic analysis, stress trajectory/contour