ABSTRACT:

This paper presents the ANN model for predicting the surfaceroughness performance measure in the machining process by considering the ArtificialNeuralNetwork (ANN) as the essential technique for measuring surfaceroughness. A revision of several previous studies associated with the modelling issue is carried out to assess how capable ANN is as a technique to model the problem. Based on the studies conducted by previous researchers, the abilities and limitations of the ANN technique for predicting surfaceroughness are highlighted. Utilization of ANN-based modelling is also discussed to show the required basic elements for predicting surfaceroughness in the milling process. In order to investigate how capable the ANN technique is at estimating the prediction value for surfaceroughness, a real machining experiment is referred to in this study. In the experiment, 24 samples of data concerned with the milling operation are collected based on eight samples of data of a two-level DOE 2k full factorial analysis, four samples of centre data, and 12 samples of axial data. All data samples are tested in real machining by using uncoated, TiAIN coated and SNTR coated cutting tools of titanium alloy (Ti-6A1-4V). The Matlab ANN toolbox is used for the modelling purpose with some justifications. Feedforward backpropagation is selected as the algorithm with traingdx, learngdx, MSE, logsig as the training, learning, performance and transfer functions, respectively. With three nodes in the input layer and one node in the output layer, eight networks are developed by using different numbers of nodes in the hidden layer which are 3–1–1, 3–3–1, 3–6–1, 3–7–1, 3–1–1–1, 3–3–3–1, 3–6–6–1 and 3–7–7–1 structures. It was found that the 3–1–1 network structure of the SNTR coated cutting tool gave the best ANN model in predicting the surfaceroughness value. This study concludes that the model for surfaceroughness in the milling process could be improved by modifying the number of layers and nodes in the hidden layers of the ANN network structure, particularly for predicting the value of the surfaceroughness performance measure. As a result of the prediction, the recommended combination of cutting conditions to obtain the best surfaceroughness value is a high speed with a low feed rate and radial rake angle.