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Vision-based surface roughness accuracy prediction in the CNC milling process (Al6061) using ANN

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ABSTRACT

This paper proposed the methodology of identified the surface roughness accuracy rate in the CNC milling process by Artificial Neural Network. Al6061 preferred as job material for milling processes carried out in CNC milling machines. The various input parameters like speed, federate, and depth of cut used for the CNC milling process. The Artificial Neural Network modeling has consisted of different input parameters and a single output parameter. The surface roughness is fixed as an output parameter in an Artificial Neural Network. Based on the input parameter and the number of neurons, the surface roughness value was derived. The final accuracy rate of surface roughness was calculated by vision measurement value compared with the conventional stylus probe.

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1. Introduction

In the industrial world, most of the manufacturing companies are competing with each other. If a company needs profit, it should provide a good quality of products and also have more buyers. During the high-quality component production, the time constraints may increase, especially in the inspection process. AISI 4140 Steel machined by CNC lathe with various input parameters such as cutting speed, depth of cut, and feed rate. The RSM methodology used to optimize the best roughness value through the regression equation [1]. This review study used to analyze the different parameters used to predict the surface roughness value [2]. The ANN consists of three layers, such as the input layer, output layer, and hidden layer. The grayscale, cutting speed, depth of cut, F1, and F2 are input parameters to Artificial Neural Network. Based on the training and testing method, the surface roughness value was generated by an Artificial Neural Network [3]. Surface roughness prediction on Al6063 by soft computing approaches like ANFIS and random forest classification [4].

Based on the above literature survey, the 6061 preferred as job material due to its machinability character. The ANN methodology is choosing for rapid surface roughness inspection. The final accuracy level also calculates by comparison of vision and conventional surface roughness value.

2. Materials and methodology

2.1. Artificial Neural Network

Artificial Neural Network modeling was built with an input layer, hidden layer, and output layer. The input layer is active. During the algorithm, the execution process can modify the input process parameters range. The hidden layer was filled with the number of neurons, which is used to boost up the accuracy of the output value. The output parameter assigns in the output layer (Fig. 1).

2.2. Materials

Aluminum 6061 Alloy preferred as the job material, due to its low corrosion and good machinability characteristics. Most of the engine components are manufactured by aluminum alloy. Tables 1 and 2 shows the mechanical and chemical properties of Al 6061 alloy (Fig. 2).

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