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Computer vision-based surface roughness measurement using artificial neural network

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ABSTRACT

Product quality is defined by the product lifespan and the product finish. The lower wear rate leads to good quality, especially in the machining components, so low-wear components have excellent surface roughness. Al7075 (Aluminum Alloy) is used in automotive industries for its predominant machining characteristics. The paper aims to predict the accuracy of surface roughness in the aluminum cylindrical shaft by the computer vision system. A feed-forward algorithm selected in the neural network for training and testing practice, Training Practice Speed, Depth of Cut, Feed Rate, Grayscale Values, defined as the input parameters, surface roughness is the output parameters. The accuracy is calculated by the difference between the vision measurement and stylus probe value. The accuracy level attains 95%. The method can make sustainable for the surface roughness measurement in the machining process.

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1. Introduction

In recent years, machine industries need to update the method to predict surface roughness with high accuracy. More machining industries now used only the stylus probe conventional method [1]. It takes more time to complete the measurement and is also very difficult in the mass production system. The computer is one of the best alternative methods to identify the roughness with reasonable accuracy. Neural Network model developed and executed for prediction purposes [2]. The lifetime of the machine parts is derived from the quality level. The surface roughness value is one of the factors to measure the quality level [3].

The surface roughness measurement is analyzed by multiple regression and Artificial Neural Network Model [4]. AISI 1040 steel machining under the turning process, the stylus probe measured the Surface Roughness value. Multiple regression and ANN models developed and generated the surface roughness value compared with the stylus probe value to produce high accuracy [5]. Machining parameters will desire the surface characteristics, like Depth of Cut and Feed Rate, so optimizing the parameter is essential to produce excellent surface roughness. Forward and stepwise selection algorithms are proposed to predict surface roughness in the turning process. The titanium Aluminium Nitride turned aluminum and copper (TiAlN) Coated cutting tool [6].

The aim is to predict the surface roughness height and turned surface by using the Neural Network model with the different inputs like the nose radius, rake angle, Feed Rate, Speed, Depth of Cut, Tool Insert [7]. The surface roughness of the Al-SiC was analyzed by Neural Network and ANOVA Analysis in Cylindrical Grinding Process. The Neural Network Architecture (4–12-1) used to predict the 94.20% accuracy level. The input process is Feed Rate, Work Piece Velocity, and Wheel Velocity [8]. Fig. 1 shows the CNC machined Aluminum 7075 workpiece.

2. Artificial Neural Network

Artificial Neural Network is a soft computing approach consisting of Input Layers, Hidden Layers, and Output Layers. Mostly the Neural Network is used to predict the Classifications Pattern Matching, Optimization, and Data Mining [9]. Fig. 2 represents the construction of an Artificial Neural Network.

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