Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Surface roughness accuracy prediction in turning of Al7075 by adaptive neuro-fuzzy inference system

B. Veluchamy [a], N. Karthikeyan [a], B. Radha Krishnan [b,*], C. Mathalai Sundaram [b]

[a] Mechanical Engineering, K. Ramakrishnan College of Engineering, Trichy, India
[b] Mechanical Engineering, Nadar Saraswathi College of Engineering and Technology, Theni, India

ARTICLE INFO

Article history:
Received 12 May 2020
Received in revised form 25 June 2020
Accepted 28 June 2020
Available online xxxx

Keywords:
Aluminum alloy
CNC machining
Grayscale
Surface roughness
ANFIS

ABSTRACT

This research proposes the surface roughness inspection by an adaptive Neuro-fuzzy inference system. The adaptive Neuro-fuzzy inference system model developed by input parameters (Speed, Depth of cut, feed rate, and Grayscale value) and an output parameter (surface roughness). The training and testing module, which is used to generate the surface roughness value. The grayscale value derived from the machinability of the Al7075 workpiece. The machined workpiece image as converted as grayscale value, which is feed into one of the inputs of the adaptive Neuro-fuzzy inference system. The vision measurement value was compared with the stylus probe value for predicting the accuracy level of the adaptive neuro-fuzzy inference system. The accuracy was above 98%, which is helpful for inspecting all machined components in the mass production system.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Newer Trends and Innovation in Mechanical Engineering: Materials Science.

1. Introduction

In recent years many automobile industries achieving a good profit because of its quality. The quality can ensure by the paper inspection method. Especially in the engine component must be getting more accuracy in surface roughness. Normally the industries prefer the stylus probe for measuring surface roughness, and it took more time for the inspection process. This research can overcome this limitation. The adaptive neuro-fuzzy inference system, Genetic Algorithm, and Random Forest classification methods can produce surface roughness value in Al6063 with an accuracy of 97%, which is acceptable value and also measure the all the machined components in very less time [1–2]. The ANN model constructs by an F1, F2, Grayscale, Speed, Depth of cut, feed rate, and surface roughness value. The training and testing method is executed in ANN for predicting surface roughness with 96% accuracy [3]. AISI 4140 steel machined by CNC machining process under various conditions. The Response surface methodology used to optimize the value for achieving good surface roughness [4]. The surface roughness can be measured by different methods like Average Value (Ra), Root means Square (Rz), Peak to Valley (Rt) [5].

The EN24 steel machined by surface grinding machine with various machining conditions (cutting speed, feed rate, and depth of cut) the surface roughness value as the target. The RSM method utilizes to predict the optimal regression solution for good surface roughness value [6–7]. IS2062 E250 steel normally used for heavy machinery components like bearing and shaft. In bearing material should have fewer wear characteristics, so the need to the IS2062 E250 steel should be machined with the good surface finish for avoiding the wear loss. The RSM used to produce the optimal parameter for achieving the good roughness value [8]. Al7075 is the source of the primary materials due to if good machinability and low weight characteristics. The al6061 and Al7075 machined by CNC with various input parameters like speed, Depth of cut, and machine feed rate. ANN method used to predict and investigate the surface roughness quality of aluminium product [10]. Based on the literature review, the surface quality is the major role for machined components, so this study proposes the methodology of the ANFIS model used to identify the good surface roughness (Ra) in Al7075 material, which is preferred for engine and framework application.

* Corresponding author.
E-mail address: radhakrishnancadcam@gmail.com (B.R. Krishnan).

https://doi.org/10.1016/j.matpr.2020.06.560
2214-7853/
Selection and peer-review under responsibility of the scientific committee of the International Conference on Newer Trends and Innovation in Mechanical Engineering: Materials Science.