Abstract

The surface roughness as output cutting parameter is needs to be addressed for production of goods with precision and quality. The modeling of cold work tool Steel Böhler K110 (hardness 64 HRC) is presented. An experimental investigation and prediction model for the surface roughness of hardened die steel is presented in this work. Adaptive Neuro-fuzzy inference system (ANFIS) is used in prediction model using speed, feed and depth of cut as an input cutting parameter and surface roughness as an output parameter. The measured surface roughness (Ra) is compared with the predicted surface roughness using bell shape, triangular and trapezoidal membership function. It is observed that the average prediction accuracy using triangular membership function is 99.88 %.

The die steel material DC53 is an improvement over the familiar cold die steel SKD11. This work presents an investigation for the effects of machining variables on the surface roughness of End Milling DC53 die steel. In this study, the machining variables investigated were speed, feed and depth of cut. An Adaptive neuro – fuzzy inference system was used to find out the variables affecting the surface roughness. An experimental investigation is executed and conducted to collect the data for training and testing purpose. The measured surface roughness (Ra) is compared with the predicted using bell shape, triangular and trapezoidal membership function. It is observed that the average prediction accuracy using triangular membership function is 99.87 %.

The surface roughness prediction is different for each material due to varying material properties. The modeling of Hardened Die Steel Böhler K340 (hardness 61-62 HRC) is presented. An experimental investigation and prediction model for the surface roughness of hardened die steel is presented in this work. Adaptive Neuro-fuzzy inference system (ANFIS) is used in prediction model using speed, feed and depth of cut as an input cutting parameter and surface roughness as an output parameter. The measured surface roughness (Ra) is compared with the predicted using bell shape, triangular and trapezoidal membership function. It is observed that the average prediction accuracy using triangular membership function is 99.01 %.
The aim of this study is also to correlate work piece material hardness with surface roughness in prediction studies. The proposed model is for prediction of surface roughness of tool steel materials of hardness 55 HRC to 62 HRC (±2 HRC). The machining experiments are performed under various cutting conditions using work piece of different hardness. The surface roughness of these specimens is measured. The result showed that the influence of work piece material hardness on surface finish is significant for cutting speed and feed in CNC end milling operation. It is also observed that the surface roughness prediction accuracy of Adaptive neuro fuzzy inference system using triangular membership function is better than Gaussian, bell shape membership function and regression analysis. Surface roughness prediction accuracy with material hardness as input parameter is 97.61%.

An adaptive-network based fuzzy inference system (ANFIS) was used to predict the work piece surface roughness after the end milling process. Three milling parameters that have a major impact on the surface roughness, including spindle speed, feed rate, depth of cut, and Step over ratio were analyzed. Bell shaped membership function was adopted during the training process of ANFIS in this study in order to compare the prediction accuracy of surface roughness by the two membership functions. The predicted surface roughness values derived from ANFIS were compared with experimental data. The error of the surface roughness values predicted by ANFIS with the bell shaped membership function is only 4%, reaching accuracy as high as 96%.