ABSTRACT

Conventional Turning (CT) machining has been widely used for the cutting process of various types of materials. In the application of the CT machining process there are several obstacles to produce good surface roughness and result in rapid tool wear. To overcome this problem, the use of Ultrasonic Assisted Turning (UAT) machining process has been widely used as a potential solution. Recent studies conducted on the UAT process have shown quality improvements in tool life, cutting temperature, and surface finish. In this study, a comparison was made between the UAT and CT machining processes for the turning process of aluminum alloy 6061. The Design of Experiment (DOE) used in this study was Full Factorial Design. The independent variables in this study are spindle speed, feed rate, depth of cut and frequency, each of which has three levels of parameters and the number of experiments carried out in this study were 108 experiments. The response variables for this research are surface roughness (Ra), cutting temperature, and tool wear parameters. The NDVAT machining process is proven to improve the quality of surface roughness up to 35.04%, produce a much lower cutting temperature of up to 32.52% and increase tool life quality up to 63% better than CT machining. Predictive mathematical model has a prediction accuracy rate of 77.22% with a mean error of 12.3%. The combination of machining variables from the prediction model produces the most optimal surface roughness value (Ra = 0.410 m) using the parameters n = 2000 rpm, f = 0.05 mm/rev, ap = 0.25 mm, and F = 20 kHz.

Keywords— Normal Directional Vibration Assisted Turning, Conventional Turning, Surface Roughness, Tool Wear, Cutting Temperature, Full Factorial Design