ABSTRACT

Cutting conditions on conventional turning machines can affect the service life of the insert tool. The large cutting force and thick chips caused by cutting conditions that are close to the maximum limit of the insert tool make the service life of the insert tool shortened due to wear. A shortened insert tool life can have a negative impact on the productivity and economy of the manufacturing industry, due to the need for additional funds and time to replace worn insert tools. To overcome this, 2D Ultrasonic Vibration Assisted Turning (2D UVAT) machining can be an alternative solution in reducing cutting force and smoothing chips. Full factorial method (FFM) was used to determine the effect of 2D UVAT machining variables on cutting force and chip formation. Based on the experimental results and ANOVA test, the machining variables that affect the cutting force are feed rate¸depth of cut and frequency. Depth of cut has the largest contribution to changes in cutting force with a percentage of 60.69%. The variable depth of cut also has a significant effect on chip formation. The larger the frequency variable in 2D UVAT machining can result in lower the cutting forces. The average reduction in cutting force in 2D UVAT machining is 14.7% compared to conventional turning. The combination of machining variables with the smallest cutting force consists of spindle speed = 2000 rpm, feed rate = 0.05 mm/rev, depth of cut = 0.25, and frequency = 20 kHz which produces a cutting force value of 36.42 N. The combination optimal 2D UVAT machining variable consists of spindle speed = 855 rpm, feed rate = 0.05 mm/rev, depth of cut = 0.25, and frequency = 20 kHz.

***Key Words*: 2D UVAT, CT, *Cutting Force*, *Chip Formation, Aluminium Alloy* 6061-T6**