

The Effect on the Application of Coolant and Ultrasonic Vibration Assisted Micro Milling on Machining Performance

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ABSTRACT

Advancing of micro-milling process via ultrasonic vibration assist has been proven able to improve machining characteristics such as surface roughness quality and dimension accuracy. The improvement is due to the cutting motion of Vibration Assisted Machining (VAM) process. Thus, for every vibration motion manner, the cutting characteristic of the VAM system will be difference from one to another. This paper presents the development approach of ultrasonic vibration assisted micro-milling (UVAM) using tilted 45° XY stage. It covers theoretical perspective and the influence of Minimum Quantity Lubrication (MQL) system as cutting fluid. It will emphasize on the theory of surface roughness, dimension tolerance and cutting tool life. Piezo-actuator is used as fast servo vibration mechanism in specific axis input with controlled signal. The input signal is sine wave with controllable frequency and amplitude to allow mechanism control algorithms to be develop during the process. In addition, the effect of cutting fluid was be analyzed to understand the potential capabilities of this aid on UVAM process.

KEYWORDS: Dimension Tolerance, Material Removal Rate (MRR), Surface Roughness (SR), Ultrasonic Vibration Assisted Micro-Milling (UVAM)

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