

Evaluation of tool wear and machining performance by analyzing vibration signal in friction drilling

ABSTRACT

Tool condition plays an important role in machining performance. In machining processes, multiple phenomenon occurs during material cutting. To improve their robustness, the reliability pattern recognition techniques have been implemented in tool condition monitoring systems. This study demonstrates a tool condition monitoring approach in a friction drilling operation based on the vibration signal collected through accelerometer sensors. The experiment has been carried out on a CNC milling machine. In this present work, an optimal parameter in friction drilling has been used on medium carbon steel AISI 1045. The signals were collected by accelerometer sensors and Low-pass-filter was utilized to filter the raw data. Pattern recognition was identified and categorized into one of three clusters which are; tool at good, half-life and worn-out conditions. The results found that the vibration amplitude is directly proportional to tool wear and friction which support the nature of tool wear in drilling process. The hole size reduction on the workpiece can also be seen clearly with the increasing vibration on the process due to the tool wear. With the effectiveness of pattern recognition, the damages of the machine tool can be avoided to control the product quality consistently.

Keyword: Tool wear; Friction drilling; Vibration; Pattern recognition