University of HUDDERSFIELD

Centre for Precision Technologies

Micro-touch detection using Acoustic Emission Sensor on Inconel 718

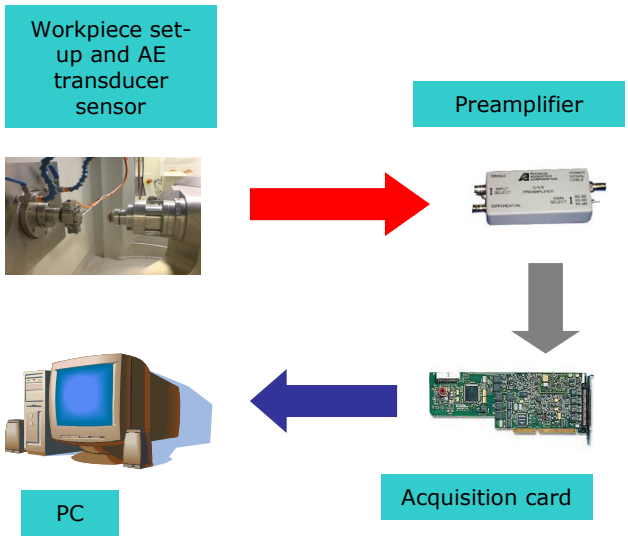
Introduction

An intelligent non-destructive method of monitoring and detecting failures in machining processes is very important. Acoustic Emission (AE) sensors has been used as a non destructive technique in the past for crack and wear detection in workpiece and machine tools. This poster presents the efficacy of using AE sensor for touch detection during probing.

Aim

This project is aimed at identifying the sensitivity of physical AE sensor in detecting a micro-touch on inconel 718 workpiece at a micro level in machining process.

Data Acquisition set-up



- Workpiece: cut sample of Inconel 718
- A wideband AE transducer sensor with piezoelectric crystal for capturing AE signals
- Preamplifier and a 2-channel PCI-2 18 bit A/D converter acquisition card used for retrieving and processing data

Experimental Procedure

- Inconel 718 was polished in a two-step strategy to a fine surface finish
- First, nickel bonded abrasive was used to reduce the surface roughness of Inconel 718 from 0.4 to 0.1 micron (Sa) to remove pre-ground marks
- In the second step, different grit sizes of silicon carbide (SiC) paste were used to achieve a surface roughness of 42nm.
- 3um SiC was applied on the tool and the spindle feed at 500 rev/min at a step of 1um to the workpiece until contact is made with the workpiece
- The result was collected and processed.

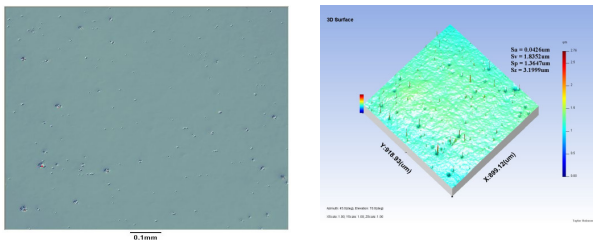


Figure 1: White light interferometer surface topography of Inconel 718 before micro-touch

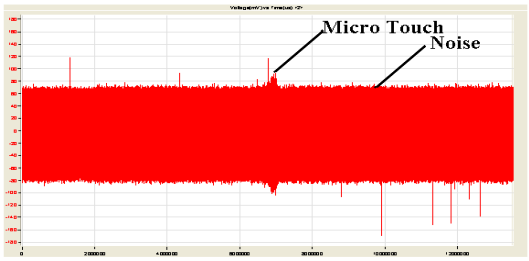


Figure 2: Raw signal showing micro-touch detected by AE sensor

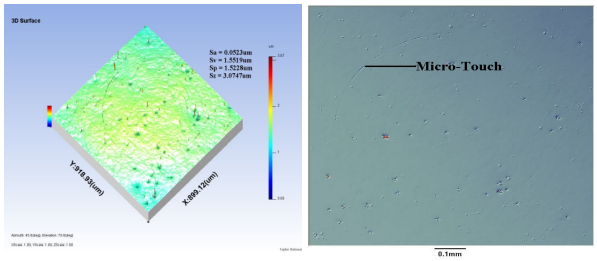


Figure 3: White light interferometer surface topography of Inconel 718 after micro-touch

Result and Discussion

- There is a peak in the AE signal as contact was made between the tool and workpiece figure 2
- The achieved surface roughness Sa before touch is 42nm and after touch is 53nm. Showing a difference of 11nm.
- The difference in the RMS value (Sq) before and after touch is insignificant. The Sq indicates the uniformity of the surface.

Conclusion and further work

- AE sensor is effective in capturing micro-touch.
- The surface defect caused by the touching grit is inconsequential when compared to the structural defects present in the workpiece.
- Based on these experiment and future trials, AE can be used as an efficient method of collecting datum for machine tool.

Research student: Stanley Obi **AMTG (Advanced Machining Technology Group** **Supervisors: Dr Xun Chen**