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# Micro-touch detection using Acoustic Emission Sensor on Inconel 718

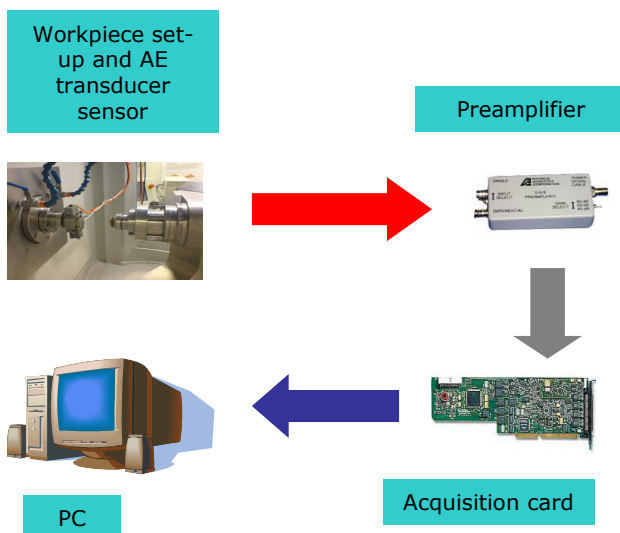
## Introduction

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 ( $S_a$ ) 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.

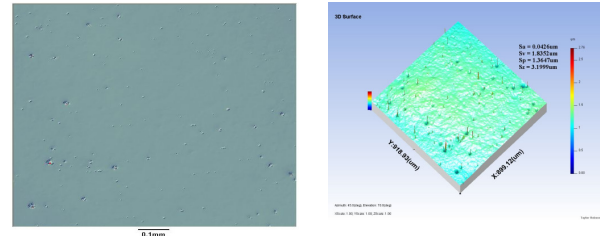


Figure 1: White light interferometer surface topography of Inconel 718 before micro-touch

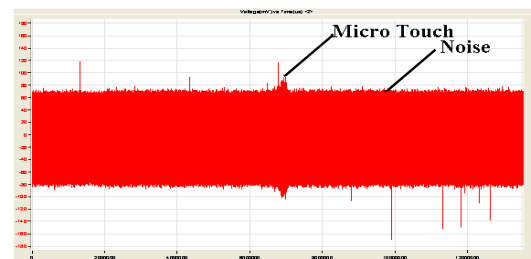


Figure 2: Raw signal showing micro-touch detected by AE sensor

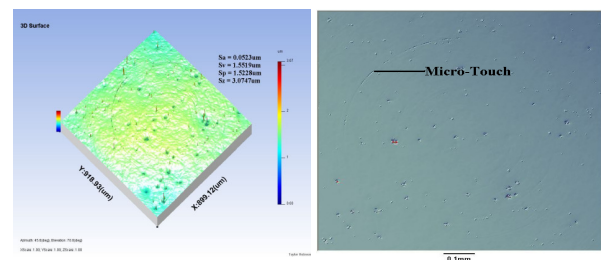


Figure 3: White light interferometer surface topography of Inconel 718 after micro-touch

## 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  $S_a$  before touch is 42nm and after touch is 53nm. Showing a difference of 11nm.
- ▶ The difference in the RMS value ( $S_q$ ) before and after touch is insignificant. The  $S_q$  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.