University of Huddersfield Repository

Obi, Stanley

Micro-Touch Detection Using Acoustic Emission Sensor On Inconel 718

Original Citation


This version is available at http://eprints.hud.ac.uk/5220/

The University Repository is a digital collection of the research output of the University, available on Open Access. Copyright and Moral Rights for the items on this site are retained by the individual author and/or other copyright owners. Users may access full items free of charge; copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational or not-for-profit purposes without prior permission or charge, provided:

- The authors, title and full bibliographic details is credited in any copy;
- A hyperlink and/or URL is included for the original metadata page; and
- The content is not changed in any way.

For more information, including our policy and submission procedure, please contact the Repository Team at: E.mailbox@hud.ac.uk.

http://eprints.hud.ac.uk/
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.

Data Acquisition set-up

Workpiece set-up and AE transducer sensor

Preamplifier

Acquisition card

PC

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 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.

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.

Supervisors: Dr Xun Chen and Prof. Liam Blunt

Research student: Stanley Obi

AMTG (Advanced Machining Technology Group)

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 ground marks
- In the second step, different grit sizes of silicon carbide (SiC) paste were used to achieve a surface roughness of 42nm.

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

Figure 4: 3D and 2D profile of inconel showing the depth of micro-touch

www.hud.ac.uk/researchfestival