



University of HUDDERSFIELD

University of Huddersfield Repository

Clough, David A, Fletcher, Simon and Longstaff, Andrew P.

Non-contact measurement and analysis of machine tool spindles

Original Citation

Clough, David A, Fletcher, Simon and Longstaff, Andrew P. (2010) Non-contact measurement and analysis of machine tool spindles. In: Future Technologies in Computing and Engineering: Proceedings of Computing and Engineering Annual Researchers' Conference 2010: CEARC'10. University of Huddersfield, Huddersfield, p. 189. ISBN 9781862180932

This version is available at <https://eprints.hud.ac.uk/id/eprint/9343/>

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/>

INTRODUCTION

With tolerances in production constantly reducing it is necessary to know the capabilities of machine tools. A major source of inaccuracy in machine tools is down to spindle errors.

It is therefore the aim of this project to assess the effect of these errors on part production depending on machine and operation, with a view to enabling easier spindle checks and therefore predictive maintenance.

TECHNOLOGIES

Eddy Current Sensor

These work using a magnetic field to sense the distance to the target



Laser Displacement Sensor

These work using a high frequency laser triangulation to sense distance to the target



Capacitance Sensors

These work using an electric field to sense the distance to the target

Accelerometer

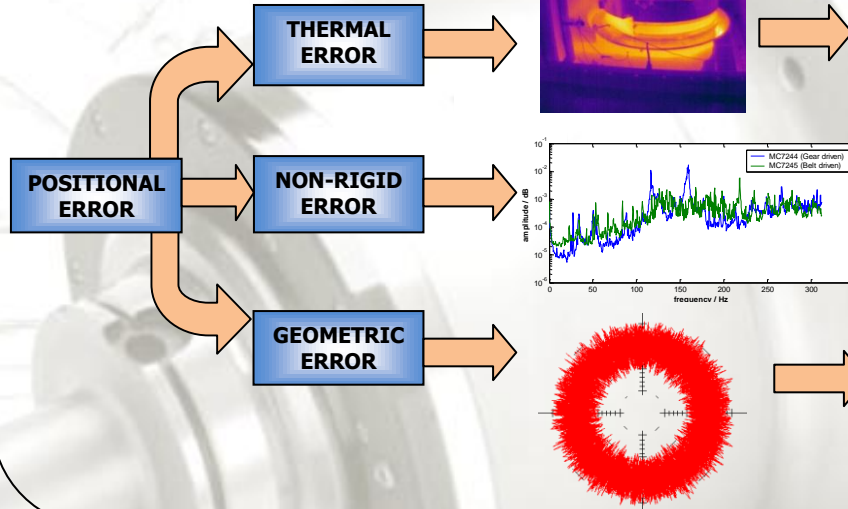
These usually use a piezoelectric material generating voltage proportional to acceleration



Requirements & Considerations

- Non-Contact Measurement Required for Dynamic Tests
- Spindle Speeds (typically up to 120000rpm)
- Sampling Frequencies necessary dependant on bearing size against spindle speed
- Spindle Sizes and tool holder interfaces

SOURCES OF ERROR

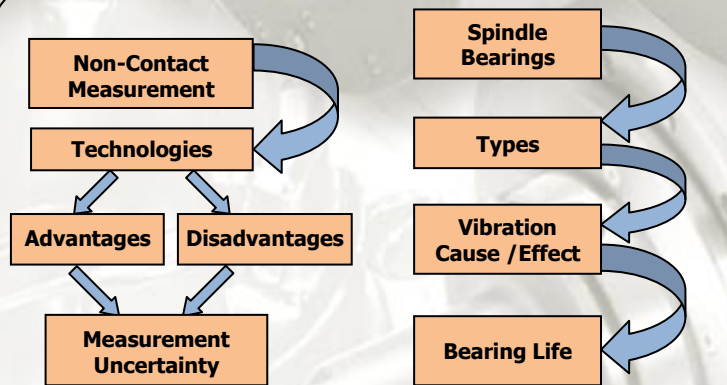


Thermal expansion due to heat generated in the spindle bearings at high speeds is the most common source of error in machine tools.

Bearing Vibration due to bearing wear / damage can cause a poor quality surface finish. The figure to the left shows spikes in noise at certain frequencies.

Spindle Position in relation to the machine tool, including axial and radial errors. The figure to the left shows an out of roundness plot

RESEARCH



CONCLUSIONS

The successful completion of this project will result in: -

- A better knowledge of the capabilities of non-contact measurement technologies including measurement uncertainty in different environments, cost etc
- A clearer understanding of the cause / effect of spindle bearing vibration
- The ability to analyse machine tool spindles in industry in order to assess capability and predict maintenance requirements

PROJECT AIM: TO INCREASE SPINDLE ANALYSIS EFFICIENCY AND ACCURACY