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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

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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

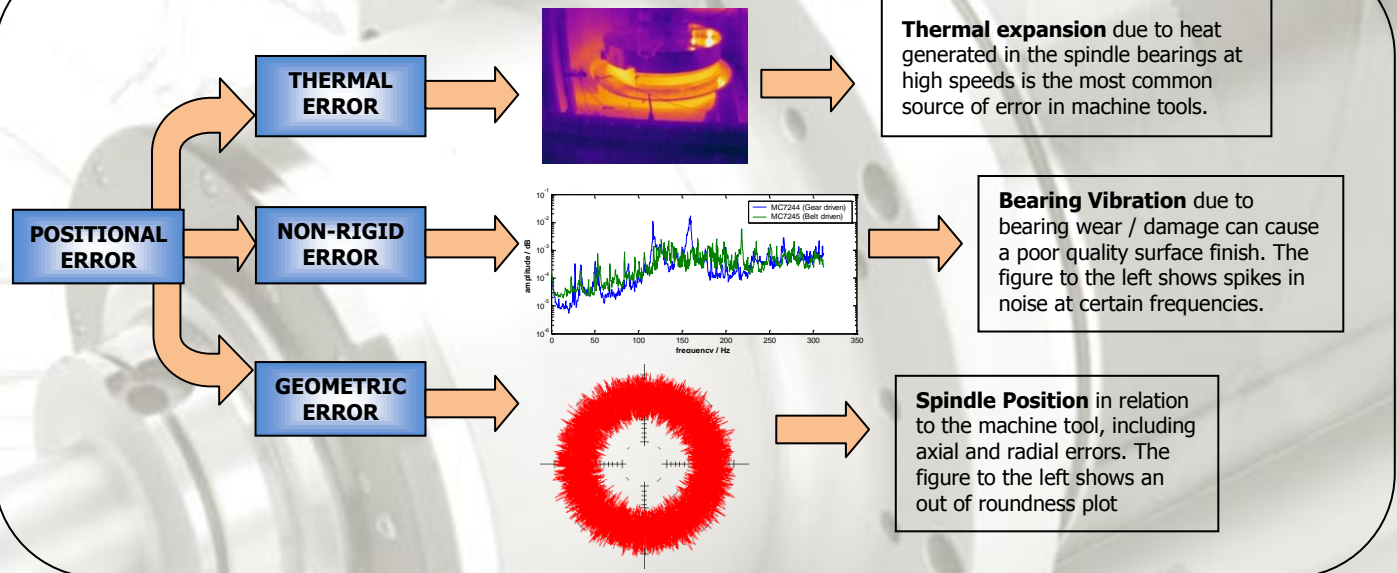
These usually use a piezoelectric material generating voltage proportional to acceleration



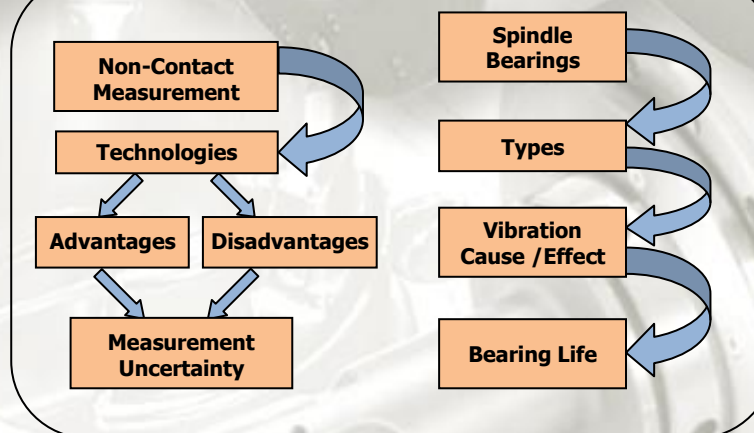
Requirements & Considerations

- 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



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