NON–CONTACT MEASUREMENT AND ANALYSIS OF MACHINE TOOL SPINDLES

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MTT MACHINE TOOL TECHNOLOGIES

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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

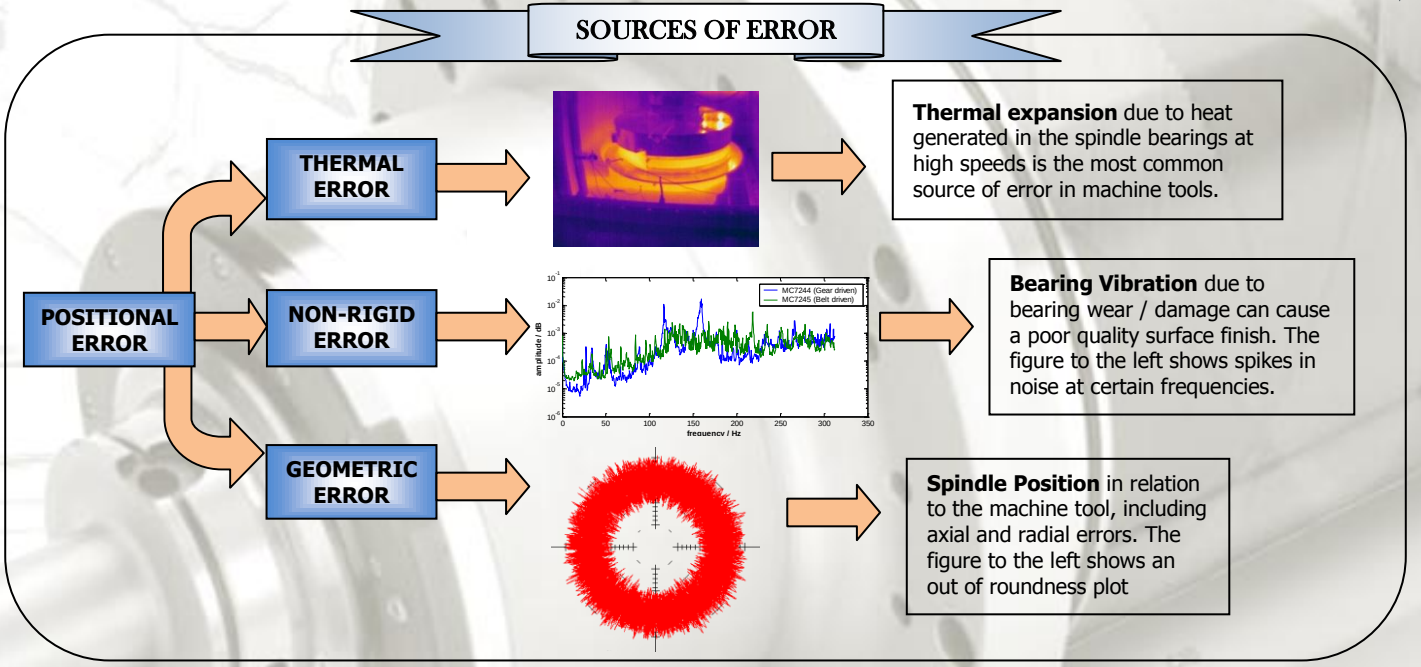
Accelerometer

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

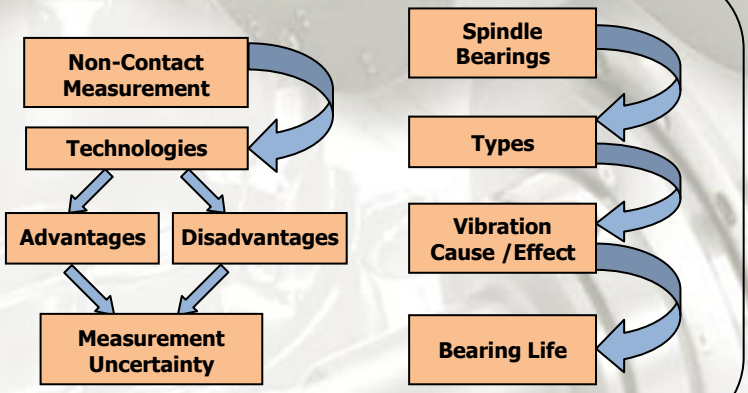


Thermal expansion due to heat generated in the spindle bearings at high speeds is the most common source of error in machine tools.

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