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Non-contact measurement and analysis of machine tool spindles

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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 due 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.

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 due 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

RESEARCH

- Thermal Error
- Positional Error
- Non-Rigid Error
- Geometric Error

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