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A NOVEL FRAMEWORK FOR ESTABLISHING A MACHINE TOOL QUALITY METRIC

Engineering Control and Machine Performance Group

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Year 1 PhD - 2010



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1. Introduction

Currently there is an absence of a best-practise framework for engineers to use when performing a full machine tool calibration. When performing the procedure of machine tool calibration it is imperative that care is taken to ensure that the results are accurate, the process is repeatable, and a full traceability chain is maintained. In addition, there is also no standard method of machine evaluation by the use of a single metric. This would be highly beneficial for reporting on the quality of the machine and the testing procedure.

ISO 17025

General Requirements for the competence of testing and calibration laboratories.

ISO 230

Test code for machine tools.

ISO 9000

Quality management systems.

ISO 10012

Measurement management systems.

Both **British** and **International Standards** must be identified and then enforced. This is a critical part to the calibration process as it is imperative for most organisations to maintain BS/ISO compliance.

2. Objectives and Goals

This project will develop a best-practise framework with beneficial features derived from well established Software Engineering & Business Methodologies. The framework will, with due reference to ISO, also provide a method for producing the evaluation metric based upon the captured data including consideration of the uncertainties within the measurement procedures. In addition to the framework, a software package will be developed that incorporates the framework and can be used throughout the calibration process from design to verification.



Renishaw XI80

Wyer Zeromatic

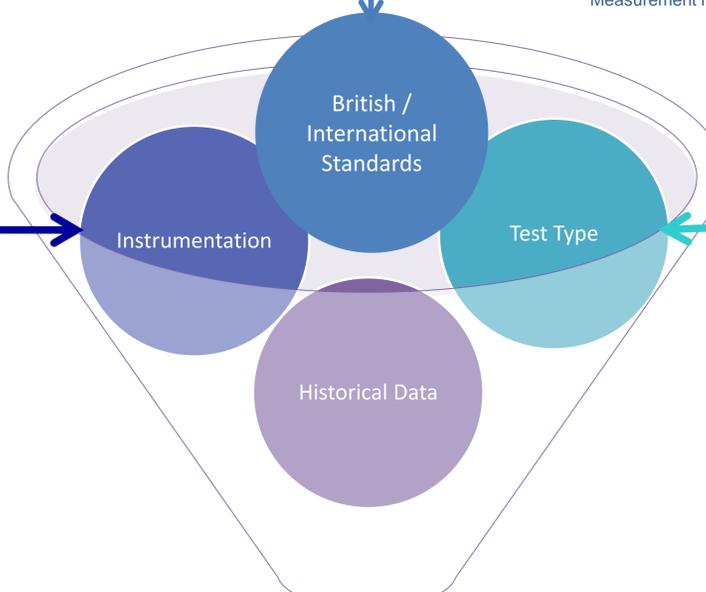


(Wyer, 2010)

Renishaw QC10

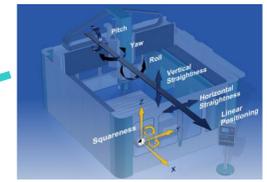


The company will typically have a wide variety of **Metrology Instrumentation** available for performing the measurement procedure. Selecting the right equipment to capture the required data for analysis is crucial to the Calibration Process.



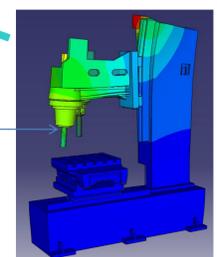
Understanding the types of **errors** that should be tested is fundamental to the success of the calibration process. If an error is never tested it is possible that it will never be corrected causing the calibration process to be a waste of time.

Geometric



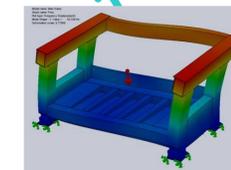
(www.machinery.co.uk, 2010)

Thermal



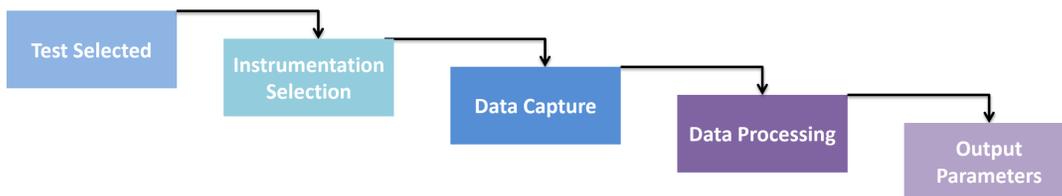
(Naeem Mian, 2010)

Non-rigid



(Andrew Longstaff, 2010)

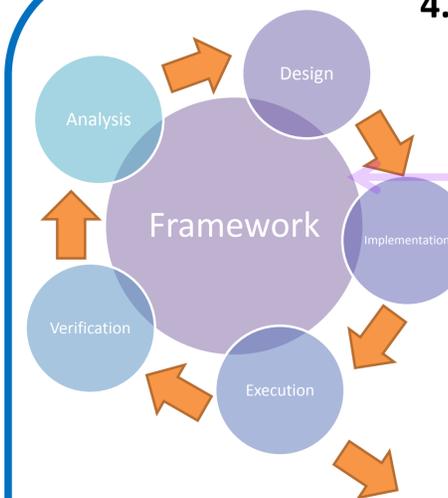
3. Current Procedure



Problems with the current procedure

- Ignorance of British and international standards as well as industrial best practises.
- Complacency with working procedure could result in efficiency gains not being realised.
- Little consideration is taken to measurement uncertainties.
- Poor design and implementation can lead to the lack of traceability.
- No indication of the machine's quality based upon the calibration process.

4. Novel Framework



How

Adopting aspects from well established **Software Engineering** and **Business Methodologies** to produce a diverse but rigorous framework to apply to the process of **Machine Tool Calibration**.

Benefits

- Framework maintains consistency with **British** and **International Standards**.
- **Quality Metric** allows for evaluation of the machine.
- Rigid design process allows for the **traceability** chain to be maintained.
- The **accuracy** and **repeatability** of the test is improved by ensuring the test's validity.
- The most **efficient** method of calibration is always taken.

Quality Metric

Output Parameters

Historical Metrology Instrumentation Data stored both centrally and remotely in an anonymous fashion to its source for other users of the same instrumentation to use.