- COMPUTING & ENGINEERING -

EFFICIENT MACHINE ERROR MEASUREMENT

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CPT

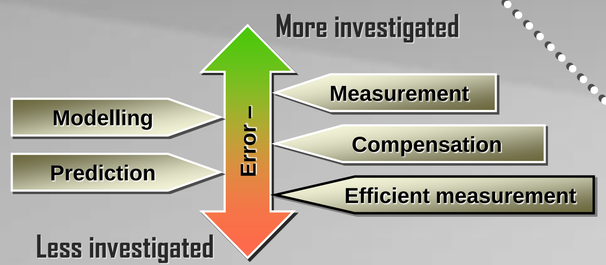
Introduction

Machine tool (MT) capability & availability are of paramount importance in modern manufacturing industry. The first is determined by measurement, the second depends on maintenance & calibration which includes measurement procedures.

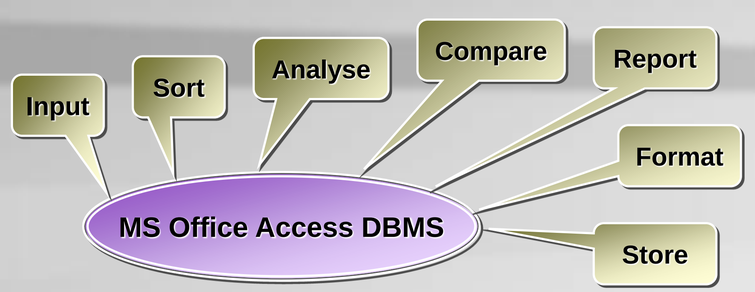
Increasing measurement efficiency leads to:

1. More accurate & repeatable results
2. Machine downtime decrease
3. Uncertainty estimation

Novelty

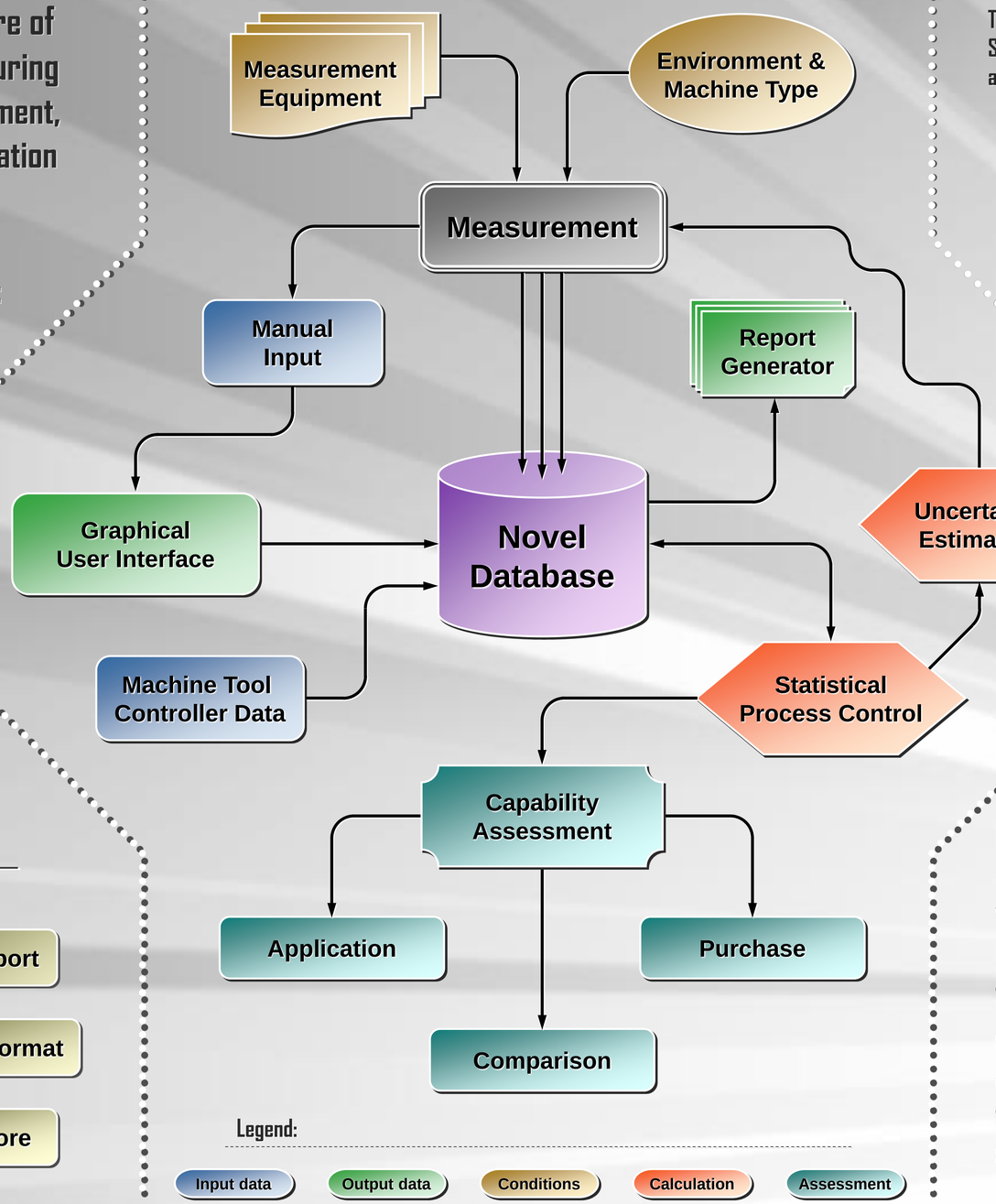


Methodology



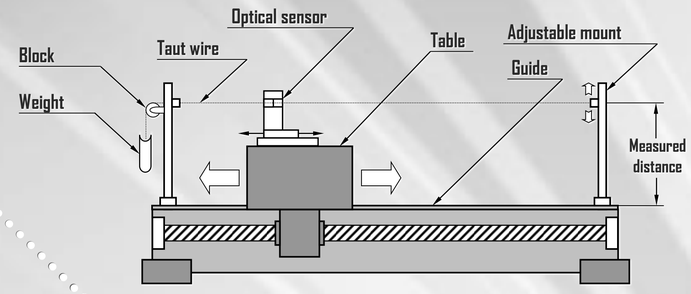
DBMS – Database Management System

Data management



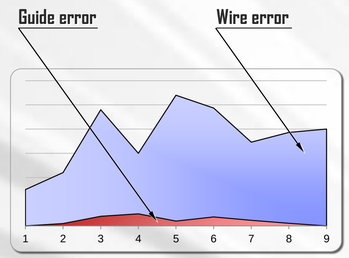
New test development

The alternative to a traditional laser measurement is proposed for a straightness Simple, precise and more effective on long ranges, the method utilizes taut wire and an optical sensor, mounted on a moving table (saddle).



Sensor displacement is measured in a number of points which form a graph showing a combined error of the guide and the wire like shown on the graph:

To remove the wire error a method of sensor shifting is used:



After measuring once another measurement is done with the wire shifted one step forward or backward, and then both wire and guide errors are calculated separately:

$$x_i = x_{i-1} + s_i - c_{i-1}$$

where x – guide error on a step i, c – combined error (measured), and s – combined error on the shifted wire

The accuracy of measurement does not depend on wire surface defects and its straightness, the only factor which affects the result is repeatability of the wire which proved to be very high. This brings final measurement error to a sub-micron level.