



SOMMACT Self Optimising Measuring MACHine Tools

Grant Agreement no.: **CP-FP 229112-2**

Start Date: 2009-09-01

Duration: 36 month



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Deliverable D2.3

Report on the TiLOR technical solution

Document title: **D2_3_Rep_on_Tilor_Draft_v03.doc**

Reference WP/Task: **WP2 / T2.3**

Lead Task beneficiary: **ISM-3D**

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Date: **2010-06-29**

Revision: **00**

Status: **Draft** Final

Nature ¹⁾: **R**

Dissemination level ²⁾: **RE**

1) **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

2) **PU** = Public, **PP** = Restricted to other programme participants, **RE** = Restricted to a group specified by the consortium, **CO** = Confidential, only for members of the consortium



Executive summary

This document reports of the TiLOR (Timely Low-Orders Recovery) technical solutions in terms of expected performances as well as of practical and economical feasibility.

Standardisation issues and adaptability to error compensation models implemented in existing CNCs are also considered.

Different approaches are analysed including:

- The use of zero thermal expansion scales;
- Approaches using extensometers to measure machine deformations and to calculate low order error corrections;
- The measurement of temperature and temperature gradients for geometry error compensation;
- The measurement of bending under load;
- The use of process intermittent measurement of simple reference artefacts;
- The use of electronic levels;
- Integration of expert systems and self-learning systems to estimate correction parameters.

For each considered technical solutions, this document (i) discusses the relevant applicability, (ii) reports on possible limitations and (iii) describes preferred applications.

The mathematical model associated to each considered technical solution is formulated and analysed.

All presented alternatives are feasible and can be implemented in many different ways. The choice of methods will depend on the basic accuracy and stability of the machine tool, the expected process disturbances, the requested accuracy and the target system cost.

This report also preliminarily proposes “tool kits” to address three different scenarios:

- low cost solutions for any type and any size of machine tools;
- high performance solutions at reasonable costs for medium to large machine tools and
- high end choice for medium to large machine tools.

For each solution, this document suggests the requirements for implementation including: (i) a description of the recommended artefacts or reference structures, (ii) the suggestions for the associated sensors with their ranges and accuracies, (iii) the suggestion for fixtures or other means of adaptation to the machine and (iv) the possible ways of interfacing with the machine tool controllers.



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