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Machine tools — Numerical compensation of geometric errors

Machines-outils — Compensation numérique des erreurs géométriques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 39, *Machine tools*, Subcommittee SC 2, *Test conditions for metal cutting machine tools*.

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Introduction

This Technical Report provides information associated with numerical compensation of geometric errors of machine tools.

Numerical compensation of geometric errors has the potential to

— increase the accuracy of parts produced on machine tools,

— reduce the costs for production of machine tools and assembly, and

— reduce the maintenance cost during the life cycle of the machine tool by adding or replacing mechanical re-fitting.

The information provided in this Technical Report might be useful to the machine tool manufacturer/supplier, the user, the metrology service provider, and the metrology instrument manufacturer.

Valuable general information on numerical compensation of geometric errors may be gathered in Schwenke, et al[12].

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Machine tools — Numerical compensation of geometric errors

1 Scope

This Technical Report provides information for the understanding and the application of numerical compensation of geometric errors for numerically controlled machine tools including:

— terminology associated with numerical compensation;

— representation of error functions output from different measuring methods;

— identification and classification of compensation methods as currently applied by different CNCs;

— information for the understanding and application of different numerical compensations.

This Technical Report does not provide a detailed description of geometric errors measurement techniques that are specified in ISO 230 (all parts) and in machine tool specific performance evaluation standards and it is not meant to provide comprehensive theoretical and practical background on the existing technologies.

This Technical Report focuses on geometric errors of machine tools operating under no-load or quasi-static conditions. Errors resulting from the application of dynamic forces as well as other errors that might affect the finished part quality (e.g. tool wear) are not considered in this Technical Report.

Deformations due to changing static load by moving axes are considered in 7.4.2.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 230-1:2012, *Test code for machine tools — Part 1: Geometric accuracy of machines operating under no-load or quasi-static conditions*

ISO 841:2001, *Industrial automation systems and integration — Numerical control of machines — Coordinate system and motion nomenclature*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 841:2001, ISO 230-1:2012 and the following apply.

3.1
machine tool coordinate system
machine tool reference coordinate system
right-hand rectangular system with the three principal axes labelled X, Y, and Z, with rotary axes about each of these axes labelled A, B, and C, respectively

[SOURCE: ISO 841:2001, 4.1, modified]

Note 1 to entry: ISO 230-1:2012, Annex A provides useful information on machine tool coordinate system and position and orientation errors.

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