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Statistical methods in process management — Capability and performance —

Part 7: Capability of measurement processes

Méthodes statistiques dans la gestion de processus — Aptitude et performance —

Partie 7: Aptitude des processus de mesure

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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This document was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 4, *Applications of statistical methods in product and process management*.

This second edition cancels and replaces the first edition (ISO 22514-7:2012), which has been technically revised.

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The main changes compared to the previous edition are as follows:

— use of the MPE values in the calculations;

— revision of the calculation of the linearity, with amendments in the example in Clause A.1;

— addition of a method to calculate the capability when the specifications of the characteristic of interest is defined as a one-sided specification (new 9.3).

A list of all parts in the ISO 22514 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The purpose of a measurement process is to produce measurement results obtained from defined characteristics on parts or processes. The capability of a measurement process is derived from the statistical properties of measurements from a measurement process that is operating in a predictable manner.

Calculations of capability and performance indices are based on measurement results. The uncertainty of the measurement process used to generate capability and performance indices are estimated before the indices can be meaningful. The actual measurement uncertainty should be adequately small.

If the measurement process is used to judge whether a characteristic of a product conforms to a specification or not, the uncertainty of the measurement process is compared to the specification itself. If the measurement process is used for process control of a characteristic, the uncertainty should be compared with the process variation. Limits of acceptability are stated for both cases.

The quality of measurement results is given by the uncertainty of the measurement process. This is defined by the statistical properties of multiple measurements, or estimates of properties, based on the knowledge of the measurement process.

The methods specified in this document address the implementation uncertainty (for more information on implementation uncertainty, see ISO 17450-2). Therefore, they are only useful if it is known that the method uncertainty and the specification uncertainty are small compared to the implementation uncertainty. This document specifies methods to define and calculate capability indices for measurement processes based on estimated uncertainties. The approach given in ISO/IEC Guide 98-3 (GUM) is the basis of this approach.

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Statistical methods in process management — Capability and performance —

Part 7: Capability of measurement processes

1 Scope

This document defines a procedure to validate measuring systems and a measurement process in order to state whether a given measurement process can satisfy the requirements for a specific measurement task with a recommendation of acceptance criteria. The acceptance criteria are defined as a capability figure (C_{MS}, C_{MP}) or a capability ratio (Q_{MS}, Q_{MP}).

NOTE This document follows the approach taken in ISO/IEC Guide 98-3 (GUM), and establishes a basic, simplified procedure for stating and combining uncertainty components used to estimate a capability index for an actual measurement process.

This document is primarily developed to be used for simple one-dimensional measurement processes, where it is known that the method uncertainty and the specification uncertainty are small compared to the implementation uncertainty. It can also be used in similar cases, where measurements are used to estimate process capability or process performance. It is not suitable for complex geometrical measurement processes, such as surface texture and position measurements that rely on several measurement points or simultaneous measurements in several directions.

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2 Normative references

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 3534-2:2006, *Statistics — Vocabulary and symbols — Part 2: Applied statistics*

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 5725-3, *Accuracy (trueness and precision) of measurement methods and results — Part 3: Intermediate measures of the precision of a standard measurement method*

ISO 5725-4, *Accuracy (trueness and precision) of measurement methods and results — Part 4: Basic methods for the determination of the trueness of a standard measurement method*

ISO 5725-5, *Accuracy (trueness and precision) of measurement methods and results — Part 5: Alternative methods for the determination of the precision of a standard measurement method*

ISO 5725-6, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

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