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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 40681.2-2023

**Statistical methods in monitoring process capability and
performance - Part 2: Process capability and performance of
time-dependent process models**

生产过程能力和性能监测统计方法 第2部分：时间相依过程模型的过程能力与性能

(English Translation)

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents" Drafting:

This document is Part 2 of GB/T 40681 "Statistical Methods for Monitoring Capability and Performance of Production Processes": GB/T 40681 has been released the following sections are included:

---Part 2: Process capabilities and performance of time-dependent process models;

---Part 4: Process capability estimation and performance measurement;

---Part 5: Process capability and performance estimation of counting characteristics;

---Part 6: Multivariate normal process capability analysis:

This document is modified to adopt ISO 22514-2:2017 "Capability and performance of statistical methods in process management Part 2: Time dependence" Process capabilities and performance of process models:

Compared with ISO 22514-2:2017, this document has made the following structural

adjustments:

---Added the title "3:1 Terms and Definitions", 3:2 and 3:3 correspond to 3:1 and 3:2 in ISO 22514-2:2017:

The technical differences between this document and ISO 22514-2:2017 and their reasons are as follows:

---Replaced ISO 3354-2 (see Chapter 2 and Chapter 3) with normatively cited GB/T 3358.2 to facilitate readers' understanding of this document statistical concepts;

---The explanation of the symbol "C4" has been changed (see 3.1), the original explanation is not clear;

---The explanation of the symbol "d2" has been changed (see 3.1): The original explanation is not clear:

The following editorial changes have been made to this document:

---In order to coordinate with the existing standards, the name of the standard is changed to "Statistical Methods for Monitoring Production Process Capacity and Performance - Part 2: Time Dependent process capabilities and performance";

---Replaced ISO 3534-1 with the informative GB/T 3358.1, and replaced ISO 7870-2 with GB/T 17989.2, GB/T 40681.4 replaced ISO 22514-4:2016;

---Deleted the comment in the original text, which can easily cause confusion (see Chapter 1);

---Added explanations of dots and horizontal lines in b) and c) in Figures 1 to 8, the original text is missing;

---Change "xi is the order statistic" in equation (12) in Table 3 to "x(i) is the order statistic";

---Deleted the last paragraph in 6:1:3 and duplicated the second paragraph in 6:1:4;

---Suppose equation (19) " $\sigma_{st} = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$ " changed to " $\sigma_{st} = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (x_i - \bar{x})^2}$ ";

Please note that some content in this document may be subject to patents: The publisher of this document assumes no responsibility for identifying patents:

Introduction

Process capability analysis is a common statistical tool in statistical process control, used to describe the production or processing process to meet product quality requirements:

ability: GB/T 40681 is a series of standards for statistical methods for production process capability and performance monitoring, and is planned to consist of 8 parts:

---Part 1: General principles and concepts: The purpose is to describe the basic principles of capability and performance of manufacturing processes:

---Part 2: Process capabilities and performance of time-dependent process models: The purpose is to show when the parameters of product or process characteristics are related to A method of estimating process capability or performance statistics for that characteristic when time-dependent:

---Part 3: Equipment performance research based on component measurement data: The purpose is to provide continuous production of parts under repeatable conditions Statistical method of short-term process capability of equipment:

---Part 4: Process capability estimation and performance measurement: The purpose is to present commonly used process capability and performance measurement methods:

---Part 5: Process capability and performance estimation of counting characteristics: The purpose is to give a process capability for calculating counting characteristics and Performance indicator methods:

---Part 6: Multivariate normal process capability analysis: The purpose is to give a set of process or product characteristics that obey a multivariate normal distribution Statistical methods for process performance and capabilities:

---Part 7: Measuring process capabilities: The purpose is to provide methods for verifying whether the measurement system and measurement process can meet specific measurement requirements:

program:

---Part 8: Equipment performance analysis of multi-state production processes: The purpose is to give the short-term capability to verify the production process, that is, the equipment Performance index method:

Standardization bodies at all levels as well as industry have developed many standards regarding process capability/performance: They all assume that the process is under statistical control state, obeying a stationary normal distribution: However, a comprehensive analysis of the production process shows that it is difficult to maintain the process over time:

This state:

Based on this fact, this document gives a statistical method for the process capability/performance of a production process under a series of time-varying models:

Law: These models are classified according to the stability of the mean and variance, i.e. whether they are constant, vary systematically, or vary randomly: because Rather, process capability/performance can be estimated based on the distribution of processes following different shapes over time:

Detailed methods for calculating process capability/performance index are given in other parts of this series of standards: It should be noted that in when calculating the process capability index given in this document, only a point estimate of its true value is obtained: Therefore, it is recommended to calculate and report confidence intervals for the index:

Statistical methods for production process capability and performance monitoring Part 2: Time-dependent process models Process capabilities and performance

1 Scope

This document provides methods for estimating process capabilities or performance statistics for a product or process characteristic when its parameters are time-dependent:

Law: The distribution models of characteristics can be divided into 8 categories, and this document also gives calculation formulas for estimating the position and divergence parameters of each type:

The statistical methods described in this document are only applicable when the quality characteristics are continuous data and are applicable to any industrial or economic sector: production process:

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text: Among them, the dated quotations for undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to this document:

GB/T 3358.2 Statistical vocabulary and symbols Part 2: Applied statistics (GB/T 3358.2-2009, ISO 3534-2:

2006,IDT)

ISO 22514-1 Competence and performance in statistical methods in process management Part 1: General principles and concepts (Statistical cepts)

3 Terms, definitions, symbols and abbreviations

3.1

Terms and definitions the terms and definitions defined in GB/T 3358.2 and ISO 22514-1 apply to this document: