
Control charts —

Part 9:
**Control charts for stationary
processes**

Cartes de contrôle —

Partie 9: Cartes de contrôle de processus stationnaires



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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions, and abbreviated terms and symbols	1
3.1 Terms and definitions.....	1
3.2 Abbreviated terms and symbols.....	2
3.2.1 Abbreviated terms.....	2
3.2.2 Symbols.....	2
4 Control charts for autocorrelated processes for monitoring process mean	3
4.1 General.....	3
4.2 Residual charts.....	3
4.3 Traditional control charts with adjusted control limits.....	6
4.3.1 Modified EWMA chart.....	6
4.3.2 Modified CUSUM chart.....	8
4.4 Comparisons among charts for autocorrelated data.....	8
5 Monitoring process variability for stationary processes	9
6 Other approaches to deal with process autocorrelation	11
Annex A (informative) Stochastic process and time series	12
Annex B (informative) Performance of traditional control charts for autocorrelated data	15
Bibliography	20

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.

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*.

A list of all parts in the ISO 7870 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.

Introduction

Statistical process control (SPC) techniques are widely used in industry for process monitoring and quality improvement. Various statistical control charts have been developed to monitor the process mean and variability. Traditional SPC methodology is based on a fundamental assumption that process data are statistically independent. Process data, however, are not always statistically independent from each other. In the industry for continuous productions such as the chemical industry, most process data on quality characteristics are self-correlated over time or autocorrelated. In general, autocorrelation can be caused by the measurement system, the dynamics of the process, or both. In many cases, the data can exhibit a drifting behaviour. In biology, random biological variation, for example the random burst in the secretion of some substance that influences the blood pressure, can have a sustained effect so that several consecutive measurements are all influenced by the same random phenomenon. In data collection, when the sampling interval is short, autocorrelation, especially the positive autocorrelation of the data, is a concern. Under such conditions, traditional SPC procedures are not effective and appropriate for monitoring, controlling and improving process quality.

Autocorrelated processes can be classified in two kinds of processes, based on whether they are stationary or nonstationary.

- 1) Stationary process – a direct extension of an independent and identically distributed (i.i.d.) sequence. An autocorrelated process is stationary if it is in a state of “statistical equilibrium”. This implies that the basic behaviour of the process does not change in time. In particular, a stationary process has identical means and variances.
- 2) Nonstationary process.

Detailed information about stochastic process and time series can be found in [Annex A](#).

To accommodate autocorrelated data, some SPC methodologies have been developed. Mainly, there are two approaches. The first approach is to use a process residual chart after fitting a time series model or other mathematical model to the data. Another more direct approach is to modify the existing charts, for example by adjusting the control limits based on process autocorrelation.

The aim of this document is to outline the major process control charts for monitoring both of the process mean and the process variance when the process is autocorrelated.

Control charts —

Part 9:

Control charts for stationary processes

1 Scope

This document describes the construction and applications of control charts for stationary processes.

2 Normative references

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

3 Terms and definitions, and abbreviated terms and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3534-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

autocovariance

internal covariance between members of series of observations ordered in time

3.1.2

control charts for autocorrelated processes

statistical process control charts applied to autocorrelated processes