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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

Exactitude (justesse et fidélité) des résultats et méthodes de mesure

Partie 2: Méthode de base pour la détermination de la répétabilité et de la reproductibilité d'une méthode de mesure normalisée

FDIS stage

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: + 41 22 749 01 11

~~Email:~~

E-mail: copyright@iso.org
Website: www.iso.org

Published in Switzerland~~.~~

Contents

Foreword

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This document was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 6, *Measurement methods and results*.

This third edition cancels and replaces the second edition (ISO 5725-2:2019), which has been technically revised.

The main changes are as follows:

— several typos have been corrected;

— subscripts have been made consistent;

— references have been updated

A list of all parts in the ISO 5725 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

ISO 5725 uses two terms, “trueness” and “precision”, to describe the accuracy of a measurement method. “Trueness” refers to the closeness of agreement between the arithmetic mean of a large number of test results and the true or accepted reference value. “Precision” refers to the closeness of agreement between test results.

General consideration of these quantities is given in ISO 5725-1 and so is not repeated in this document. ISO 5725-1 should be read in conjunction with all other parts of ISO 5725, including this document, because it gives the underlying definitions and general principles.

This document is concerned solely with estimating the repeatability standard deviation and reproducibility standard deviation based on an interlaboratory design in which each laboratory conducts a number of independent measurements of the same sample under repeatability conditions. There are other designs (such as nested, factorial or split-level experiments) which can be used for the estimation of precision: these are not dealt with in this document but rather are the subject of other parts of ISO 5725. Nor does this document consider any other measures of precision intermediate between the two principal measures; those are the subject of ISO 5725-3.

In certain circumstances, the data obtained from an experiment carried out to estimate precision are used also to estimate trueness and can be used to evaluate measurement uncertainty. The estimation of trueness is not considered in this document; all aspects of the estimation of trueness are the subject of ISO 5725-4. The evaluation of measurement uncertainty, using inter-laboratory estimates of trueness and precision, is the subject of ISO 21748.

Annex C~~Annex C~~ provides practical examples of estimating the precision of measurement methods by experiment. Worked examples are given to demonstrate balanced uniform sets of test results, although in one example a variable number of replicates per cell were reported (unbalanced design) and in another some data were missing. This is because an experiment designed to be balanced can turn out to be unbalanced. Stragglers and outliers are also considered.

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

1 Scope

1.1 1.1 — This document

— — amplifies the general principles for designing experiments for the numerical estimation of the precision of measurement methods by means of a collaborative interlaboratory experiment,

— — provides a detailed practical description of the basic method for routine use in estimating the precision of measurement methods, and

— — provides guidance to all personnel concerned with designing, performing or analysing the results of the tests for estimating precision.

NOTE Modifications to this basic method for particular purposes are given in other parts of ISO 5725.

1.2 1.2 — It is concerned exclusively with measurement methods which yield measurements on a continuous scale and give a single value as the test result, although this single value can be the outcome of a calculation from a set of observations.

1.3 1.3 — It assumes that in the design and performance of the precision experiment, all the principles as laid down in ISO 5725-1 are observed. The basic method uses the same number of test results in each laboratory, with each laboratory analysing the same levels of test sample; i.e. a balanced uniform-level experiment. The basic method applies to procedures that have been standardized and are in regular use in a number of laboratories.

1.4 1.4 — The statistical model of ISO 5725-1:2023, Clause 5, is accepted as a suitable basis for the interpretation and analysis of the test results, the distribution of which is approximately normal.

1.5 1.5 — The basic method, as described in this document, (usually) estimates the precision of a measurement method:

a) a) — when it is required to determine the repeatability and reproducibility standard deviations as defined in ISO 5725-1;

b) b) — when the materials to be used are homogeneous, or when the effects of heterogeneity can be included in the precision values;

c) c) — when the use of a balanced uniform-level layout is acceptable.

1.6 1.6 — The same approach can be used to make a preliminary estimate of precision for measurement methods which have not reached standardization or are not in routine use.