

JJF

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**Evaluation and expression of uncertainty in measurement
(English Translation)**

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1 Scope

a) The general method for evaluating and expressing measurement uncertainty specified in this specification is applicable to measurement fields of various accuracy levels, such as.

1) The establishment of national measurement standards and measurement standards at all levels and the comparison of values;

2) The setting value of standard substance and the release of standard reference data;

3) Preparation of technical documents such as measurement methods, verification procedures, verification system tables, calibration specifications, etc.;

4) Expression of measurement results and measurement capabilities in measurement qualification recognition, measurement confirmation, quality certification, laboratory accreditation;

5) Calibration, verification and other measurement services of measuring instruments;

6) Measurement in the fields of scientific research, engineering, trade settlement, medical and health care, safety protection, environmental monitoring, resource protection.

b) This specification mainly concerns the measurement uncertainty of the measured estimated value that is clearly defined and can be characterized by a unique value. As for the measured quantity value that appears as a distribution of a series of values or depends on one or more parameters (for example, with time as the parameter variable), the description of the measured quantity value shall be a set of values, the distribution and relationship shall be given.

c) This specification is also applicable to the evaluation and expression of uncertainties in the design and theoretical analysis of experiments, measuring methods, measuring devices, complex components and systems.

d) This specification mainly applies to the following conditions.

- 1) It can be assumed that the probability distribution of the input is symmetrically distributed;
- 2) It can be assumed that the probability distribution of the output is approximately normal distribution or t distribution;
- 3) The measurement model is a linear model, a model that can be converted into a linear model, or a model that can be approximated by a linear model.

2 Normative references

This specification refers to the following documents.

JJF 1001-2011 General terms in metrology and their definitions

GB/T 70-2008 Numerical rounding rules and expression and judgment of limit values

GB 3101-1993 General principles concerning quantities, units and symbols

GB/T 4883-2008 Statistical interpretation of data - Detection and treatment of outliers in the normal sample

ISO/IEC GUIDE 98-3:2008 Uncertainty of measurement - Part 3. Guide to the expression of uncertainty of measurement

ISO 3534-1:2006 Statistics - Vocabulary and symbols - Part 1. General statistical terms and terms used in probability

For dated references, only the dated versions apply to this specification; for undated references, the latest versions (including all amendments) apply to this specification.

3 Terms and definitions

The metrology terminology in this specification adopts JJF 1001-2011, which is based on the revision of international standard ISO/IEC GUIDE 99:2007 (the third edition of VIM). The probability and statistical terms used in this specification basically adopt the terms and definitions of the international standard ISO 3534-1:2006.

3.1 Measured [JJF 1001,4.7]

The amount to be measured.

3.2 Measurement results, result of measurement [JJF 1001,5.1]

A set of measured quantity values as assigned along with other useful relevant information.

3.3 Measured quantity value [JJF 1001,5.2]

Also called the measured value quantity, referred to as measured value.

Represents the magnitude of the measurement result.

3.4 Measurement precision [JJF 1001, 5.10]

Referred to as precision

Under the specified conditions, the degree of agreement between the measured indication value and the measured quantity value through repeated measurement of the same or similar measured object.

4 Evaluation method of measurement uncertainty

The method for evaluating the measurement uncertainty in this specification is called GUM method for short. The general process of evaluating measurement uncertainty with the GUM method is as shown in Figure 1.

4.1 Analysis of sources of measurement uncertainty

4.1.1

The measured quantity value obtained by the measurement is only the estimated value to be measured. Random effects and system effects in the measurement process will cause measurement uncertainty.

4.1.3

The correction is only to compensate the system error; the correction value is uncertain. When evaluating the measurement uncertainty of the corrected measured estimated value, it shall consider the uncertainty introduced by the correction.

4.1.4

Errors or sudden factors in the measurement are not a source of measurement uncertainty.
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4.2 Establishment of measurement model

4.2.1

In the measurement, when the measured (i.e. output quantity) Y is determined by N other quantities $X_1, X_2, \dots, X_N$ (i.e. input quantity) through the function f , the formula (1) is called the measurement model.

4.2.2

In simple direct measurement, the measurement model may be as simple as the formula (3).

4.2.4

The measurement model for physical quantity measurement is generally determined based on physical principles. For non-physical quantities or when it cannot be determined by physical principles, the measurement model can also be determined by experimental methods;

4.2.5 If the data indicates that the measurement function fails to model the

measurement process to the accuracy required for measurement, additional input must be added to the measurement model to reflect the lack of knowledge of the amount of influence.

4.3.1 Overview

4.3.1.1

The measurement uncertainty is generally composed of several components; each component is characterized by the standard deviation estimate of its probability distribution, called the standard uncertainty. Each component represented by standard uncertainty is represented by u_i .

4.3.3 Type B evaluation of standard uncertainty

4.3.3.1

The method of type B evaluation is to judge the measured possible value interval $[-a, +a]$ based on the relevant information or experience, assuming the probability distribution of the measured quantity value, according to the probability distribution and the required probability p , to determine k , then the standard uncertainty u_B of type B can be obtained by formula (21).

Where.

4.3.3.2

The half width a of interval is generally determined based on the following information.

4.3.3.3 Determination method of k value

4.3.3.4 The probability distribution is assumed in the following different situations.