Comments on the contents of the dependability terminology standard

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Abstract. Aim. *The long-lasting discussion of the dependability-related terminology is evidence of the relevance of the subject matter and, at the same time, identifies difficulties associated with finding middle-ground solutions. This article aims to eliminate the shortcomings associated with the application of the conventional, yet insufficiently substantiated terms in the GOST 27.002-2015 interstate standard. Correct understanding and use of terms are of great significance.* **Methods.** *The paper lays down the requirements for the used terminology in terms of internal logical consistency and identifies specific terms, the use of which violates such requirements. Several terms from the standard underwent a logical and terminological analysis based on statutory requirements and the semantic meanings of such terms.* **Findings and conclusions.** *The paper states that the perfection of terms, definitions and basic concepts comes down to the fact that a standard shall not contain synonyms, homonyms and terms previously adopted in other standards with new or modified definitions. The terminological analysis helped to identify the terms whose use is unjustified. It was noted that the term "dependability" is clearly defined as a property, whose content and meaning are set forth with adequate substantiation. However, other definitions of dependability in the standard are not substantiated. Several cases of the use of terms that do not comply with the proposed requirements were considered, e.g., "dependability estimation", "dependability indicators estimation", "state of item", etc.*

Keywords: *dependability, terminology, requirements for terms.*

Introduction

In the Russian Federation, an interstate standard [1] was into action that is used practically in all technical fields in the country. It should be noted that the users of the standard also include college students majoring in various branches of technology.

The author responded to the call of the Editorial Board to take part in the discussion of the dependability-related terminology.

In this paper, based on regulatory documents and logical terminological analysis, requirements are defined that, in the author's opinion, the used terms must comply with. Then, several use cases of terms are noted that do not comply with such requirements. At the same time, the author does not engage into a discussion regarding what concepts and their definitions are to be.

Source overview

As of late, a number of papers have been published that are dedicated to the dependability-related terminology. Many authors focused on the definition of the term "dependability". However, the standard [1] contains many other terms and definitions that, in the author's opinion, require rethinking and improvement. The most thorough publication in this subject matter is [8]. It sets forth the main principles that a general dependability-related terminology standard is to conform to: continuity in relation to preceding similar standards, alignment with other general technical standards, close association with international standards, internal consistency and logical coherence. In [8], the concept of dependability is examined subject to the conditions of operation, maintenance, storage and transportation. It is concluded that the definition of the term "dependability" is to reflect its nature as a comprehensive property.

In [5], the discussion continues on a limited number of concepts and terms, namely "entity", "item", "failure", "property", "calculation", "estimate", etc. For instance, it is concluded that the term "dependability estimation" should not be used. It is noted that according to standard [2] estimation (estimator) is understood as the statistics used for the purpose of estimating a certain parameter. It is concluded that the terms "estimate" and "dependability estimation" should not be introduced into the national dependability standard.

In [7], the terms "item" is analyzed that is used in the fundamental standard [1]. The term's history is examined, a list of the types of items is provided, the term "entity" is discussed that is used as a synonym of "item". It is clarified that the concept of "item" may cover hardware and software.

The author of [9] focused on the definition of the term "dependability", in which the author sees two parts, i.e. the functional and the parametric. The paper demonstrates the possibility of a common approach to the functional and parametric dependability, which, in the author's opinion, would allow refining the definition of dependability as a property. The requirement is substantiated for a clear interpretation of the term "dependability".

In [4], the current system of dependability-related terms is criticized and substantiated, in the author's opinion, proposals as to the modification of fundamental terms are suggested. For instance, "dependability" is interpreted not as a property, but as a science; reliability, maintainability, storability, durability are interpreted not as properties, but as dependability indicators (i.e., indicators of a science?), etc. The contradiction is eliminated by introducing the term "item": "item dependability", "item reliability", etc.

Methods

First, let us dwell upon the general principles and distinctive features of their application in the area of dependability. The author agrees that "if the general principles are agreed upon first, then it will be easier to come to solutions for specific terms and definitions" [8].

The Standardization Recommendations [3] state that the terminology is to be unambiguous and self-consistent. The Recommendations set forth the requirements a used term is to comply with. A term must express only one concept and one concept must be expressed by only one term. Two or more definitions of one concept are not acceptable. Violations of such concordance cause polysemy (homonymy) and synonymy.

In the introduction to the standard [1] it is stated that, for each concept, a single standardized term is defined, while Section 1 also states that synonymous terms cannot be applied. It is obvious that the terms, definitions and basic concepts set forth in this standard are to comply with those requirements. Thus, the perfection of terms, definitions and basic concepts, in the author's opinion, comes down to the following:

1) all terms, definitions and basic concept set forth in the standard are to be unambiguous and self-consistent;

2) all terms, definitions and basic concepts set forth in the standard are to be consistent with other national standards and not contradict preceding standards.

That means that a national standard **shall not contain**:

1) different terms, definitions and basic concepts with identical scope and meaning (must not contain synonyms);

2) one and the same term, definition and basic concept with different scope and meaning (must not contain homonyms);

3) terms previously adopted in other national standards with new, modified scope.

When the above deviations and discrepancies are the case, the standard must contain the required explanations and justifications.

Given the above, some remarks regarding standard [1] can be made that could later provide the foundation for subsequent proposals for amendments aimed at improving the standard.

First of all, the meaning of the basic concepts in the name of the standard are to be clarified. Those include the concept of "term", "definition" and "dependability". The definitions of the first two concepts are given in [3]:

Term, a word or phrase belonging to a certain field of knowledge chosen or created for the purpose of expressing a concept and requiring a definition.

Definition, a logical technique that allows distinguishing, finding and representing a relevant concept.

For a better understanding of the above concepts, let us provide their definitions based on information from general purpose dictionaries and encyclopedias.

Term, a word or phrase that clearly designates a certain concept used in a special field of science, technology, art.

Definition, a wording that clarifies the meaning, content, essence, primary characteristic features of the terms using known and meaningful words.

The term "dependability" is defined in item 3.1.5 of standard [1]:

Dependability is the property of an object to maintain in time the ability to perform the required functions in the specified modes and conditions of operation, maintenance, storage and transportation.

In this definition of the term "dependability", the essence of the term is explained and its content is defined as a property. This definition is unambiguous. No other interpretations, methods, means, variants, varieties of the definition of the term "dependability" must exist.

Thus, the terms, definitions and basic concepts used in standard [1] must comply with the above requirements, including "term", "definition", "dependability", featured in the title of the standard must also comply with such requirements.

Results

Let us take the liberty to note the contradictory and incorrect use of certain terms, definitions and concepts in the standard [1].

1. "Methods of dependability definition"

The standard mentions three methods of defining the dependability in the following items:

3.7.9 computational method of dependability definition;

3.7.10 computational and experimental method of dependability definition;

3.7.11 experimental method of dependability definition.

Thus, in this standard, the term "dependability" is defined as a property (item 3.1.4) and three more various methods of defining this term, in which no definitions (wording) is given. Therefore, the above methods of defining the term "dependability" are meaningless.

The term "method of dependability definition" is not included in the alphabetical index.

2. Use of the concept of "definition"

The concept of "definition" is used in the following items:

3.7.6 definition of numerical values;

3.7.8 definition of compliance with …

No definition of "dependability estimation and "dependability supervision" is given. Apparently, the concept of "definition" is used in a different sense that is not explained in the standard.

3. "Dependability estimation"

The standard uses the concept of "dependability estimation":

3.7.6 Dependability estimation as the definition of the numerical values of the item's dependability;

3.7.10 Method of dependability estimation …

As "Dependability" is a property, the above terms imply the "property estimation". The definition of the term "property estimation" is not given; the concept is not defined in either regulatory documents, or other sources. The introduction of the term "dependability estimation" by the authors of the standard was not justified.

It should be noted that, according to the standard [2], "estimate" is a statistic used for the purpose of estimating a parameter that is a feature of a family of distributions. Thus, the terms "estimate" is defined in standard [2], according to which parameters, rather than properties (!) are defined.

4. "State"

This term is used in Section "3.2 States". This section is the only one, whose title consists of a term, whose definition is not given. In order to provide a comprehensive idea of this shortcoming, let us note the sections, whose names are made of defined terms:

3.4 Failures, defects, damage

3.5 Maintenance, restoration and repairs

3.6 Dependability indicators

3.8 Redundancy

3.9 Dependability testing

However, section "3.2. States" is an exception from the rule; the term in the title is not defined.

The term "state" is not included in the alphabetical index.

5. "State of item"

In section "3.2 States", various states are mentioned that are defined through the term "state of item". There are more than 10 such states. Therefore, the term "state of item" can be considered fundamental. However, this term is not defined. A simple question arises: is it possible that (in a national standard!) terms are defined through a term that is not defined?

The term "state of item" is not included in the alphabetical index.

Discussion and conclusions

Thus, the paper sets forth substantiated suggestions for improving the dependability terminology standard. It is shown that standard [1] contains ambiguity and logical inconsistency as regards the standardization of certain terms.

In standard [1], the term "dependability" is clearly defined. Other definitions of dependability used in the standard are not substantiated. The term "dependability estimation" is introduced incorrectly. This term contradicts well-known and universally adopted terms "estimate". The concept of "definition" is used in the standard with different meanings.

The author hopes that the publication and discussion of the above observations will enable a stricter approach to the wordings of the dependability terminology standard.

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The author's contribution

The author conducted a terminological analysis of the fundamental dependability terminology standard and noted incorrect application of certain terms. If the author's point of view is adopted, such terms can be improved or provided with better substantiated definitions.

The analysis identified the terms, whose definition need improvement.

Conflict of interests

The author declares the absence of a conflict of interests.