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On the Physical Size and its Measure

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Abstract

The purpose of this paper is to clear up the notions of "physical size" and "measure" and other notions or concepts connected with them, less or no means used in the technical-scientific literature, or used in confuse or inaccurate wording, a.s.o. The difference is emphasized, and also the connection between the concepts of "physical process" and "phenomenon", which are in correlation with the mentioned terms. Linguistic arguments for using the term of "measure" in metrology are presented both to appoint the result of the measuring operation, the material conventional unit (measure standard), indication of a measuring instrument and also for quantitative expression of a physical size generally determined even by calculation as a product of a number (called numerical value of measure) and a unit of measure.

Keywords: *Physical size, measure.*

Introduction

The author suggests the publishing of some papers regarding the physical size and its measure in order to clear up these terms and others connected with them, to emphasize the measure properties, to establish the measure of a physical size determined by a relation among other physical sizes, to define more accurately the correspondence concept-phenomenon in the correlation between the physical size and its measure, to differentiate the relations among the physical sizes and those established among the measures of those sizes, or just only among the numerical values of the physical size measures a.s.o. This paper is the first from the announced series.

It is found out that the term "measure" is very little used in the technical-scientific literature though technicians, engineers and scientific researchers, respectively, work not only with physical sizes, but also with numerical values obtained by measurements or by calculations using corresponding units of measure, so, they work with measures of physical sizes. As a matter of fact, this term is not to be found among the general metrological terms (see [1] and [2], Appendix B). For example, in [1] and [2], Appendix B, the expressions "value (of a size)"and "result of a measurement" are used. Also, confusions between physical size and its measure or between measure and its numerical value can be found in literature. This is an example: "In table 1.3 the values p, ρ, T depending on height, also as speed of sound are presented". In the book where I found this sentence, by p, ρ and T, the pressure, density and temperature, respectively are noted, therefore physical sizes, and in the mentioned table the measures of these sizes are presented, and also the measures of the altitude and of the speed of sound, in shape of values concentrated in the columns of the table, and of the units of measure defined in the cassettes above them. As a result, instead of the formulation: "the values p, ρ, T"

and the expression “the speed of sound”, it had to be used the expressions “the measures of p, ρ, and T”, and “the measures of the speed of sound”, respectively, which “depend on the measures of height” and do not depend on “height” (which is a physical size).

As usually, in different works instead of “measure”, the notion “value” is used; for example, “the speed of photon propagation in vacuum is $2.997925 \cdot 10^8$ m/s, while the speed of motion of the common material particles can take any smaller *value* than this one”. It is noted that the expression “$2.997925 \cdot 10^8$ m/s” contains not only numerical value, which is $2.997925 \cdot 10^8$, but also the unit of measure – m/s, therefore it is a measure. But in the expression “the value of the earth acceleration at the sea level and at the geographic latitude of 45° is 980.665 cm/s^2”, the word “value” is unnecessary because the expression “the Earth acceleration at the sea level and geographic latitude of 45°” represent a measure, as a concretised (physical) size being equal to 980.665 cm/s^2 (see the chapter “Terms of «physical size» and «measure»”).

Also, confused formulations of the “measure” term definition can be found. Although in [3] the author agrees with the fact that term of “measure” expresses interdependence between the concepts of “quality” and “quantity”, however, this term is not used. In exchange he uses the expression “value of a size” or the expression “measured value”. In this way, by “the value of a size A” is understood [3] as “the value which is obtained by the measuring of the respective size and it is expressed by the product between a number $\{A\}$ and the used unit of measure $[A]$”, and “the measured value” represents [3] “the product between the unit of size to be measured and a number:

$$V = \{V\} \cdot [V],$$

where V = the physical size to be measured; $[V]$ = unit of measure; $\{V\}$ = numerical value showing how many times the unit $[V]$ is included in the size to be measured V”. It is found that “the measured value” is identified with “the physical size to be measured”, that is not correct. Also in [4] it is the talk about “the value determined by measurement”, which is given by “the product of the unit of measurement and a whole or a decimal number”, although “the unit of measurement” is defined in the same work as “unitary measure”: „The unit of measure is the size considered as a unitary measure depending on which one all the same sizes are expressed”. In [5] it is stated that „The measurement operation is mathematically expressed by the relationship

$$A = n \cdot U\ ,$$

where A = the size subjected to measurement; U = the unit of measurement or the qualitative factor; n = the quantitative factor or the number showing how many times the unit of measurement U is included in the measured size”. Therefore, in accordance with [5], the physical size is the product of a number and the unit of measurement, what we cannot accept. At last, in [1] “the result of a measurement” is determined as being “the value attributed to a measurand obtained by measurement”, “the measurand” being “particular size subjected to measurement”.

Otherwise, the sense of “measure”, specified in [6], is not accurate, and creates confusions with the notion “value”: “I.1. The value of a size, determined by relating to a given unit; measurement, determination”. The same confusion presents the meaning given to the verb “to measure” [6]: “I.1. To determine by means of some measuring instruments or apparatus, standards of measurement, a.s.o. the value of a size (length, mass, weight, voltage, a.s.o.); to take measure; *esp*. to weigh”.

Confusions and inaccurate expressions in connection with the notion of “value” and the terms of “measure” and “physical size” are found in different technical and scientifically works published not only in our country, but also in other countries.

Habit of using the notion “value” is explained by the deep involving of Mathematics, especially Statistics, and recently Informatics by means of specialized calculation programs, in processing the experimental data and in sophisticated calculations used in designing and in the "pseudo-experimental" research (by means of the finite element method, a.s.o.) in different areas of sciences and techniques, where physical sizes, measures of the physical sizes, respectively, are used, but "by abstracting, the sense of the given and sought sizes is left out, and it is kept only the mathematical seed" (Hans Reichardt, in the book introduction [7]).

It is raised for discussion the relationship writing between the physical sizes and their calculation. In this way are often used "equalities" in the following way:

$$\sigma = \frac{F}{A} = \frac{50 \cdot 10^3}{\pi \cdot 25^2 / 4} = 101{,}859\,\mathrm{MPa}\,.$$

It is mentioned the fact that the sign "=" shows an *equi-valence*, in the etymological way of the component element "equi-" and of the word "valence", that is an *equality of value* or a *quality of what is has the same value*. Being in accordance with this meaning, it can be observed that these relationships are not equalities. If the first equality, in the left side, expresses a relation among physical sizes (σ, *F* and *A*), the second equality is a relation among physical sizes (*F* and *A*) and a mathematical expression, where numbers/numerical values are used (being not, though, a number which should correspond to *A*, but only a mathematical expression), finally the last equality contains in the left-side a mathematical expression, and in the right-side member a number accompanied by the symbol of the unit of measure, that is a measure. As a result, the second and the third equalities are not accurate. They should be relations only among the measures of the sizes σ, *F* and *A*, in the shape:

$$\mu(A) = \frac{\pi \cdot 25^2 \cdot \mathrm{mm}^2}{4} \cong 490.874\,\mathrm{mm}^2\,;$$

$$\mu(\sigma) = \frac{50 \cdot 10^3 \cdot \mathrm{N}}{490.874 \cdot \mathrm{mm}^2} \cong 101.859 \cdot \frac{\mathrm{N}}{\mathrm{mm}^2} = 101.859\,\mathrm{MPa}\,,$$

where by μ(*A*) and μ(σ), the measure of *A* and of σ, respectively, are noted. In order to omit the including a new notation for measure of a physical size, we can use the symbol of that size, but we have to understand that it is talk about the measure of that size (see further).

Physical process and phenomenon

Before discussing about notions as "physical size" and "measure", we have to state the difference, but also the connection between the concepts of "process" and "phenomenon", which are in correlation with these terms.

The objects and processes are areas of the reality. The reality we are speaking about is the *physical reality*.

The process (*processus* in Latin) is a dynamical succession of states inside a system or in transitions from a system to another one [9]. *The nature of systems* about it will be discussed in the frame of this study is a *physical* one.

The state of the physical system is that situation of the system determined by its structure, by outside conditions a.s.o., and it is defined by *the state sizes* whose measures are their *physical parameters*.

The process is characterized by a *relative stability*, which is its property to preserve along a time its quality, to be with itself identical as a unit of the contraries. The relative stability expresses the fact that the flow of processes in the physical world, far to be a chaotic, amorphous torrent, presents a *determined, lawful, order*.

The object and process essence is demonstrated by the laws of their structure and dynamics.

Essence (*essentia* in Latin) expresses what is *main and stable in objects and processes*, *their inside hidden nature*, what it is not given or direct perceptible; *what can be known* only leaving behind the external shape of the things and processes, *by means of the mind* penetrating in their depth [9].

Therefore, *the laws*, being "the shape of generality in nature" (Friedrich Engels), "the identical in phenomena" (V. I. Lenin), are expressions of the relative stability of the things and processes in the physical world.

Phenomenon ("*phainomenon*" in Greek means "*what appears*") presents *the essence external manifestation*, *that side* of the objects and processes which occur in nature (but also in the society), which is *empirically ascertainable* [9].

By *experiment* it is indirectly emphasized *the phenomenon* by means of measuring instruments (which can measure physical sizes), and by *modelling*, on the basis of a theory, *the process essence revelation* by establishment of its dynamic law, is tried.

Notions of physical size and measure

The objects and processes occurring in nature and those created by the man demonstrate their *properties/features*: shape, appearance, colour, size, dimension, strength, density, weight, fluidity, viscosity, elasticity, plasticity, distance, speed, acceleration, temperature, resistance, flow rate, pressure, luminosity, a.s.o. These are *phenomena* discovered by the man by *experience*, either directly by perceptions, or indirectly by means of some measuring instruments or apparatuses. They are called by *notions* which usually are words borrowed from different languages enriching the Romanian language in the course of time[1] (see also [8]) and which have known and unknown etymology.

Consequently, *the properties* of the objects and processes, as prevailing features which show their character and differentiate them, there are, that is the notions through which we appoint them have real and concrete correspondents.

The objects and process properties may be *experientially compared*, from qualitative point of view, by observations, by perceptions, or *in an experimental way*, from quantitative point of view, by measuring.

A process may be intuited or the existence of a process may be intuited, but its characteristics, due to its nature, could not be discovered, or demonstrated than only later. This thing shows *the historical character of the knowledge* based on knowledge accumulations (after time). Therefore, *the objective quality of the properties/characteristics* in order to belong to a process or an object is emphasized, independent on the fact that they are know or are not.

A certain *class of objects or processes* is characterized by a common property or by more common properties which can be measured. These *common measurable properties* are called physical sizes.

The physical size is the common property of some objects or processes which can be directly or indirectly measured, and on their basis the respective objects or processes can be ordered in a row.

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[1] "About a sustained care to enrich the Romanian language with scientific terms cannot be discussed than only by penetrating in our country, either directly, or by new Greek channel or Russian one, of the modern culture at the end of XVIII century and in the first half of the XIX century. The education and press development in Romania played a prominent part in this action." (In accordance to [8].)

Examples of physical sizes are*:* length, aria, volume, mass, time, temperature, speed, acceleration, force, weight (which is a force), density, viscosity, flow rate, pressure, (mechanical) tension, energy, electrical resistance, electric current intensity, magnetic inductance, thermal conductivity, substance quantity, luminous flux a.s.o.

The historical character of the physical size consists in the fact that the notion showing the respective physical size, was materialized at a given moment, being elaborated in the course of the time by promotion the scientific knowledge leading to the human discovery of the respective common property of the objects and processes having the same nature, and also to conceptual evolution of the scientific world.

The very same physical size differs from an object to another one or from a process to another one by its measures determined by the measuring operation.

Measuring is the operation by means of which, at a given moment, the physical size of the object/process to be measured is compared with the physical size of the same kind of the measuring instrument, and as a result the respective physical size measure is obtained.

Therefore, generally speaking, *what can be measured* is the pnenomenon and it is not the object or the process.

The measuring presumes *an arbitrary and conventional adoption of a unit of measure* for the physical size, *the existence of a measuring instrument/apparatus* and *carrying out an operation (of measuring)*.

The measuring represents an experimental modality for quantitative estimation of a physical size. For that reason, it is subjected to errors (of measuring), that is to say, it is made with certain *accuracy* or it is characterized by certain *incertitude*.

The result of the measuring operation of a physical size with certain accuracy is *the measure of the respective physical size* at the measuring moment.

By adoption of the unit of measure, as a result of the measuring operation a real finite number is obtained, which shows how many times the unit of measure is included in the measure of the physical size of the object/process to be measured at the moment *t*. This real finite number is called *the numerical value of the measure*.

The measure of a physical size characterizing an object or a process at a given moment, or more correctly speaking, in a time period (how much the measuring operation is lasting), it is what will result by measuring that physical size with a certain accuracy by means of a measuring instrument/apparatus and using a certain unit of measure, that it is to say, it is a quantitative expression of the measured size (concerning the fact how large the measured size is) made of a number and a unit of measure. The number occurring in the measuring expression represents the numerical value of measuring that physical size subjected to measuring operation.

An argument for what has to be understood by measure is the etymology of the term “meter”. The word “meter” (“metru” in Romanian) results from the Greek “metron” that means “measure” ([10], [15]). Therefore, in fact, meter is a measure. But meter is also the unit of measure for length. It will result that, by extension, the unit of measure of a physical size is a measure of the respective physical size, and namely, that measure whose numerical value is the unit (see the related meanings 2 and 3 for the Romanian word “măsură” – “measure” in English – explained in [6]: “2. The conventional unit for measuring dimensions, quantities, volumes, a.s.o.; vessel, apparatus, a.s.o., which represents this conventional unit. ◊ *Measuring instrument* (or *apparatus*) = instrument (or apparatus) used to measure. ◊ *With the same measure* = alike, very similar. ♦ Content of such an instrument. 3. Determined quantity, limited extend”; also see the meanings 1b, 1c, and 2 for the English word “measure” explained in [15]). This means that *the measure of a physical size* is not only the numerical value obtained by measuring, but also the unit of measure. Also *the measure of a physical size* is the defined/limited/accurately stated/concretized physical size; for example, the speed of light in vacuous space, the length of the straight line segment $\overline{AB}$, the Earth gravity acceleration at sea level and at latitude of 45°, the normal atmospheric pressure, the electron mass at rest, the proton magnetic moment, a.s.o. are measures.

The state physical size characterizing an object, equipment, system, physical or technological process or an (technological) installation in normal running conditions (well defined), is called *physical parameter* or, simply, *parameter* of the object, equipment, system, installation or of the physical/technological process (as a measure represented by a physical size concretized by the respective object, process a.s.o., and by the working conditions). The Romanian word "parametru" ("parameter" in English) is taken over (see [6]) from French ("paramètre") being built from a composition element "para-" (= contra/foarte/tare/puternic [6]; contrary/very/ firm/ strong, in English) and "mètre" (= "metru", in Romanian; "meter", in English). The element "para-" is borrowed from New Greek ("para", [6]), with the above mentioned meaning. The term "mètre" comes from the Latin "metrum" having at its basis the word "metron" (= "măsură", in Romanian, [10]; "measure", in English, [15]) from the Old Greek. The verb "parametreo" from the Greek is translated as "to measure a thing by another one" ("a măsura un lucru prin altul", accordingly to [11]). It is noted the fact that "parameter" represents in Mathematics "an independent variable of a function, defined by the multitude of real and complex number" (accordingly [6]). In this way "parameter" is "the counter measure"/"firm measure"/"principal measure". Also in accordance with "the explicit related meaning" 2 of this word, which is presented in [6], the parameter is the proper size of an object, a mechanism, a system, a process (and is not a phenomenon as it is defined in [6]), a.s.o., serving to characterize one of its specific property. This definition makes also evident a measure as a definite/concretized physical size. In this way, it is made a *difference between kinematical parameters and kinematical sizes* (displacement, speed, and acceleration), the kinematical parameters being the measures of the kinematical sizes. *The parameters of a machine, installation, or an equipment or a technological process* are the physical sizes proper to the machine, installation or to an equipment or to a technological process in a normal (well defined) running or development conditions. The parameters of a technical system are used to characterize its behaviour during the operation. For example, *the main sizes of the drilling rigs* are: the maximal useful load (F_M), the maximal drilling depth (H_M) and the installed power (P). But, the maximal useful load of the drilling rig F320-3DH, the maximal drilling depth that can be reached by the rig, by using drilling pipes of 4½ in, and the installed power of the same rig are *the main parameters of the rig F320-3DM*, that is, in presented order *the measures of* F_M, H_M, *and* P: 320 tf, 6000 m and 1960 kW, respectively.

The measure of a physical size has a *well defined historical character* in the way that the determination accuracy of the numerical value of measure depends on the adopted unit of measure, on the measuring instrument (including the measuring principle), being imposed by the practical necessity of the respective century (see the measuring units adopted along the time; for example in [12] and [13]).

Let be M any physical size, $[M]$ the considered unit of measure, and $w(M)$ the numerical value obtained by measurement or calculation (the numerical value of measure). Than, the measure of the physical size M is:

$$\mu(M) = w(M) \cdot [M], \tag{1}$$

where μ is the *measure operator*, and $w(M) \in \mathbf{R}$.
If $w(M) = 1$, then

$$\mu(M) = [M] \equiv \mu_1(M), \tag{2}$$

where $\mu_1(M)$ is *the unitary measure/ the unit of measure of the physical size M,* and μ_1 is *the unitary measure operator*. For example, if v is the displacement speed of the body X, then it is considered that by measurement or calculation will be obtained:

$$\mu(v) = 3\frac{m}{s}, \tag{3}$$

where the numerical value of the speed measure is 3, $w(v) = 3$, the unit of measure being m/s, $[v] \equiv \mu_1(v) = \text{m/s}$.

I Observation – *In order to omit the wrinting complications, it is given up, by convention, to the operator* μ, that is in equality (1) is admitted the notation

$$M \equiv \mu(M), \tag{4}$$

however understanding by M the measure of this physical size. Then, the equality (3) becomes

$$v = 3\frac{m}{s} \tag{5}$$

and we read: "the measure of the displacement speed of the body X is 3 m/s or is equal to 3m/s" or "the movement speed of the body X is 3 m/s.

II Observation – The speed also as the distance and acceleration is a physical size characterizing the movement/displacement of a body, and is not the size of the respective body. So, the movement or displacement of the body is a physical process, and the distance, speed and acceleration are physical sizes/phenomena which characterize this process, even though the expressions "the speed of the body X" and "acceleration of the body X" were naturalized.

III Observation – Also, about *the measure of a physical size* there is talk *in the case when it is determined by means of calculation*, using a physical formula (a certain relation among more physical sizes), which will express a physical law or a relation for definition of a physical size. For example, the mechanical tension is a size and its measure is determined by means of relations among tensions and deformations (offered by the Elasticity Theory), knowing the deformation measure or the measures of the respective deformations. Also, if the mass m of the body X has the size equal with 1000 kg, then the weight of the body G, expressed by the known formula:

$$G = m \cdot g, \tag{6}$$

where g is the earth gravitational acceleration (the free fall acceleration of a body in the earth gravitational field) has the calculated size (admitting the notation (4)):

$$G = 1000 \cdot \text{kg} \cdot 9.81 \cdot \frac{\text{m}}{\text{s}^2} = 9810 \cdot \text{N} = 9.81 \cdot \text{kN},$$

if for g the measure 9.81 m/s^2 is accepted.

IV Observation – Taking into account the distinction between the size as a physical meaning, as it appears in the present work, and the numerical value which characterizes a measure of a size, instead of the common expression "the order of the size", the expression "*numerical order*" is used. For example, the numerical order of the measure 12.6 MPa is 10 it stands to reason that in the case where the unit of measure is that one defined, that is MPa.

In natural language, the measure of a physical size is expressed by the complement of measure (in accordance with the Romanian language grammar rules). The complement of measure, in its turn, is expressed by a noun with preposition, accompanied by a numeral. By the numeral it is the numerical value of the measure expressed, and by the noun the kind of the unit of measure. The used prepositions are: "of", "from", "to", "about of". For example, "The liquid pressure in the pipe is *of ten megapascals*", or "The measure of pressure of the liquid in the pipe is *equal to ten megapascals*". Very useful is the expression where the complement of measure is substituted with the respective measure (the numerical value and the symbol of the unit of measure); for example: "The liquid pressure in the pipe is *of 10 MPa*", or "The liquid pressure in the pipe has the measure *equal to 10 MPa*". In this way, two *modes of expressions* may be marked out: one, where the respective physical size appears and the other one where the word "measure" appears. When it is used the word "measure", the used construction is "the measure (is) equal to".

Linguistic arguments for using the term "measure"

By surprise we find out that the term "measure" ("măsură" in Romanian) is not used as a metrological term (see [1] and [2]) in order to appoint the quantitative expression of a measured size, or determined by calculation, that is the product between the numerical value of the measure and the unit of measure, although this word exists by its correspondent in different world-wide circulation languages, and it is used in the frame of some expressions, as for example "unit of measure".

It is mentioned that these standard, [1] and [2], correspond to standard having the same name, elaborated by BIPM (Bureau International des Poids et Mesures), IEC (International Electro-technical Commission), IFCC (International Federation of Clinical Chemistry), IOS (International Organization for Standardization), IUPAC (International Union of Pure and Applied Chemistry), IUPAP (International Union of Pure and Applied Physics) and IOML (International Organization of Legal Metrology), the used terminology being that corresponds in English and French languages.

In [1] and [2] it is used the term "măsură" (in Romanian), with the purpose to name only the materialized conventional unit (vessel, instrument, device, a.s.o.) for measuring dimensions, quantities, volumes, a.s.o.; for example standard wedge, (marked) mass measure, volume measure, standard electric resistor, standard signal generator a.s.o. [1]. But the correspondent terms are (in accordance with [1]): "material measure" (in English) and "mesure matérialisée" (in French).

But for the expression determined by the "product between a unit of measure and a number" (which it is also what will result from a measurement, the measurement being in accordance with [1] "the ensemble of operations having as a purpose the determination of the value of a size"), the purpose term is "valoare (a unei mărimi)" (in Romanian), "value of a quantity" (in English), and "valeur d'une grandeur" (in French). In [1] also is defined „rezultatul unei măsurări" (in Romanian), "result of a measurement" (in English), „résultat d'un mesurage" (in French), as being "the attributed value of a measurand, obtained by a measuring", „măsurandul" (in Romanian), "measurand" (in English), „mesurande" (in French), representing (in accordance with [1]) "the peculiar size subjected to measurement". Therefore, there are two names which have the same meaning: "value (of a quantity)" and "result of a measurement", because both of them are expressed by the same product between a number and a unit of measure, the (inexplicit!) differentiation being that only "the result of a measurement" is what may be obtained by measurement.

In fact, there is also a third term expressing the same above mentioned product: "indicație (a unui mijloc de măsurare)" (in Romanian), "indication of a measuring instrument" (in English), "indication d'un instrument de mesure" (in French), defined as "a value of a quantity supplied by a measuring instrument". But, this "indication" has not to be expressed in the same way result of a measurement, any one would be the measuring instrument?

And then, is it not simpler that the three names to be expressed by the same term? Because this term may be found both in Romanian and in English, French, German, a.s.o.

In this way, to the word “măsură” (in Romanian) will semantically correspond the words “mesure” (in French), “measure” (in English) and Maß (in German). The French word “mesure” (from Latin “mensura”) means (in accordance with [14]): “Action de mesurer.|| Résultat de cette action. || Unité employée pour la mesure. *Mesures de longueur, de capacité*. || Quantité que peut contenir le récipient qui sert à mesurer pour vendre en détail certaines denrées. *Une mesure de sel, d’avoine.* || Dimension. *Prendre les mesures d’un bâtiment. ...*” The English word “measure” (taken over from French, having in the beginning the same form of writing as in French [15]) means (in accordance with [15]): “1 b: the dimensions, capacity, or amount of something ascertained by measuring; c (1): a measured quantity, (2) AMOUNT, DEGREE; 2 a: an instrument or utensil for measurement, b (1): a standard or unit of measurement, (2): a system of standard units of measure ‹metric measure›; 3: the act or proces of measuring”. Similar meanings has also the word „measurement” (see [15] a.s.o.). The German word “Maß (das)” has the meanings (in accordance with [16]): “1. Einheit (Maßeinheit): eine zum Vergleich anderer Größen der gleichen Größenart als Grundlage dienende Größe; ein einzelnes Objekt (Stück oder Stoffmenge), insbesondere ein Meß- beziehungsweise Prüfobject, das ein oder mehrere Merkmale aufweist; soviel wie Maßverkörperung. –maß (in Wortverbindungen): 1. logarithmiertes Verhältnis zweier Energie- oder Feldgrößen , wenn damit die Eigenschaften eines Objectes charakterisiert werden. Beisspiele sind die Pegelmaße. 2.Wortverbindung mit Maß: Maßgröße, Maßsystem, Maßwert u.a.”

Therefore, in all these four languages (Romanian, English, French and German) we can differentiate the following metrological meanings of the term “measure”: result of the measuring action, a material conventional unit (standard of measure), quantity contained in a standard vessel and even “the value of a size, determined by relating it to a given unit” (see [16]), together with this unit (of measure). The word “determination” is the fact to determine (in accordance with [16]), that is to establish (for example by measuring) the properties of a body, a process, or to calculate, to infer on the basis of some data.

Conclusions

The paper raises for discussion some aspects refering to terms of “physical size” and “measure”.

Inaccurate and confuse formulations are found in the technical-scientific literature regarding these terms and other ones connected to them as “numerical value of measure” and “unit of measure” and incorrect modalities of writing the relation between the physical sizes and their calculation, frequently used in different works.

Then, the difference, but also the connection between the concept of “physical process” and “phenomenon”, which are in correlation with the terms of “physical size” and of “measure” are emphasized. The phenomenon as an external manifestation of the objects and processes (natural or created by the man), that is their essence manifestation, is all that may be empirically ascertained, raised for evidence, respectively, by experiment. The object and process properties/characteristics are even phenomena which can be experimentally determined by measurement.

The “physical size”, “operation of measuring” and “measure of the physical size” are further defined and the historical character of these terms is emphasized. On etymological basis, the term of “physical parameter” or “parameter of an object or process”, “parameter of an equipment or installation”, respectively are explained, differentiating the notion of “number” used in Mathematics and that of “physical size”, as would be the kinematical sizes (displacement, speed, and acceleration), incorrectly called “kinematical parameters”.

The general expression of a physical size determined either by measuring or by calculation in the shape of a product between the numerical value of the measure (and generally not of the physical size) and the unit of measure, is specified.

Finally, the use of the term “measure” in metrology is suggested, both to appoint the result of measuring action/operation, the material conventional unit (measure standard), indication (of a measuring instrument) and for the quantitative expression of a physical size, generally determined even by calculation as a product between a number (called numerical value of measure) and the unit of measure. This fact is argued by the existence of corresponding words, as meaning, with the term “measure” in the world-wide circulation languages as English, French and German. The last meaning of the term “measure” may be adopted by extension, even if it does not appear well defined in the analysed languages.

In the following papers the author suggests to analyse also other features regarding the terms of “physical size” and of “measure”.

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Despre mărimea fizică şi măsura ei

Rezumat

Scopul articolului este de a clarifica noțiunile de „mărime fizică” şi de „măsură” a acesteia şi alte noțiuni sau concepte legate de ele, utilizate mai puțin sau, chiar, deloc în literatura tehnico-ştiințifică, sau folosite în formulări confuze sau incorecte etc. Se evidențiază diferența, dar şi legătura dintre conceptele de „proces fizic” şi „fenomen”, care sunt în corelație cu noțiunile amintite. Se aduc argumente lingvistice pentru utilizarea termenului „măsură” în metrologie, atât pentru a desemna rezultatul operației de măsurare, unitatea convențională materializată (etalonul de măsură), indicația (unui mijloc de măsurare), cât şi pentru expresia cantitativă a unei mărimi fizice, în general, determinată chiar prin calcul, ca produs dintre un număr (numit valoare numerică a măsurii) şi o unitate de măsură.