The improving quality of products and efficiency of production and scientific research brings to our attention the important problems of the evaluation of errors contracted in measuring both under production and scientific research conditions.

It is generally accepted that measurement errors can be obtained by calculation only as a certain "sum" of components due to various effects. It is also possible to consider as a generally accepted fact that the measurement-error components consist of random quantities or processes. Moreover, the basic problems then deal with the manner (form) of presenting (expressing, determining) the measurement-error components and the method (way) of summing them up. Opinions here are divided between two general opposite tendencies. These two tendencies are very characteristic for modern metrology. One of them, it appears to us, reflects the striving of certain experts, mainly instrument makers, to preserve under new conditions the established concepts and methods. The second tendency reflects the striving of the other group of experts, mainly theoretical metrologists, to utilize to the greatest extent the achievements of modern theory, especially of mathematics, with the object of developing strict methods for evaluating measurement errors.

The problem of the form for representing the measurement error components is solved by the supporters of the first tendency in the following manner. The measurement-error components should be represented by the maximum interval in which they could be located. Moreover, they usually fail to mention that such an interval (confidence) should be supplemented by the probability (fiducial) with which the error component, as a random quantity, is located in the given interval. Sometimes it is indicated that since in practice the errors have truncated probability distribution laws, the above-mentioned interval can be considered as the base of a truncated distribution law, i.e., the fiducial probability should in fact be considered to equal unity. However, since the assumption that the fiducial probability is equal to unity imposes a considerable responsibility, the supporters of this approach normally simply fail to mention the probability. The approach to the main measurement-error component, the measuring-equipment (ME) error, can serve in this case as a characteristic example. It is known that the valuation of the ME error exclusively in the form of tolerance boundaries for the basic and additional errors (without indicating any probability) has its supporters. Moreover, it is then indicated that such a valuation is preferable also for ME errors which have a substantial random component [1]. The standard [2] is based on this approach. It is possible to see from the example of [2] the inconsistency of the approach under consideration to the representation of the measurement error components.

In order to select a rational method for evaluating the ME errors, it is necessary to take into consideration the purpose for which the ME error data will be used. The actual representation (expression, determination) of the ME error is not an end in itself. The objectives and principles of evaluating metrological characteristics, and in particular, the ME error were formulated in [3]. Bearing in mind the fact that in subsequent publications [4, 1] the same objectives and principles were described, it is possible to consider that there are no objections to them. One of the basic aims thus mentioned consists in the possibility of utilizing the evaluated ME characteristics for evaluating measurement errors. However, despite the fact that the characteristic "precision class" has been used for evaluation purposes for many years, there were as yet no suggestions how the concept "precision class," which characterizes the tolerated boundaries of ME basic and additional errors, can be used for determining the ME errors under actual utilization conditions. Only recently did a suggestion appear how the tolerated boundaries of the ME basic and additional errors can be used for evaluating the ME error under utilization conditions [1]. However, this suggestion is not based on adding the tolerated boundaries of the basic and additional errors, but on adding their dispersions. It is suggested that these dispersions should in turn be determined from the tolerated boundaries of the basic and additional errors by also taking into consid-

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Let there even be grounds for assuming a given distribution law for the errors represented by the tolerated boundaries. Then, in order to determine dispersion from the errors' tolerated boundaries, it is necessary to know the probability which corresponds to these boundaries. If it is perhaps possible to assume the fiducial probability as equal to unity for the boundaries of systematic errors (or their nonexcluded remnants), for errors which contain a substantial random component the fiducial probability must be smaller than unity. However, the supporters of the first tendency do not intend at all to designate the fiducial probability. Thus we find that in mentioning the evaluation of the total error from the tolerated boundaries of its components, the author of [1] is actually forcing the readers to the conclusion that in addition to the tolerated boundaries of errors it is also necessary to know their distribution laws. However, if the error distribution laws are known the boundaries of their tolerated values are not required. The material provided in [1] actually stresses the fact that it is impossible to evaluate measurement errors from the "precision class," and it is necessary to have additional information on the properties of the ME error.

Thus, the supporters of the first tendency understand that the confidence intervals (for an unknown fiducial probability) of the measurement error components cannot be justifiably added up and, therefore, it is proposed to introduce additional arbitrary data without attempting to substantiate them. The latter is quite understandable, since any attempt to substantiate the proposed error distribution law would lead to the realization that the evaluation of the basic and additional errors' tolerated boundaries is insufficient for this purpose and this would contradict the initial premise of this tendency. It can be asserted that the problem of finding an appropriate manner for evaluating the ME error (and, therefore, representing other measurement error components) does not permit the supporters of the first tendency to adopt a sufficiently substantiated solution for the second of the problems raised at the beginning of this article, namely, finding the method for adding the measurement error components (random quantities) in a manner to obtain the total error evaluation sufficiently close to the actual measurement error. Thus, the first general tendency in approaching the measurement error evaluation is not substantiated either mathematically or metrologically.

Let us now deal with the second of the extreme tendencies in evaluating the measurement error. It stems from the basic, on the whole correct, premise that the most complete description of random quantities (measurement error components are such quantities) consists of their distribution laws. On this basis it is considered that the measurement error components should be represented (expressed, determined) in the form of precise probability distribution laws. Then the second question of finding a method for adding them to find the total measurement error can be solved rigorously theoretically with sufficient simplicity: by the "combination" (composition) of their distribution laws. As a result of this, the precise distribution law of the total measurement error is determined as well as any characteristic of this law, including the confidence interval corresponding to a given fiducial probability.

It should be stressed that such an approach assumes that the appropriate error-distribution laws are known for the interval from the instant of their determination to the instant when the measurements are made and, moreover, that the distribution laws remain the same as they were at the time of their evaluation.

With reference to the tendency of using as characteristic of the measurement-error components their precise distribution laws it is possible to present the following consideration. It would appear that methods of rigorous experimental evaluation of distribution laws are lacking. Known statistical methods for checking hypotheses on the type of random-quantities distribution laws serve to arrive at the conclusion about the existence or lack of contradiction in the assumption that the experimental data correspond to a selected distribution law. Even in the case of a positive result in checking the assumed hypothesis there are, strictly speaking, no reasons to assert that the random quantity has the assumed distribution law. Such a conclusion can only be arrived at approximately, moreover, the degree of approximation to the shape suitable for further error computations cannot be evaluated by known methods.

It is necessary to know the measurement-error distribution law in order to be able to use known estimates of the mathematical expectation (systematic error) and the mean-square deviation (MSD) of the random error for calculating the confidence interval in which the er-