AUTOMATION OF RESEARCH IN THE FIELD OF ECOLOGY

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Like in any scientific activity, for realization of ecological research it is necessary to have the adequate information on the investigated phenomenon. The ecological object is characterized by plenty of physical, chemical and biological parameters, whose control and study requires reception, storage and processing of large volume of the precision information. Therefore decision of tasks of the control, estimation and up-to-date management, in any environmental research, is possible only on the basis of uniform methodology of the system approach with extensive use of modern mathematics, cybernetics, modelling, informational measuring and computer facilities.

One of the first stages of the process of research is the objective collection of the information concerning the investigated phenomenon, i.e. measurement with high accuracy of a certain quantity of parameters describing the investigated phenomenon. The accuracy of the measuring information is of great importance, since reliability of the accepted decision of final result of research considerably depends on the quality of the obtained results. Therefore, the problem of measurement is very urgent and, within the framework of possible opportunities, the optimisation of the metrological characteristics of results of measurement is always necessary. The problem is rather difficult, as the mistakes of measurement are caused by a number of different factors. They are: methodical, tool and casual mistakes [25]. The methodical mistakes are connected with the following factors: taking of the indications of the gauge before the end of the transient process, linearization of a scale of the device, mistake of dozing and diluting, deterioration of details and blocks of the device, etc. The tool mistakes are caused by discrepancy of processing both manufacturing of details and blocks of the measuring device. The casual mistakes are caused by a random changing of that environment, in which the process, and specificity of behaviour of measuring system develops; in particular, internal casual distortions of the measuring channel, heterogeneity of the measurable medium, etc.

Because of an essential difference of the factors of distortion of results of measurement methods and means of overcoming them are different. In particular, for reduction of methodical mistakes of measurement widely used are the methods of improvement of dynamic characteristics of means of measurement, structural methods of correction of mistakes of results of measurement, graduation and test calibration of means of measurement, imitating and mathematical modelling of the measuring device with a circuit of automation of their designing and the metrological analysis. In the report the basic results obtained by the author in the specified directions [1,2,4-6,8,15,21-23,28] are briefly stated.

For reduction of tool mistakes wide use of methods of automatic designing with a circuit of simplification of their manufacturing, improvement of professional skill of the manufacturer, use of high-quality materials and modern means, quality supervision of process of manufacturing and ready production, use of modern manipulators and robotization in production are necessary with the purpose of its complete automation.

For overcoming mistakes, random fluctuation, methods of mathematical statistics are widely used, in particular, methods of filtration, planning of optimum experiment, the regressive analysis, correlation and the dispersion analysis, methods of processing of time lines, etc. Correct use of these methods enables up to practically acceptable limits to reduce influence random fluctuation by results of measurement. The main results obtained by the author on these problems are stated in works [7,10,13,18,20,24,29,31,37,39].

The problem of essential reduction of mistakes of measurement can be successfully solved only with the help of using of automatic analysers, means of measurement and systems, in which the realization of above mentioned methods of increase of the underground - logic characteristics of results to measurements [26-28,35,47] is possible.

Among questions of automation of research in the field of ecology the second large problem consists in creation of the automated information systems and software packages of the ecological data collection, their compact and reliable storage, operative search, authentic processing convenient for recognition and representation of the obtained results, which will enable relevant services, administrative bodies, scientists and experts dynamically supervise an existing ecological situation, operatively accept and realize the necessary decisions, to study and to investigate not only existing, but also expected ecological change, with a circuit of elimination of undesirable results. Without presence of such means the collection, storage and use is impossible during research of the information of large volume. Otherwise there is a significant probability of distortion and damage of the information at each stage that in the end influences quality of results of research. With a circuit of automation of the given stage it is necessary to create and widely put into practice the device of the collection and transfer of the information automated systems, information bases [3,9,12,14,16,17,19,30,42-46].

At the present stage it is impossible to obtain, practically in any field of knowledge, on the basis of researches more or less essential results without research of mathematical methods of processing of the information. Modern mathematics is versatile, very deep and for experts from other areas it is very difficult to use it professionally. Even in such exceptional cases, practically it is impossible to process information files without modern computers because of the amount and complexity of calculations. Therefore it is necessary to create the universal, specialized software packages automated workplaces, which carry out function of the tool of research and incomparably deepen its opportunities. For creation of such tools the necessary requirements should be formed by subject researcher. To such products, in general, the following requirements are set: it is necessary, that they are reliable, are simple in using, i.e. for their use the special knowledge should not be required the obtained results should be evident, convenient for recognition and use.

For the decision of the above-mentioned problems under the management and direct participation of the author a number of program products for IBM overlapping PC was created. Among them it is necessary to note: a package of the applied programs of processing of the experimental information [34], the automated system of the control of a level of pollution of objects (water, air) environmental [25,17, 49, 50], device of the collection and transfer of the information [36], automated workplace of the ecologist - researcher [32], automated workplace of the ecologist [33], software package of identification of sources emergency dirty makers of the rivers [11,38, 41], package of the applied programs of acceptance of the optimum decisions [48], software package of realization of mathematical models of polluting substances, describing carry, in the rivers [25,40].

In the paper the purpose, peculiarities and function of the abovementioned products are described.

In order that with a peak efficiency the existing means of automation of process of research were used, and on the other hand, to give stimulus for creation of such means, that, in total, will improve quality of the obtained results and will make by its competitive in conditions of the modern open global market, in our opinion it is necessary, practically in all countries and, particularly, in the countries of CIS, to carry out the following measures:

– To ensure general computer education;

– On any speciality of higher educational institutions to enter study of computer sciences and widely use the computer in educational process;

– At an estimation of qualifying works to provide really a level of computer processing of materials;

– For realization of research works to consider a wide use of mathematical methods and computer processing at any stage of research as a necessary condition;

– Accelerated introduction of computers in any sphere of a national economy;

– At an estimation of qualification and establishment of the size of wages to provide computer knowledge of the expert.

It is important to apply the above-mentioned computer education problem in practice and not only pose in which took place for last 10-15 years of the communist power and has not given desirable result, as at the present stage of development practically it is impossible, that one and the same man was the highly skilled expert in several different areas of science.

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