**Introduction**

This paper examines the organization of direct interaction between the user (experimenter) and an automated system for experimental data processing (ASEDP). The analysis considers two points of view in the development of such a system — that of the user and that of the system designer.

In systems of this kind the user is assumed to be a specialist not familiar with programming. He presents to the system a complex data-processing problem and communicates with the system by means of dialogue problem-oriented nonprocedural languages developed by the system designer and tailored to the user's needs. This allows the user some idea of the organization of the computation process in the ASED P to the extent this is possible with the problem-oriented languages. On the other hand, the designer deals with program modules which provide the real organization of the computational process in the system employing all the hardware and the operational tools, data control, interpretation of the user instructions, data processing according to the adopted methods, and other functions.

In this paper, the term system is used to refer to the methods of organization of data files and data processing procedures. And the term language designates sets of words which, together with syntactic and semantic rules, serve to provide the link between the system and the user.

**System Functions**

We will consider ASED P intended for processing of multichannel information flowing in from an experimental object. Such systems are characteristic, for example, of strength tests of new equipment [1, 2] or processing of the results of a space probe [3]. Each measurement channel can either carry complete information on the values of some physical parameter of the object or the value of the parameter has to be determined from a set of measurements in a number of channels. For subsequent discussion, it will be sufficient to assume that each channel is associated with the value of one physical parameter, so that we will discuss the processing of the logical measurement channels, disregarding the preliminary processing of signals [4].

The user must be given the capability to perform the following principal functions in processing the experimental data with the aid of the system:

1) selecting from the input flow the set of channels necessary for numeric processing;
2) monitoring a given set of time processes registered by the system on its graphic displays and documenting segments on a paper carrier [5];
3) performing a proximate analysis for the given set of measurement channels using methods of mathematical statistics in an on-line process with the information inflow from the object [6];
4) processing the set of channels by methods of mathematical statistics in a mode which makes use of input information flow prerecorded in disk files;
5) outputting the results onto visual displays or a print-out terminal;
6) interacting with the problem solution process for immediate intervention in the data processing;
7) preliminary preparation of system files.

These functions are combined into a common technological cycle of experimental data processing by means of appropriate linguistic tools of this system, which, in turn, reflect the peculiarities of its data base.
We will describe a typical data base of an ASEDP.

**System Data Base**

The data base consists of a set of files of different structure containing information on the state of the measurement object, sensor characteristics, data processing regimes, output printing formats, visual display formats, and auxiliary information. The principal requirement of the data base is the possibility of its restructuring during the preparation for and performance of a current experiment, both reliable and convenient to the user. The data base of an ASEDP comprises the following components.

The input file (IF) contains data on all measurement channels connected to the channel scanner. The IF is normally fed into the system either directly from sensors or from numeric recorders. The volume of IF frequently is as large as tens of megabytes, so that its complete intermediate copying onto the magnetic disks is not recommended due to limited resources of ASEDP. When performing function 3, IF is fed directly to processing; when performing functions 2 or 4, function 1 should be first carried out.

The data file (DF) contains the set of time series selected from IF for further processing. Each series can have its individual quantization frequency linked through a filtering factor to the frequency of the channel scanner. DF has an irregular structure since the values of different series are arranged sequentially, taking into account the filtering coefficients for each channel.

The channel table (CT) serves for description of DF. CT has a dimensionality equal to the number of channels of the system; a line of CT is identified by the channel number and its value is equal to the filtering coefficient of that channel. When all discrete values of a channel have to be copied from IF into DF, its filtering coefficient is 0. For copying every other discrete value of the channel from IF, it is 1, etc. CT is used in performing function 1 and also each time a continuous sequence of discrete values of a given channel has to be formed from DF. The latter operation is the first elementary operation in the execution of functions 2 and 4. As a result of application of the filtering operation to the input flow from IF containing NM discrete values (where N is the number of measurement channels and M is the number of discrete values in a channel), the file DF of R discrete values is constructed, where

\[ R = \sum_{i=1}^{N} \text{entier}\left( \frac{M}{K_i + 1} \right), \]

where \( K_i \) is the filtering coefficient of the \( i \)-th channel. When no values from the channel need to be copied, the filtering coefficient is the maximum integer representable in the computer minus 1.

The calibration table (CAT) serves to reduce the sensor data to physical values. Calibrations usually are piecewise functions of the true value vs the input signal. The CAT consists of lines of variable length, each identified by a channel number. A line contains the value of the number of points of approximation of a graph (n) followed by pairs of abscissa and ordinate values of these points (x, y). The logic of CAT is shown in Fig. 1. This structure of CAT is convenient for the ASEDP designer, as it occupies a minimal volume of the working storage when converting the sensor readings to the true values and also minimizes the length of CAT files on magnetic disks. The latter is particularly important for systems handling data from several test objects where a great number of CAT have to be maintained in the system simultaneously.

The processing chart (C) contains the data for the performance of channel-by-channel or correlated processing of signals. The chart is not assigned in advance to any particular set of measurement channels so that one chart can serve to process an arbitrary sequence of channels. Charts are stored as disk files and identified by numbers. One of the items in C is a code defining the instructions for processing of signals by methods of mathematical statistics. The following characteristics are usually calculated: minimal and maximal values, expectation, variance, differential distribution law, average energy spectrum, autocorrelation function, average relative spectrum, and relative correlation function. Besides, numeric filtration (e.g., by a band filter) is frequently required. All these functions are called out by the presence or absence of appropriate places in the processing assignment code. A practical example of a C file is given below; the meaning of the positions is self-explanatory:

1) processing assignment code;
2) number of discretization levels for derivation of the distribution curve;
3) time interval between two consecutive discrete values;
4) lower frequency of the band filter;