E-Learning in Monitoring and Data Processing Using Virtual Instrumentation

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***Abstract*— The virtual education (eLearning) is represented by the interaction between the teaching/learning process and the informational technologies – ICT ((Information and Communication Technology). World-wide, substantial investments are made on training programs for professors in the ICT field. The Internet became study object in many education institutions (due to the very complex technologies which involve it), but also the bibliographic and imagistic source for lessons presentation or tasks preparing. In the commercial field, a whole education strategy for public was developed in the aim to attract customers through an as attractive as possible promotion of the services and of the given offerts. This paper presents some aspects of the e-learning techniques using virtual instrumentation to study processing information.**

***Index Terms*— e-learning, educational concepts, processing information, virtual instrumentation,**

I. INTRODUCTION

The French educationalist G. Mialaret (1993) extends the „education concept" and demonstrates that it represents simultaneously: an activity organized institutional according to some educative purposefulness; a product of activity, determinable and adaptable at society requirements; a process between many human beings, in different communication and reciprocal modeling relations.

The educational systems known till now was based on institutional monopoly of the public school. Such a model could function optimum while the educational alternatives out-of-school were scanty developed and could not become competitor. But the last decades emphasized a development of new educational mediums out-of-school, able to become an alternative (either complementary or concurrential) for formal education by scholar type. The nonformal and formal education extension emphasized also some deficiencies of the scholar education.

In terminology of scientifical and technical education, besides the term of formal education, synonymous with „institutional education" we find the term of „non-formal education", education attended out of the scholastic system, into a regular or intermittent manner, considered as an assembly of extra-scholastic means for obtaining of the general knowledge or professional competence; synonymous term for the extra-scholastic education. In the International Education Dictionary we find three correlative notions: formal education, informal education and nonformal education. The nonformal education is defined: „the education received out-of-school or besides the years affected through the statute of instruction period", for example adult education. The second definition would be: „education which carries on out-of-school, through the influence of the family environment, of the friend groups and of the life medium".

In Education Wordbook (1979), besides the out-of-school education, considered as „any activity placed out of the scholastic frame and including both nonformal education and any form of occasional or permanent education", and beside the nonformal education, considered „any educative activity structured into a non-scholastic frame (traditional education, youth movements, clubs and unions)" arises also the term of stray education defined as „continuous process of knowledge and concepts acquisition, which is situated in no one of the institutional frames". In the pedagogical dictionary are consecrated the concepts of formal education (instutionalized), nonformal education (out-of-school) and informal education (stray) for correct denomination of the education types which now achieve in the society.

Inside a society of generalized communication the Internet becomes, day after day, the arbitrator of the access to education and culture, and the most corresponding form to come in greeting of the knowing and continuous forming needs is eLearning. eLearning is a term wherethrough the learning process is described through a computer connected to the Internet. The eLearning term is also known under the name of online education; eLearning becomes from the „electronic learning".

The eLearning has on the base a virtual class, an instructor (tutor) which planns the activity of the group from the virtual class. In each virtual class, the cursist studies thoroughly by one discipline, each class has its pupils and its tutor. Thus, the educational offer is much generous.

An eLearning system (of forming at a distance or virtual education) consists into a planned experience of teaching-learning, organized by an institution which provides immediately materials into a sequential and logical order to be assimilated by students into a personal manner, without to constrain the activity agents at copresence or synchronization. The mediation is achieved by different modalities, from teaching aids on disk or CD (eventually by correspondence), to transmission technologies of the contents by Internet.

II. CONCEPTS. WHAT IS E-LEARNING?

In a large sense, by eLearning we understand the totality of the educational circumstances in which we use significant the resources of the information and communication technology. The term, taken up from Anglo-Saxon literature, was extended from the primary sense, etymological, of learning by electronic means, covering now the intersection area of educative actions with modern informatic means. So defined, more than education, the semantic area of eLearning concept interferes with and superposes indefinite variable on a multitude of terms which surprise the variety of didactic experiences which can benefit by technological support: computer aided / mediated

schooling, digital / mobile / online learning/education, schooling by multimedia etc. Under the naming of didactic/educational software, a large area of electronic resources (on digital/multimedia support) is developed to simplify the education process: maps, dictionaries, encyclopedias, didactic movies, presentations in different formats, books (e-books), tests, tutorials, simulations, software which forms abilities, exercise software, didactic games etc. The computer and the electronic/multimedia resources are used as support in teaching, learning, evaluation or as communication means (for achieving of some individual tasks etc.).

In a limited sense, eLearning represents a kind of education at a distance, as planned teaching/learning experience organized by an institution which offers immediately teaching aids into a sequential and logical order in the aim to be assimilated by students into a personal manner. The mediation is achieved through the new information and communication technologies – especially by Internet. The Internet constitutes both the medium for teaching aids distribution and the communication channel between the implicated performers. Functional for the moment only on the level of the university education and in adult education, the system of teaching by Internet rejoins and adapts the components of the traditional/face-to-face didactic demarche: planning, specific content and methodology, interaction, support and evaluation.

The extensions brought by technological medium, insufficient explored and used, refer to:

a. orientation unto student, by personalization of the forming path – the different composing of the educational objects depending on the requirements of each beneficiary – by forming individualization – the nonlinear information structuring, with the possibility to return at more difficult contents after the automatic identification of the blanks – autonomy by eluding of an imposed rhythm, special independence and asynchronous seminars

b. distributed resources, by using/integration/accessing of the electronic libraries and of the multimedia materials, by the inducting of the specialists into the students discussions

c. the roles' fluidity, by the continuous balancing of the educated-educator role into the learning group („symmetric knowledge advancement"), by the continuous restructuration of the learning teams depending on the interests or based on the in task efficiency criteria.

The eLearning and eTraining concepts have taken up more elements from the traditional teaching, so that these principles have been developed during a more centuries and are only a part from that the peoples believe about teaching and learning.

Nevertheless, the new medium created by Internet and sustained by innovating technologies, given rise to these new principles insomuch as it improved the traditionals.

- asynchronous learning vs. synchronous learning, where the students and the professors learn itselves or in supervised groups;
- learning centred round the student or the professor, depending if the student or the professor occups a position witch determine the progress rhythm;
- individual or group learning, benefits by the advantage either of the unidirectional attention or of the benefits and the influence of one group;
- informal communication, creates opportunities and „institutions" on online learning platform in the aim of the information interchange (cafeteria);
- the online library, allows not only books and periodicals but also the links for internal and external data bases, for audio and video fluxes;
- online examinations, similar to the extempores and the testes, are created by professors and programmated either by the student or by the professor, depending on the educational system;
- the course management, is a distinct module which assures the administrative part of the teaching and of the curricula; it is the method which controls the learning and teaching process.
- course factory, in a method very at hand so that the teachers to prepare the course as well as the online and semestrial examinations, which can prepare presentations, media fluxes, run applications, etc.

The eLearning principles (known also as learning by Internet) can be applied in many areas of the life day-to-day, creating efficient organizations, whose it assure a long and prosper existence.

eLearning features:

1. the roles' fluidity
2. curriculum oriented for the particular needs of the student
3. distributed resources
4. virtual facilities
5. asynchronous lessons.

The eLearning concept is an institutionalized form of learning during of the entire existence. This concept allows:

- the information propagation inside the entire network
- to reach the each person from organization
- assures a continuous learning, then a competitive advantage
- facilitates the formal and informal communication inside the organization

As a result of joining of the different structures from education models it can be enumerated some factors which influent the choose of one structure.

- The education object. If we aim at the teaching staff retraining in the respect of the familiarizing with the education reform provisions, then the option should be for one independent, dual or unisection model.
- The needs for education. An open university is the best solution for great requirements.
- Available resources – human, physical and financial.
- The autonomy and control degree – depending on the orientation and on the supporting at the level of educational politics.

Generally, the educative institutions prefer to adopt a bimodal organization system, through specific projects which create a virtual institution inside of one traditional. The effects are evident after relatively short time – an university registering dozens of times as much then can hold in its course halls – but the long-term effects are those regarded, the institutions with tradition occupying a place in the tomorrow's educative framework, the virtual framework, towards a future of the „without residence university, connected (first) with peoples and ideas".

According to the classification made by European Corporate eLearning, there are three models generally accepted in the eLearning world, each occupying a proximate equal quota in this market.

a. The independent eLearning represents the model wherethrough the individual user loads the course aids from Internet or uses it directly from CD, going over it all by oneself. This represents the advantage of one very big quantity of information, which can be accessed in a very short time, but is very severe regarding the instructor-coursist communication.

b. The asynchronous eLearning allows only one single user to transmit information at a certain moment. Such an example is that in which the instructor can offer the information for coursists, but the coursists can not interact while they get the information. The major advantage in this case is that the coursist keeps his facility to work according with his owner rhythm, having the possibility to obtain also the answers at his request into an acceptable time interval.

c. The synchronous eLearning allows the information transfer with any user in any moment. An example is that in which the tutor and the coursists transfer informations during the course/seminar progress, as a rule in real time. This way is evidently the most performant from all others concerning the degree of communication facilitation, the integrated audio-video facilities, creating the concept of „virtual course class".

III. VIRTUAL INSTRUMENT FOR COMPARING AN ANALOG SIGNAL BEFORE AND AFTER MATHEMATICAL PROCESSING OF IT BY MEANS OF DERIVATION AND INTEGRATION OPERATIONS

The presented application is implemented in LabVIEW and is dedicated to an eLearning program that presents the algorithm of differential and integral calculus implementation in the case of a sampled signal and how the numerical calculation applied to a sampled signal can influence the processing results.

The instrument's front panel is composed of two windows: inside the first window is implemented the generating of a signal and the mathematical processing of it with the aid of derivation and integration operations, and in the second window is shown the graphical representation of spectral analysis for the original signal and the mathematical processed one, as well the difference between the distortion factor for the original signal and the mathematical processed one.

The input signal can be composed by user in different shapes. It is obtained by adding three types of wave (Signal 1, Signal 2, Signal 3).

Each of the three signals can be adjusted and viewed on screen by pressing the appropriate button. The instrument allows, for each considered signal, to be possible to choose the signal type (sinusoidal, rectangular, saw tooth or a white noise) as well the amplitude, frequency and phase shift so that to obtain wave forms of more complex and more similar to the real analog signals. The final signal is viewed by pressing the „SUMA SEMNALE" button (signal adding). It is considered that the converter input signal field is −5V ÷ +5V. By adding of that 3 types of wave, the amplitude of the resulted signal can exceed this input field, studying so the behavior of the converter in this case and how this is reflected in the signal reconstituted from the sampling and coding processes.

The initial signal is generated by composition of three adjustable signals. Each of these signals can be of several types (sinusoidal, rectangular, triangular, saw tooth or white noise) depending on the position of control with winding which define its. For each we can choose amplitude, frequency and phase. The three signals can be displayed and

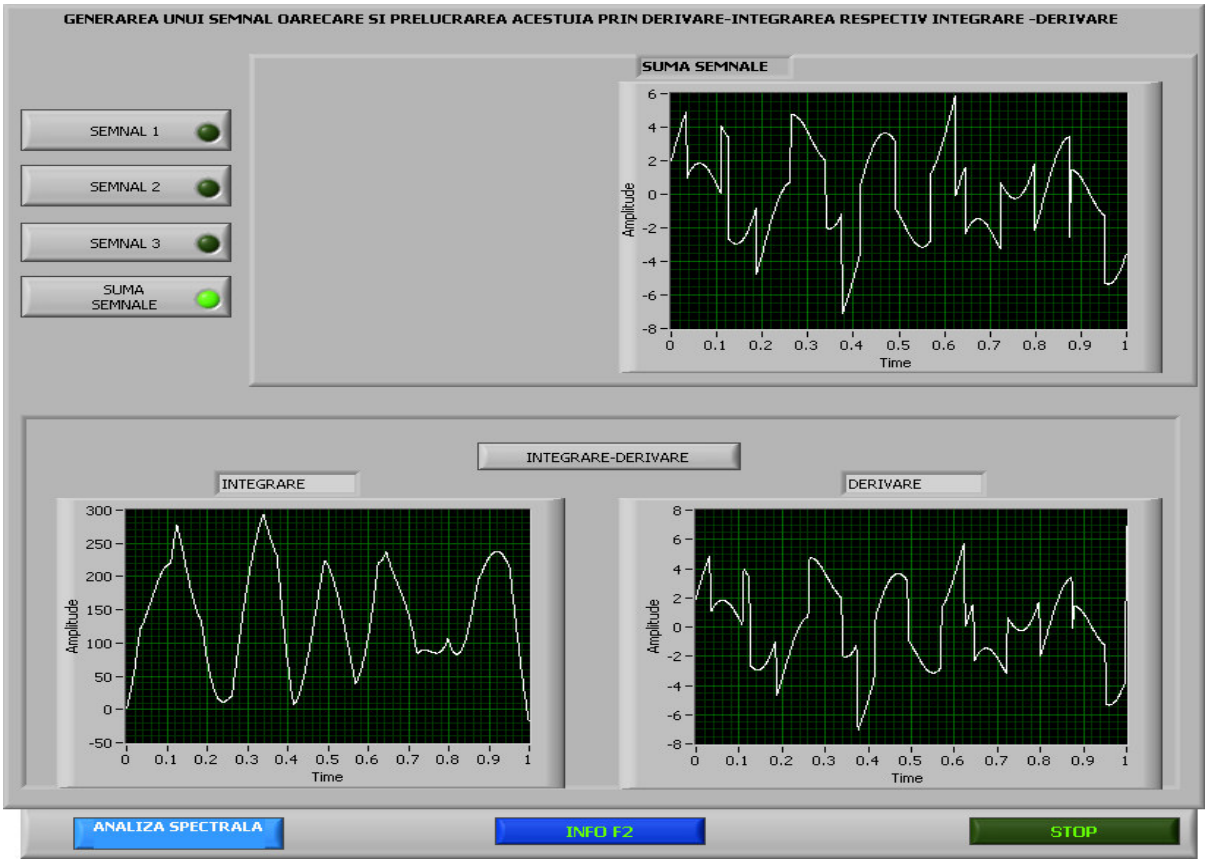

Fig. 1 Composing of the initial signal and the mathematical processing by derivation and integration operations

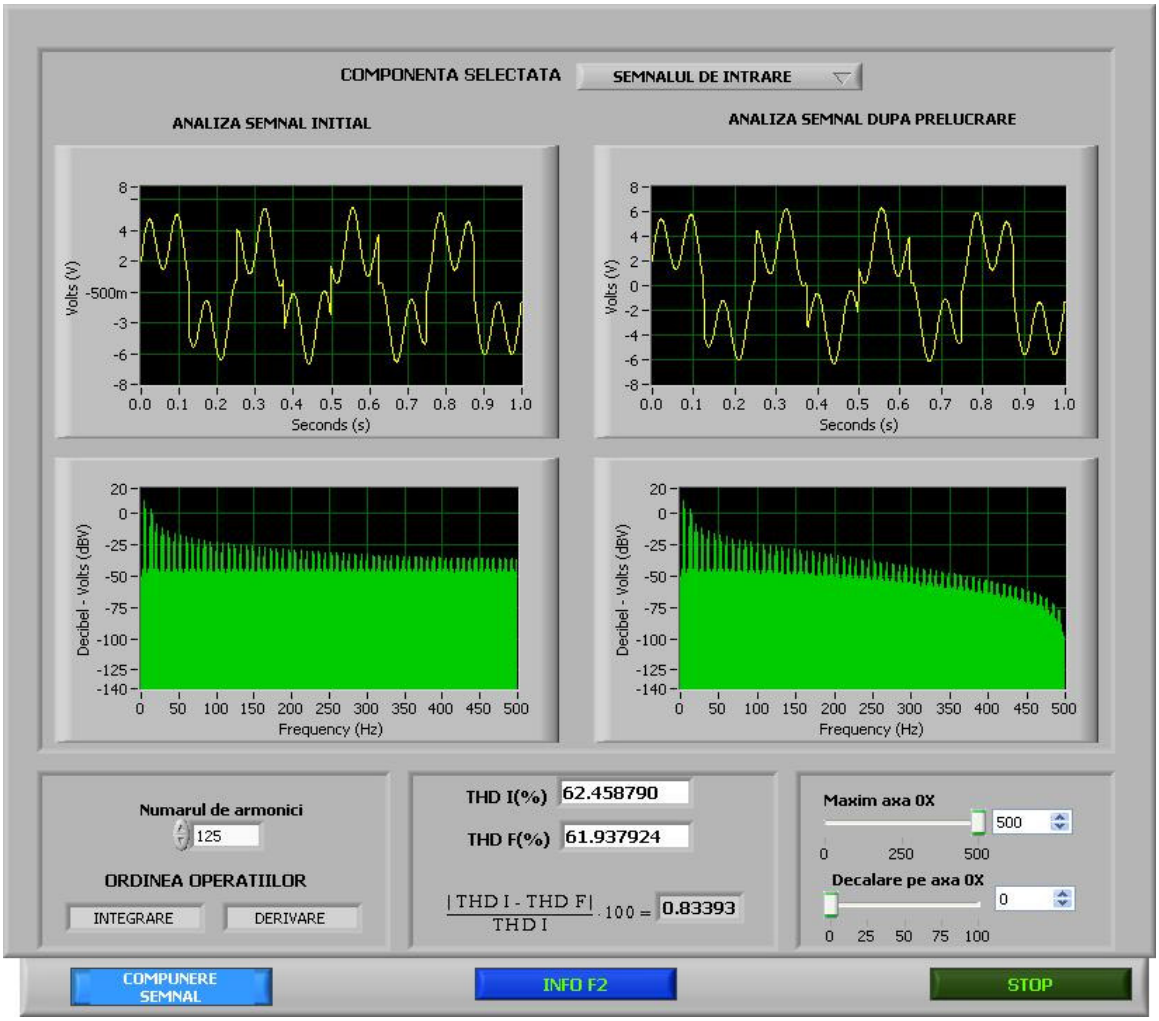

Fig. 2 Spectral analysis of the original signal and of the mathematical processed

adjusted by pressing the appropriate buttons.

At the bottom of the screen are represented by two graphs the results of mathematical processing of the initial signal. Through a button placed above these graphics the user can change the order of performing operations: derivation-integration or integration-derivation.

At the bottom-left of the instrument is the „ANALIZA SPECTRALĂ" button (spectral analysis).

On pressing it will display a new window (Fig. 2).

This is divided, in the top part, in two columns. In the first of these is represented the spectral analysis of the initial signal, and in the second is represented the spectral analysis of the processed signal. Through the „COMPONENTA SELECTATĂ" button (the selected component) the user can view the components of the two signals and their spectral analysis.

We can select the following components:

- input signal
- fundamental signal
- residual signal – composed of noise and harmonics
- harmonic
- noise

At the bottom of the instrument, on the left part, are indicated the number of harmonics taken into account and the order of performing operations.

In the second column are indicated the total distortion factors for the original signal and for that processed.

Through controls placed on the right side of the instrument we can scale the graph of the spectral analysis in the aim to identify more precisely the harmonic signals.

The entire program is included in a While repetitive structure that interrupts the running by pressing the „STOP" button. Inside of it we find three sub-programs for signals generating. Those results are added and represented on a graph.

The obtained wave form is decomposed in components:

- the amplitudes vector
- the distance between two consecutive points on the axis of time dt

The amplitudes vector is sent to a Case decisional structure with two frames. Depending on the logical value of the control for selecting the order of operations we will choose the first frame of the Case structure in which is made the derivation and then the integration, or the second frame in which is made the integration and then the derivation. At the exit of the Case structure is made the composing of the wave forms after that two operations and its displaying on two graphics.

Over the initial and final signal is applied the Harmonic distort Analyzer function which perform the spectral analysis, the calculation of the THD factor as well the signal decomposition.

The graphics scaling is made by properties nodes which define the graphics scale.

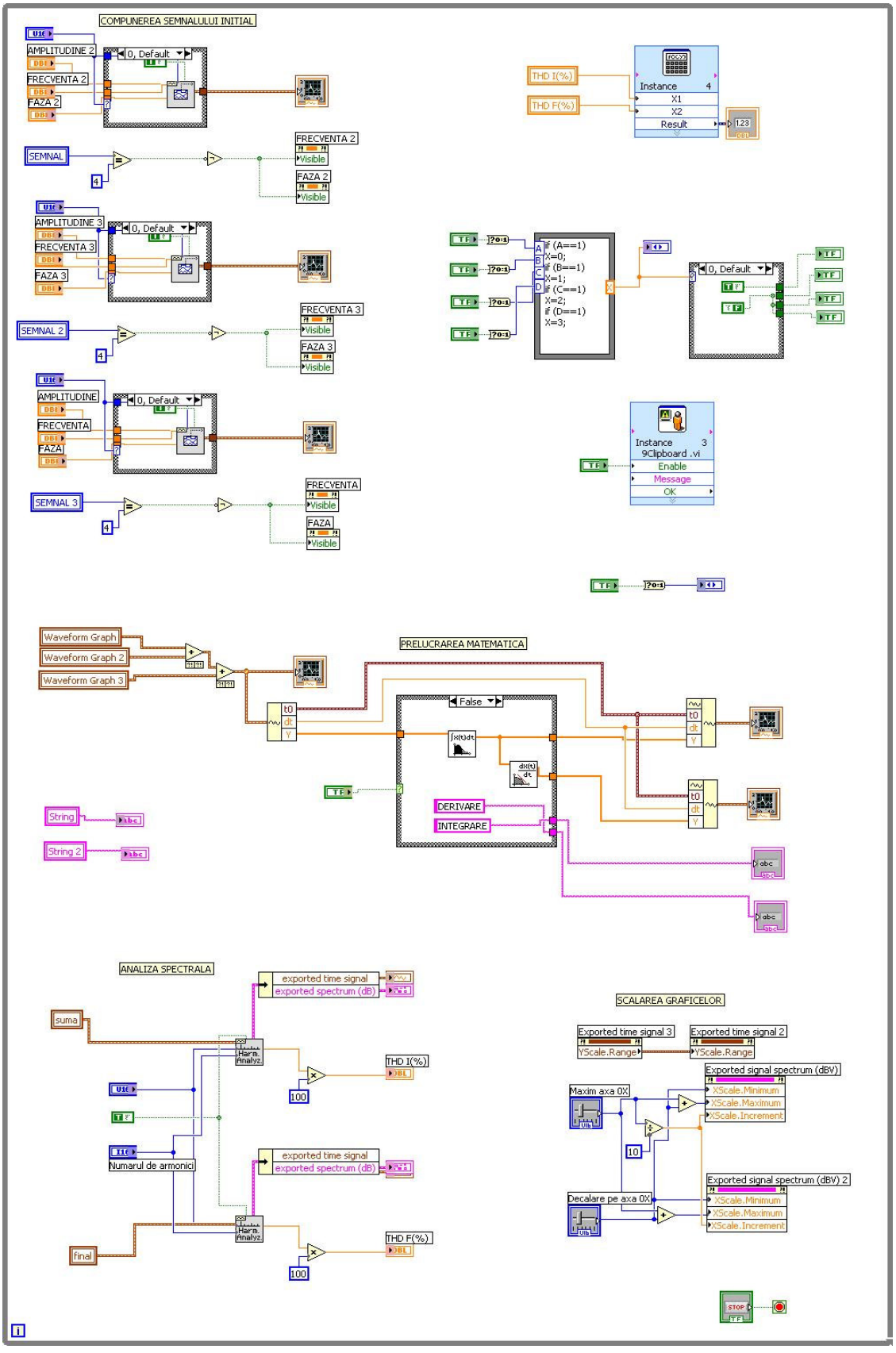

Fig. 3 Block diagram of the instrument

IV. CONCLUSION

From the spectral analysis of signals can be observed:

- the harmonics of the processed signal have a decreasing rate confronted by those of the initial signal, for high frequency some missing.
- irrespective of the type of initial signal the distortion factor for the initial signal is always greater than that of the processed signal
- the error is the great so as the signals are more irregular (Fig. 4).

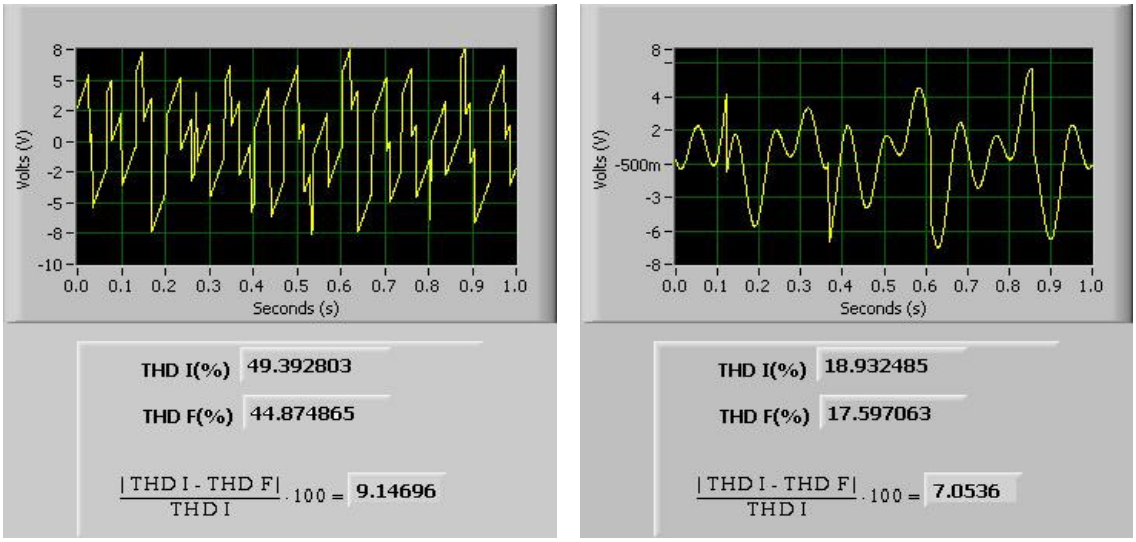

Fig. 4 Signal comparison

- along with the changing of the operations order change also the value of the THD F distortion factor of the final signal.

After the given observations it can be concluded that the mathematical operations act on the signal as a low-pass-filter eliminating a part of signal harmonics, this fact being due to the implemented computing algorithm.

The correct recomposing of the signal subjected to processing depends on the amplitude of the last point from the series that describes the initial signal. This value will influence decisive the shape of the final zone of the derived or integrated signal.

The application allows the graphical observation of some conclusions drawn from the numerical analysis theory namely that the derivation operation tends to increase the errors occurred in the numerical interpolation of the graphics and the integration to reduce these errors.

Starting from this application can be achieved a virtual instrument which allows highlighting the role of sampling windows (Hanning, Hamming, etc..) into the spectral analysis of processed digital signal as well the digital filters.

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