THE DETERMINATION OF THE SIGNALS WITHIN CERTAIN MEASUREMENTS THROUGH SAMPLING

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Abstract: *The paper describes the system of measurements through sampling, the shape on the applied shapes to one or more blocks of the system. They present the mathematical description of the ideal process of sampling in amplitude and the reconstruction possibility of the sampled signal.*
Key words:*teletransmission of the samples, train of impulses, sampling function, devices called "zero level extrapolation".*

1. INTRODUCTION

The measurements through sampling within the scientific and technical revolution of the contemporary world are necessary in all the industrial branches, as an important link in the production process as well as in the research development of all fields.

I took into consideration the wide variety of apparatus and the methods used in practice and thus, I tried to systematically organize both the structures and the elements of certain functional blocks of the measurements systems.

The paper itself is extensive, but I focussed on the way of measurements through sampling only.

In order to make measurements of a continuons signal through sampling, certain steps must be followed, such as:

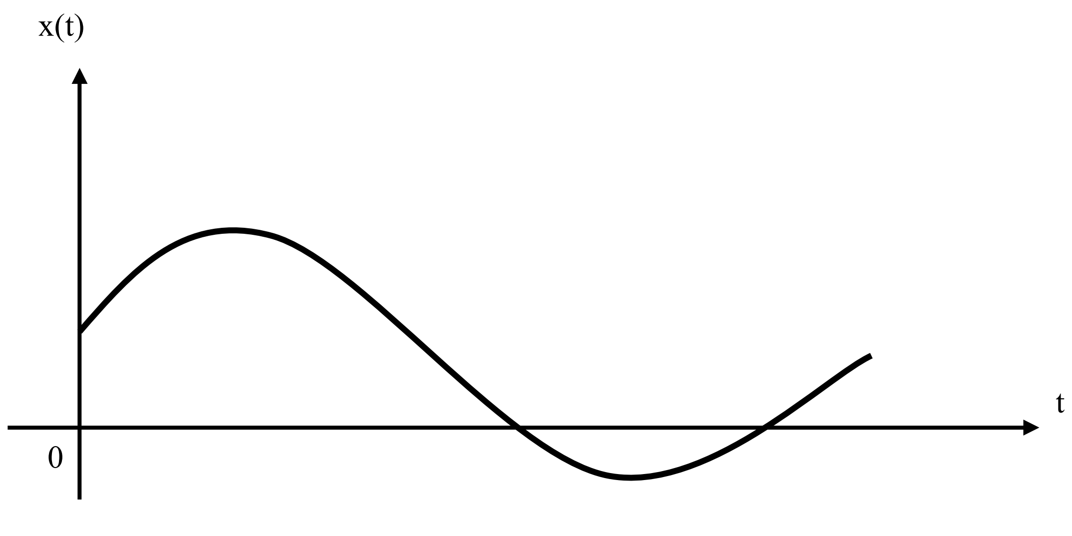
- the sampling of the continuous signal;
- the teletransmission of the samples;
- the remake of the continuous signal when it is received.

This type of measurements differs from other methods, because the signals applied to one, or more blocks of the system have the shape of a train of impulses. The information is received only in discrete moments of time while the signal as a train of impulses can only periodically be mathematically described.

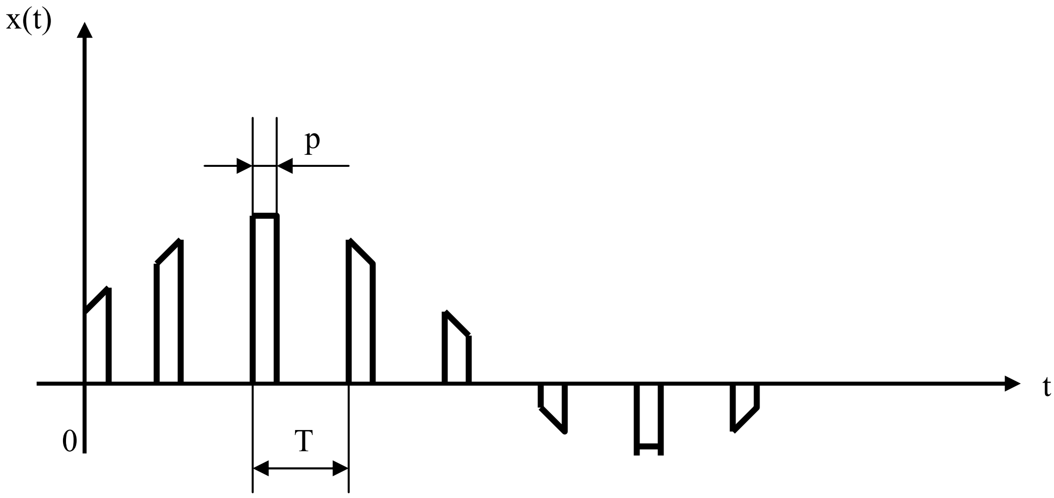
2. EXPERIMENTAL PROCEDURE

The system of sampling may include a numerical calcution or a numerical element to process the data, when the sampled signal is first changed into a numerical code (for instance a binar code) by use of a computer. The exit signal from the computer must be decoded as impulses.

Different types of samples may be made such as: the sampling in amplitude (the quantum theory) sampling in time, etc. the typical curves of these types of sampling are those in fig. 1 and fig. 2.

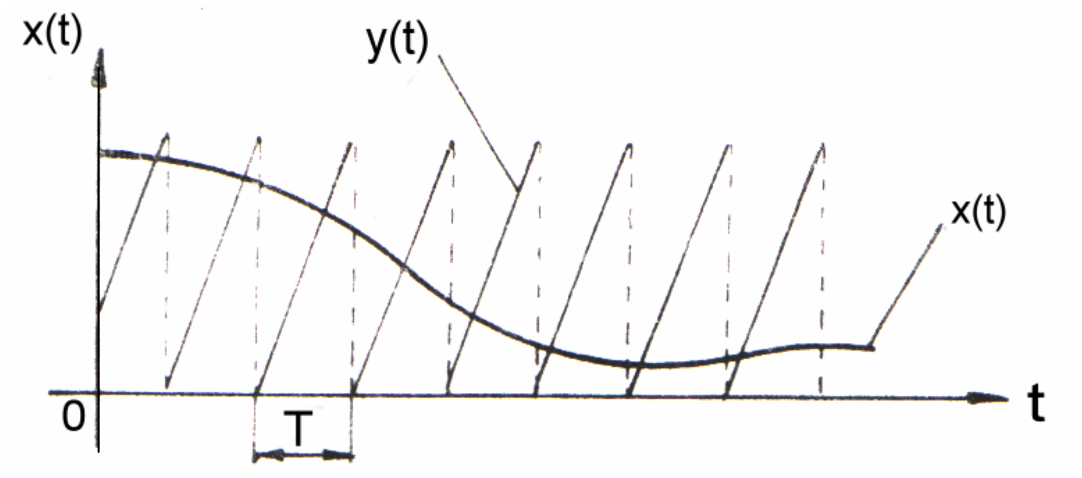


a



b

Fig. 1 *The typical curves of the entrance and exit signals of the sampling system, in amplitude*



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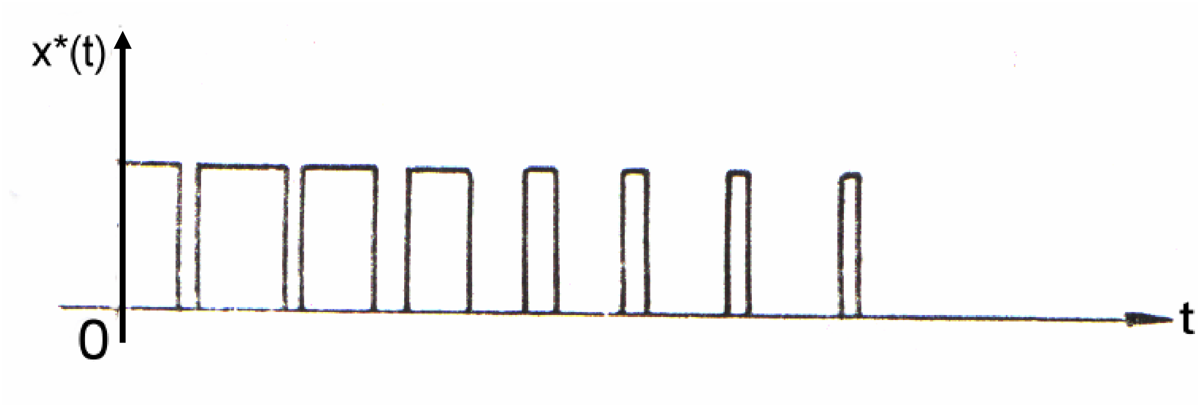

b

Fig. 2 *The typical curves of the entrance and exit signals of the sampling system in time*

The sampling itself is made up with a ”sampling function” y(t) which is obtained from a standard generator as a train of unitary impulses (fig. 3).

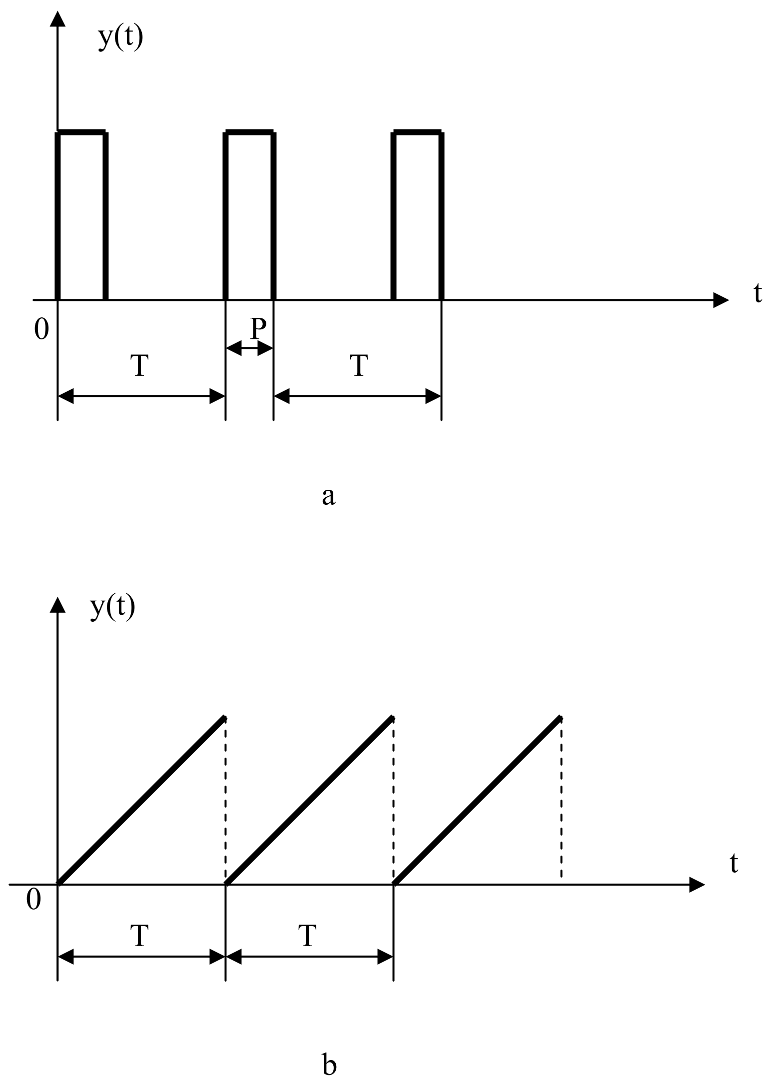

Fig. 3 *The sampling function:*
a *– for the sampling in amplitude;*
b *– for the sampling in time*

Mathematically speaking, there is a link between the continuous signal x(t) and the sampled one x*(t):

$$x^*(t) = x(t)\,\delta_T(t) \qquad (1)$$

in which $\delta_T(t)$ is a train of unitary impulse functions

$$\delta_T(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT). \tag{2}$$

If x(t) = 0 for t < 0, from the relations (1) and (2) it results:

$$x^*(t) = \sum_{k=0}^{\infty} x(kT) \cdot \delta(t - kT) \tag{3}$$

We can understand from this relation that the exit signal of an ideal sampling device is a train of impulse functions, whose areas are equal to the values of the entrance signal in the moment when the corresponding sampling kT was made.

The T period, should be chosen so as to respect the condition $T \leq \frac{1}{2}\left(\frac{2\pi}{\omega_c}\right)$, where ω_c is the highest pulsation in continuous signal (the sampling theory).

The relation (3) is viable only in the case of functioning sampling device in the field of time. If we telesend the sampled signal, it must be reconstructed when receiving the sampled data.

3. CONCLUSIONS

As the sampled signal $x^*(t)$ contains only discrete values, within different time intervals among them with T, in this interval there must be aproximated the initial signal x(t). This aproximation is made with special devices called ”zero level extrapolation”, level one or exponential.

The necessity of the continuous observation of the industrial processes, led to the creation of certain chains of automatical measurement which remove the relatively big response time of the human operator.

Comparing the method of measurement through sampling with the automatical one, a bigger precision as well as a performant fidelity is noticed.

The automatical methods of measurements start from analogical or numerical procedures and the signal got from the exit of these devices is amplified and then applied to a registrator or a servomechanism.

The chain is made up by means of correlation certain manual (hand) procedures by registrating them or by the appearance of some compensation curls which means a very high stability in frequence and a compensation of the temperature errors of the scheme taken into consideration. If there are measurements of high precision, their automatization is needed through compensation or autocompensation procedures (for example: the Rothe compensator).

To sum up, I agree on the idea and I suggest that measurements through sampling in the field of time, should be used, as being more performant.

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