ANALELE UNIVERSITĂȚII
"EFTIMIE MURGU" REȘIȚA
ANUL XV, NR. 1, 2008, ISSN 1453 - 7397

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The Study of the Mechanical Vibrations with a DAQ System

In this paper is presented the study of the mechanical vibrations made by an elastic lamella with a new program of information collection LABVIEW. In the processing of the collected information by the collection plate of the modulus SCXI 1600 *is used the described improving environment LabView, which examines the modulus used with the help of the NI-DAQmx. Using the DAQ Assistant can simplify the improvement of the application. NI recommends making some task with the help of the DAQ Assistant on using the sensories*

Keywords: *mechanical vibration, LabView, DAQ Assistant*

1. Introduction

In the modern age, the study of the mechanical vibrations has improved; they become more frequently decisive for the good working of many cars, buildings or vehicles. Making easier cars and vehicles, with higher and higher forces, makes that the spectrum of the exciting frequencies interpenetrates with the spectrum of the own forces, so the vibrations with injurious aspect become more frequently. The modern technique imagined also some installation where can be produced premeditated vibrations with technological aims: concrete vibrator, machines for compacting the ground, vibro- firing pin, conveyers, vibrant sieves, machines which are tried at stress, etc. The vibrations are dynamic phenomenon, which shows in elastically environments after a local excitation, and which is propagate inside of the environment as oscillations. The vibration is a mechanic oscillation around a reference point and defines the moving of a mechanic system. The environment must be big enough to can speak about a local excitation, and this can also propagate through the oscillation. The sizes which describes the system vibration, in other words: the shifting, the speed, the acceleration, are defined between the formulas:

$$x = A\sin\omega t \tag{1}$$

$$v = dx/dt = \omega A\cos\omega t \tag{2}$$

$$a = d^2x / dt^2 = \omega^2 A \sin \omega t \qquad (3)$$

2. The system of finding and processing the information

An especial importance is given in our the at the computer`s employment of the numerical processing of the available information after measuring some physical parameters of different industrial processes and not only.

The systemsof information`s collection are complicated systems of supervision of some processes in which interferes, as usually, a lot of physical sizes. They realize the drawing, with some appropriate translators, of numerical and analogical signals ( in function of the translator`s type), with the aim of remember, broadcast and processing the collected information.

In a DAQ, the schedule environment has the function of collecting and processing the information received from the digitizer (the collection plate), so it has the fonctions: examines and orders the whole collecting system, it receives digital collected values through a main communication line, it reconstitutes the signal from groups(change digitally-analogically), it measures some specific values to tha signal(amplitude(high value)etc.), it realizes a soft filtration of the signal, it realizes a Fourier analyse(spectral), it makes different arithmetical calculations(addition, multiplication, integration, derivation etc.).

The environment LabView is in fact a graphic language of schedule in which the code is not written as a text, it is written with the help of some pictures. The applications made by the LabView environment are called virtual instruments because it reproduces the working of true instruments as: amperemeters, voltmeters, etc.

The block scheme of the collecting and processing system of the information is presented in the figure 1:

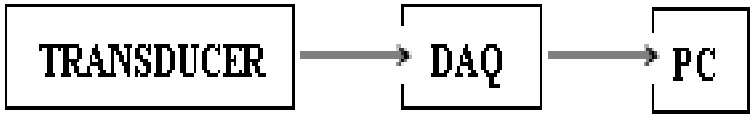

Figure 1. The block scheme of DAQ

In the specialized literature the translator is defined as a group made from a sensitive element and circuit of the signal processing, comprised in a shell which is a whole and has the role to change an unelectrical size in a size which can be measured electrically, a tension voltage accepted by DAQ.

DAQ makes the collection and processing the dates obtained at the final of the translator. In the computer is installed at the same time collecting soft LabView which makes the remember, the processing and the publishing of the dates.

3. The presentation of the collection and processing system of vibrations

As a practical application it has been studied the mechanical vibration of an elastically steel lamella with the length of 530 mm and the thickness of 2 mm, fixed at one of the extremity and the other extremity is free like in the next figure 2.

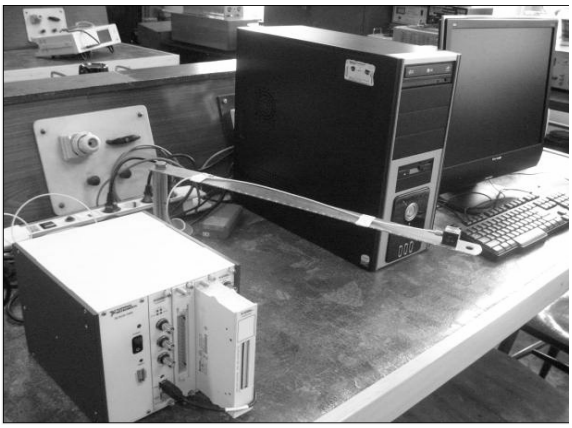

Figure 2 Experimental stand

It was made an initial deformation at the free extremity of about 30 mm and then it was delivered suddenly this extremity. I proposed to myself to record the variation in time of the free extremity acceleration. For this I used piezoelectric acceleration translator three-dimensional as Kistler with the value of $\pm$ 5g, which was fixed at the free extremity of the elastically lamella like in the previous figure. This allows the determination of the acceleration's elements after three directions perpendicularly one and the other. Two of these are written with Ax and Ay are continued in a parallel plan on the lamella's surface.

The third direction of the acceleration is written with a_z and it is perpendicularly onto the lamella's surface. These elements a_x, a_y, a_z, are obtained one by one translator's extremities.

To measure the vibrations is used the triaxial accelerometer of ceramic 8762A5T. The accelerometer is fixed on an elastically lamella, at a extremity, and at the other extremity of the lamella is fixed; the lamella is submissived to a force F, applied manually. As the majority of accelerometers, the sensibility is given by the report of the electrical exit, to apply acceleration, at the exit is obtained a low impedance tension, which is proportionally to the applied acceleration. Thanks to the low impedance are not necessary especial connections and the processing at distance is possible to be realized with a minimum noise.

For taking notice the vibrations, the accelerometer fixe don the elastically lamella changes the acceleration in an electrical size, which is proportionally to the applied force on the internal ceramic element (piezoelectric), the mechanic variable (the acceleration) being obtained from a force measuring.

The ensemble is made by a central bar, a ceramic piezoelectric element, a seismic mass and a preloading arrow. In the moment of working the unity sends a perpendicular move to the lower part. When the accelerometer is attached to a vibrant structure, the seismic mass exercises a force on the piezoelectric ceramic element. This applied force makes the piezoelectric material to produce an electrical size. Force is equal with mass multiplicated with the acceleration (*the second law of Newton),* the obtained result is proportionally with the acceleration, only when the mass is constantt.

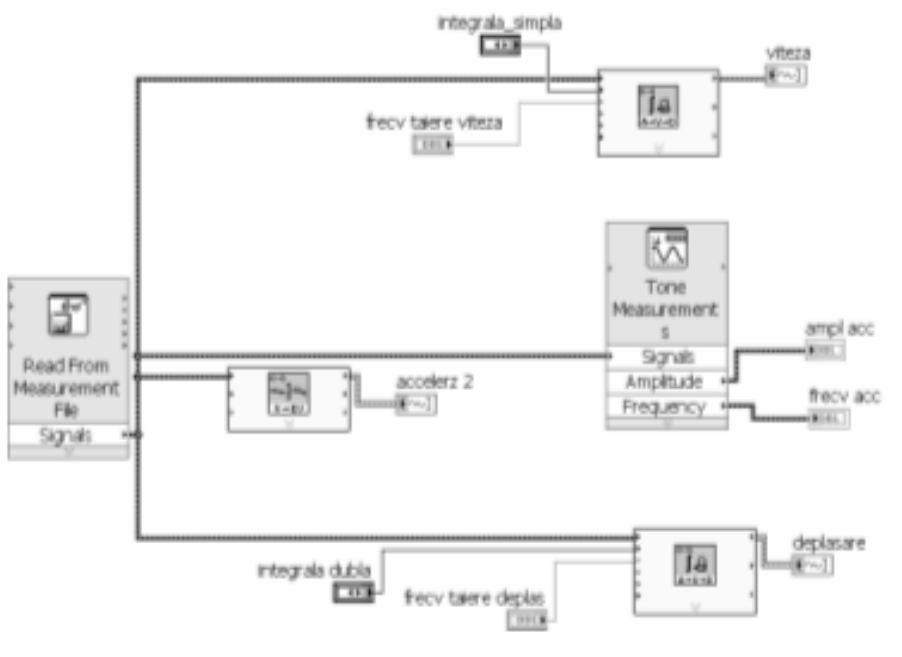

Figure 2. The block diagram of the virtual instrument used in reading the dates

The block diagram of the virtual instrument used in reading and processing the dates collected anterior is presented in the Fig. 2, in which for reading the collected information is used the block *Read From Measurement File*, information which are going to be processed by a simple and double integration, and after that it will be obtained the speed, also the shifting, which are going to be shown on the frontal panel, on two graphic indicators at which is additioned the graphic repre-

sentation of the acceleration, but also show the amplitude and frequency of this, obtained by the *Tone Measurement Block.*

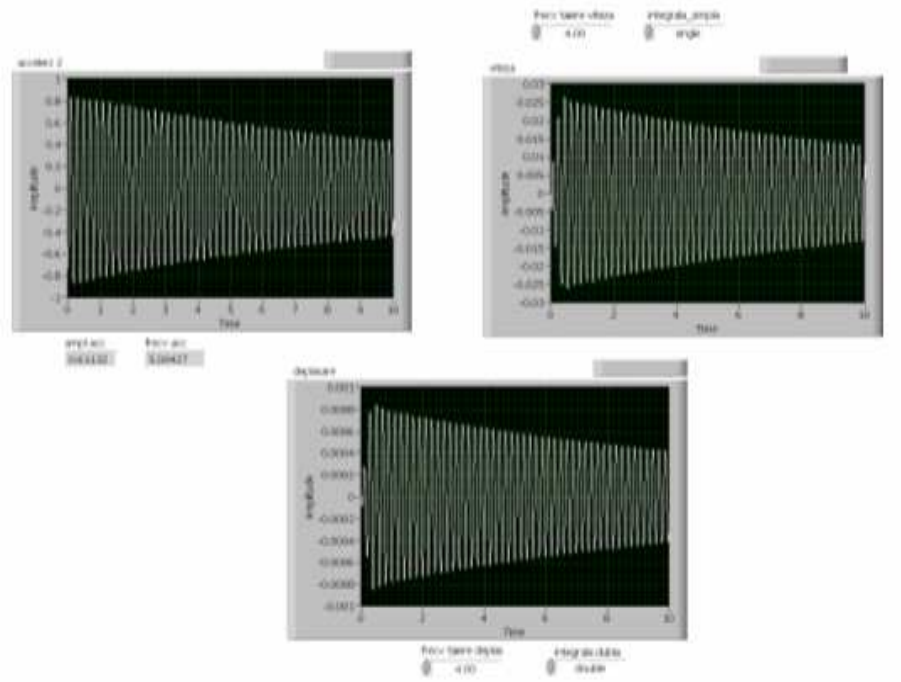

Figure 3. The frontal panel of the virtual instrument on reading the information

The development of LabVIEW environment offers also the possibility to obtain the curve of the amplitude and the theoretical curves, starting with the collected information which are processed, for that the information must be read again from the file in which were saved by the *Read From Measurements File Block,* the Boolean indicator EOF shows the final of reading information. The read date are used as a signal to enter in the block *Trigger and Gate,* which help to take a piece of the signal, after introducing a condition which refers to the starting or finishing threshold or even a static condition, in the shown model the finishing condition is at 408000 groups.

4. Conclusion

The collecting and processing information system are complicated system, made with the aim of:

- supervising, seeing some processes and phenomena;

- measuring sizes in the trying process of the functional modulus of some systems, products;
- testing the finite products;
- seeing and examine the production processes;
- see and examine the terrestrial, naval and aerian traffic.

The collecting and processing of information systems (SAPD) is an interdisciplinary domain which includes using some methods and techniques of measuring, analogical and digital electronics, communication of information, the digital processing of the signals, the theory of systems, informatics, which are used by all the type of engineers for making easier the modulus of taking the experimental results necessary in different engineer's studies.

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