

## **THE ACTIVE CONTROL TECHNICAL PROCESS OPTIMIZATION**

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### **ABSTRACT**

*The paper presents the way in which the active control can be improved via PC graphic software. It describes an example in which for a dimensional control gauge, for different dimension shafts, the dimensional measuring can be aided by computer. In this way, all the necessary information regarding the form deviations of the shaft, could be generated and stored during the measuring process.*

*The aided by computer measuring cycle was made depending by the establishing of some manufacturing precision, conform with the role which the manufactured and tested shaft was played for the finite product.*

**Key words:** *active control, dimensional measuring, virtual instrumentation*

### **1. THE PC ROLE FOR THE ACTIVE DIMENSIONAL CONTROL PROCEDURE**

Nowadays, the automatic active control is one of the most improved methods, thus actively influencing the chipping technological process, during the probes manufacturing [1]. The active control leads to a high reducing of the culls number, grace to the continuously active monitoring and intervention to the chipping mode, reporting to the probe's dimension.

The aided by computer active control could be a simply, efficient and low costing solution, reported to the complex machines intended for the active control, exclusively for some special pieces. This advantages are provided due to the high flexibility for the control adapting for different types of pieces, by a rapid re-programming of the measuring cycle. For this reason, a proper programming software is the Lab VIEW virtual instrumentation, produced by NATIONAL INSTRUMENTS. By creating virtual instruments for the dimensional measuring, the real measuring apparatus and gauges are partially eliminated, who although compose the complex machines for the active control assurance. Using the virtual instrumentation software, only the displacement transducers and the PC interfaces systems are required. The chipping modes monitoring, during the active control, can be also aided and commanded by PC, via Lab VIEW applications, who could address one or more data acquisition boards to command some execution elements to modify the chipping mode.

### **2. THE USE OF THE VIRTUAL INSTRUMENTATION FOR THE SIMMULATION OF THE ACTIVE CONTROL TO A THREE DIAMETER BEARING SHAFT**

The paper presents and describes a virtual instrument created in LabVIEW 7.1 for to simulate the active control of the maximum diameter bearing rotor shaft, fixed into an experimental research gauge.



*Figure 1. The experimental gauge for the type rotor shaft*

This type of rotor shaft is a very suggestive example for the active control simulation, considering that in real time of the measuring process of a bearing shaft, it could be subjected also to the adjustment technologic process. The chipping tool fixation could be similarly made with the displacement transducer fixation into the mobile skid, but in diametric opposite position. The advance position of the port – tool skid could be ordered manually or automatically, via the execution elements commanded by the PC.

The paper presents an application for the active control simulation, with manual ordering of the chipping tool, due to the information received by PC about the measured current bearing shaft diameter. The application permitted to resolve two main aspects.

1. The in real time high precision dimensional measuring of the maximum bearing shaft diameter;
2. The active control simulation, due to the information about the dimensional inspection, taking into account the tolerance deviations established by the user.

For the aided by computer in real time measuring, there was necessary a measuring gauge composed by an optical displacement transducer, coupled to a LS7366 32 bits decoder, with a PIC18F452  $\mu$ controller [2]. The dimensional measuring was realized in 16 equidistant points disposed around the bearing shaft circumference.

The virtual instrument created in Lab VIEW is composed by two main windows:

- a panel who represents the graphic interface with the user, in which there are showed all the necessary information concerning the active control;
- a diagram window in which there was created the cable lay - up graphic program for the described application.

The interface offers two types of information:

A. Information about the dimensional deviations of the bearing shaft; this are materialized by an array indicator, containing the form deviations, corresponding to the measuring points, three numeric indicators for the displaying of the maximum, minimum and total form deviation and two graphic indicators, the first for the displaying of the deviations distribution for a complete shaft rotation, and the second for the generation of the real geometric profile of the bearing shaft.

B. Information about the active control simulation of the bearing shaft: this information is materialized by two numeric controls, in which the user specifies the minimum and maximum tolerance admitted values for the form deviations and also four indicator state leds, who, by lighting, indicate, for each case, if the bearing shaft corresponds, is adjustable or it is rejected. To improve the active control simulation, in case of a high dimension shaft, it were into account two different cases. In the first case, it was emphasized the continuation of the adjustment process, maintaining the same advance of the chipping tool, the dimension being yet higher, and the second case corresponds to the continuing of the chipping process, but decreasing the chipping tool advance, until the optimal dimension obtaining.



In this way, in this phase, the virtual instrument permitted the displaying of the instantaneous value of the deviation for the current measuring point. For the information stabilization there were programmed three reading of the instantaneous value of the measured form deviation, in the current measuring point, this values being averaged. For this reason, there was used a repetitive *FOR* structure, containing three iterations for each reading cycle.

For the deviation determining in each of the 16 equidistant measuring point, there was used another repetitive *FOR* structure, including the first one, with 16 iterations.

For the displaying of the real profile of the bearing shaft, it was used a 2 – D graphic representing function, of type *X – Y Plot*. As input of this function it was used a data MUX, in which the following data were acquired:

- a 1-D array to define the equation of the bearing shaft symmetry axis;
- an array to define the circle equation, who materialize the nominal profile of the bearing shaft;
- two coupled arrays for the real bearing shaft profile tracing, affected by the measured form deviations; in this case to the array who defines the circle equation for the nominal profile, was cumulated the form deviations measured values array; the last one was obtained due to the passing of the two repetitive *FOR* structures.

To display the state logical leds, during the active control simulation, for each led there was used a Boolean structure TRUE / FALSE, the index of each structure being related to a comparative function between the minimum and maximum of the measured deviation and the minimum and maximum tolerances established by the user. The maximum and minimum of the measured value were extracted with the *MAX / MIN* function by the final measured form deviation array.

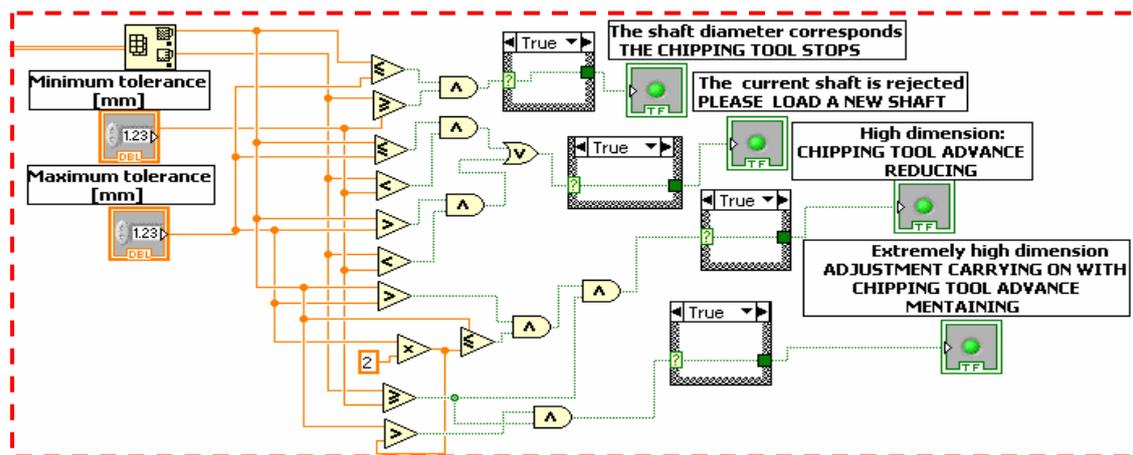


Figure 4. *Aspects of the window – diagram: regarding the state leds programming for the active control simulation*

### 3. CONCLUSIONS REGARDING THE HIGH FLEXIBILITY OF THE VIRTUAL INSTRUMENTATION FOR THE ACTIVE SIMULATION

In this case, the created program in LabVIEW 7.1 was entirely successfully used for the form deviations measuring of the other two bearings shaft, only by modifying the numeric values of the numeric control who establish the nominal diameter of the measured bearing shaft.

As a conclusion, this virtual instrument is proper for the active simulation of any symmetric revolution piece having different dimensions. Besides, using two or more displacement transducers, it is possible to simulate the active control for all piece's dimensions of interest, simultaneously.

### 4. REFERENCES

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