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COMPARATIVE STUDY AIDED BY COMPUTER FOR OPTIMAL QUALITY INSURANCE DEVICE CHOOSING

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Abstract: *The paper describes a virtual application developed in the Lab VIEW software environment issued to help the manufacturer to take a decision very quickly to use the proper measuring gauge for the quality control insurance in any situation. The manufacturing quality control optimization takes into account different aspects, like: costs, efficiency and precision. The application presents an example in which the user can be instantaneously informed if the proposed control gauge can be used respecting all the specified criteria. The solution is characterized by a very high flexibility so that for any situation a correct and rapid decision can be taken, without supplementary costs to find the proper measuring device.*
Key words: device, quality, transducer, Lab VIEW, precision, costs, efficiency

1. THE EFFICIENT QUALITY CONTROL INSURANCE

Nowadays aspects like: high productivity, low costs, low energy consumption, high quality are the main issues about the finite products manufacturing with application in all domains. Our study refers to a very important technological process that composes the manufacturing chain: the quality control of the components of a finite product. On the quality control insurance, the research was concentrated to the geometric parameters of the tested components, so to increase dimensional inspection quality was our research issue. For this reason, we proposed to develop an efficient and flexible solution to help the manufacturer to choose very rapidly the proper dimensional measuring device in any case.

2. THE DEVELOPPED SOLUTION

Using the Lab VIEW software environment, we developed an application as interface with the user.
The main issue is to help him to make the best choice when performing the manufactured components quality control insurance. For this reason, our study was centered on the dimensional inspection, the main problem to solve being to choose always the most proper measuring device. First of all it means to choose in any case the measuring device that satisfies simultaneously different criteria like: process productivity, accuracy and costs reported to the tested probe roll as component of the finite product. The virtual application allows the manufacturer to choose rapidly the proper control gauge by specifying the manufacturing conditions and the costs limits. The user has to choose a measuring device form a list, knowing the measuring conditions, the costs, accuracy and productivity limits. Besides, the user must introduce some technical characteristics of the measuring device that was chose. To be as flexible as possible, the software application can be run for 3 distinct cases: A - the case in which for the dimensional

inspection is available just a single measuring device; B – to perform the dimensional inspection there are available 2 or more measuring devices, different principles; C – If no one of the existing measuring devices does not respect the imposed criteria to ensure the quality control, a new type of measuring device is recommended to be acquired. For the first case, when running the program, the user will know immediately if the existing measuring device can satisfy the criteria to perform the necessary quality control according to the tested component. In this case the program issue is to inform the operator if the measuring device proposed to be used will correspond to ensure an accuracy and efficient control not to expansive by the point of view of the process. For this reason many criteria are analyzed like: productivity, accuracy measuring range and costs. Only if all criteria are simultaneously satisfied the proposed measuring device will can be successfully used. If one of the specified criteria is not satisfied the third case (C) is to be analyzed. By the point of view of the programming, an *AND* logic function was used, considering all the imposed conditions (figure 1).

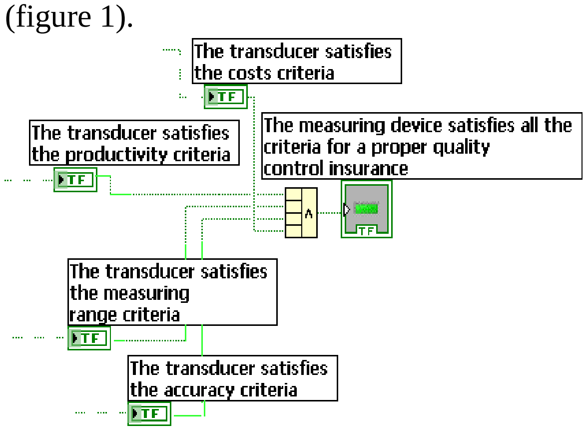


Fig.1. The programming of the algorithm about the decision regarding the use of the proposed measuring device (case A).

To appreciate if one of the four imposed criteria (accuracy, efficiency, cost or measuring range) is satisfied, the programming algorithm refers to a comparison between the measuring device performances and the imposed values according each situation about the necessary control.

For the second case (B), after the application running, the operator will know which measuring device is the best to perform the control. The programming algorithm corresponding to this situation includes the evaluation by the point of view of all criteria for each of the existing control devices proposed to be used. The maximum admissible limits must be specified about the following criteria: measuring accuracy, range, efficiency and costs, according to the manufactured tested probe's destination (figure 2).

Fig.2. The establishing of the imposed limits to ensure a high quality control

The programming algorithm consists into the comparison between the imposed limits and the performances of each measuring device by the point of view of all criteria.

As a result each of the existing measuring device to be evaluate will satisfy or not the criteria. A measuring device will be considered proper for the quality control insurance only if it satisfies simultaneously all the criteria. In fact the determined performances, as values for the costs, measuring error, measuring range, and efficiency must be smaller than the established values as limits about the specified criteria. About each criterion, the program calls a comparison function which addresses a *CASE* structure to indicate by a state led if the current criterion is satisfied (figure 3). As an example, if for one of the measuring devices, the accuracy is smaller than the imposed accuracy necessary for current tested probe's destination, a state led will indicate the accuracy criteria is satisfied.

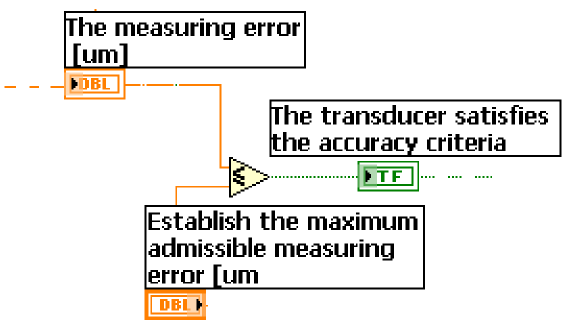


Fig.3 The programming of the accuracy testing for one of the evaluated measuring devices

The programming algorithm to determine the measuring accuracy takes into account the measuring resolution as a technical characteristic for each device and also its statistical measuring results on the precision.
On the measuring efficiency, the duration of a measuring cycle for each type of tested probe is considered as reference for the algorithm to determine the productivity for each measuring device (figure 4).
For each criterion, many state led will indicate which measuring device is proper to be used (figures 9-12). Each state led corresponds to a measuring device. Finally a state led panel will show which measuring device can be the best solution to use according to all specified criteria (figure 13).

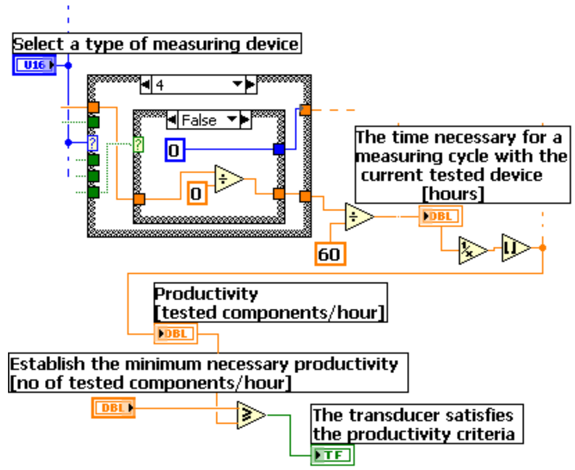


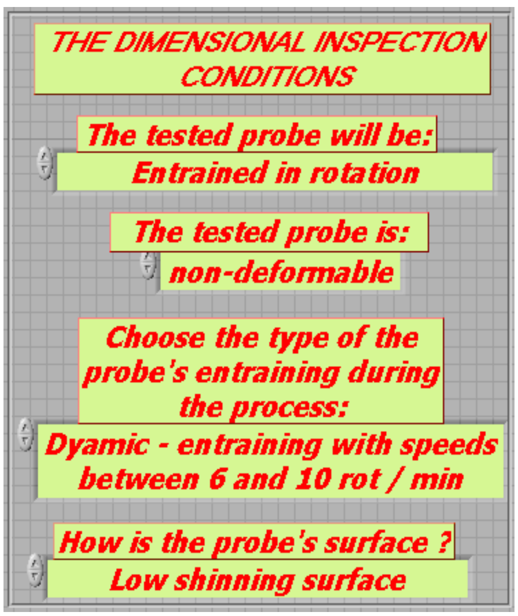
Fig. 4 The programming of the algorithm to evaluate each measuring device by the point of view of efficiency

For the last case, after the program running, the user is informed that no one of the existing measuring devices can ensure the quality control, respecting the imposed criteria. In this case, is important to know if the new measuring device proposed to be acquired will satisfy the imposed criteria for the quality control insurance. So that, after the specification of some technical characteristics of the proposed new measuring device, the application will run for the second time, giving the asked information. The programming algorithms are also based on the specified criteria, considering the estimated costs and technical characteristics of the new measuring device proposed to be acquired.

3. HOW TO USE THE DEVELOPPED LABVIEW PROGRAM

When running the program, the first step is to enter the imposed criteria to ensure a high quality control when performing the dimensional inspection, as it can be seen in figure 2. After the quality control criteria

specifying, the user has to enter the measuring condition regarding the type of tested probe and also the dimensional inspection mode (figure 5). The specifying of the tested probe's geometric parameters (probe entrained in rotation or in translation during the measuring process) is the following step to do on the program running.
The dynamic control process parameters are also important to be established by the user before the program running. First of all it is about entraining speed of the tested probe in the control gauge.



Fig,5. The specifying of the dimensional inspection conditions

In the first case (A) when only a single measuring device is available for the dimensional inspection process, the user has to complete the dialog boxes with the device's technical characteristics and costs of the measuring device (figures 6 and 7).
For the second case (B), when the user must to choose one of the existing measuring devices, he has to complete the technical characteristics and costs for each of the available devices. Beside the measuring devices costs, the use must specify also the costs for tested probes entraining devices.

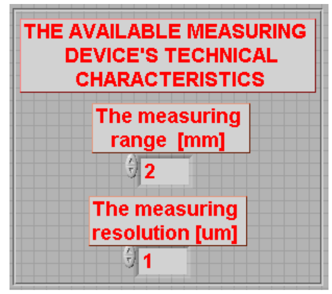


Fig. 6. The measuring device's technical characteristics

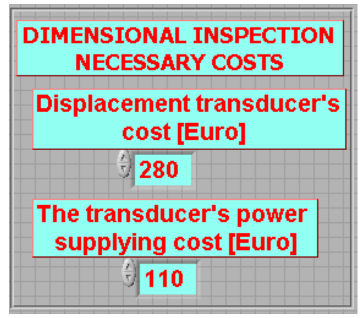


Fig. 7. The measuring device's necessary costs

For the last case (C), when no one of the available measuring devices insure the imposed quality control, for the new proposed measuring, must be specified the costs and technical characteristics
Due to the entered data, for any of the 3 cases, after the program running the user is quickly and efficiently informed about the best solution on the measuring devices to be used for the quality control insurance. First of all, the application gives the information about each of the imposed criteria (accuracy, measuring range, productivity, costs). Finally the user will know which type of measuring device is recommended to be used for any type of probe geometry. For instance, in the first case (A) the user will know if the existing measuring device corresponds by all points of view (figure 8). For the second case (2 or more displacement transducer are available), the results are also shown, for each measuring device (figures 9-12). The information refers to all optimization criteria (measuring range, accuracy, productivity and costs).

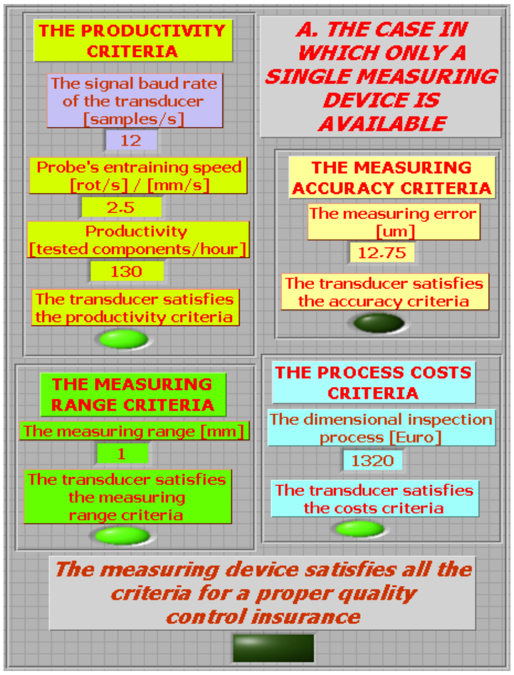


Fig.8. The results on the first case: a single measuring device is available

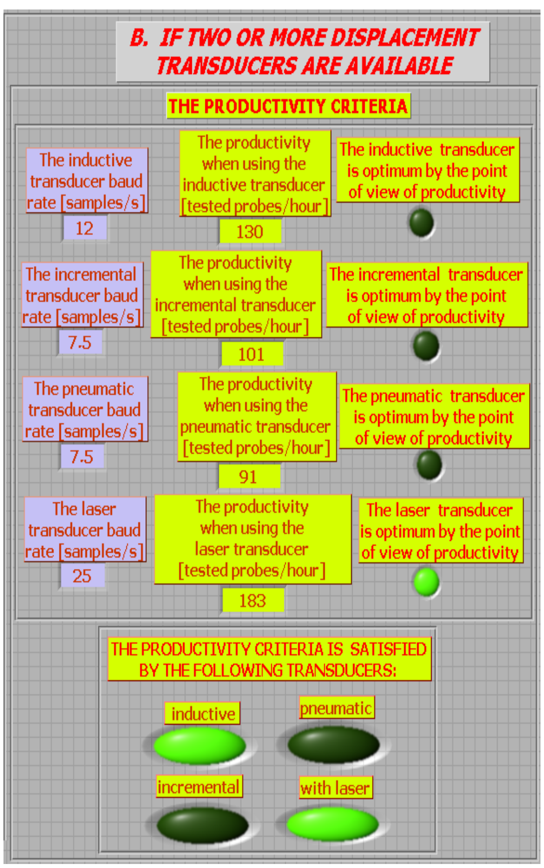


Fig.9. The results on productivity criteria for each of the available measuring devices

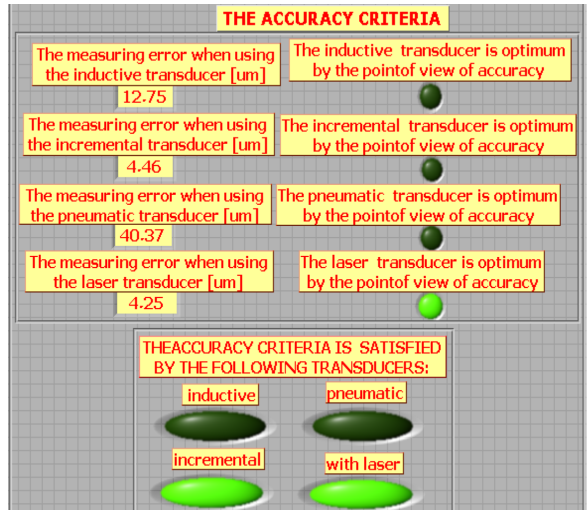


Fig.10. The results on accuracy criteria for each of the available measuring devices

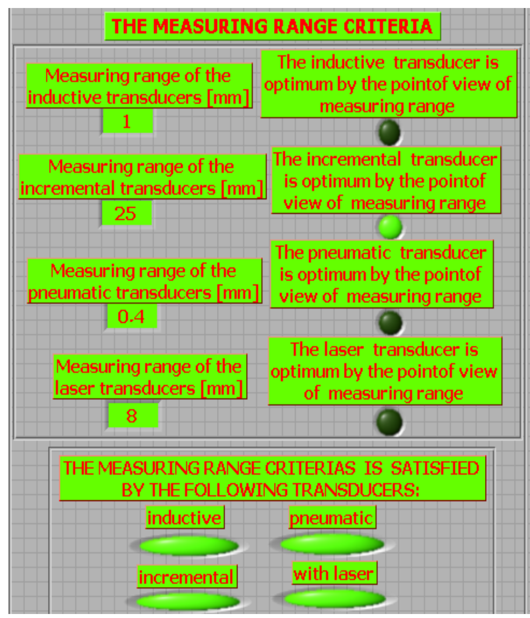


Fig.11. The results on measuring range criteria for each of the available measuring devices

As a result, finally the program shows the measuring devices recommended to be used to perform the control process, respecting all the imposed conditions to insure a high quality insurance (figure 13).

For the last case (C), based on its estimating costs and technical parameters, the application informs the user if it will correspond (figure 14).

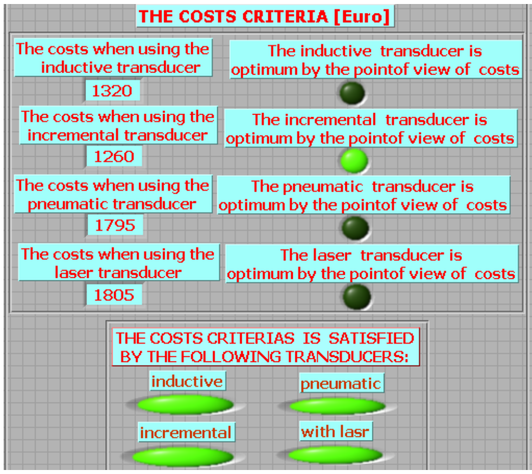


Fig. 12. The results on costs criteria for each of the available measuring devices

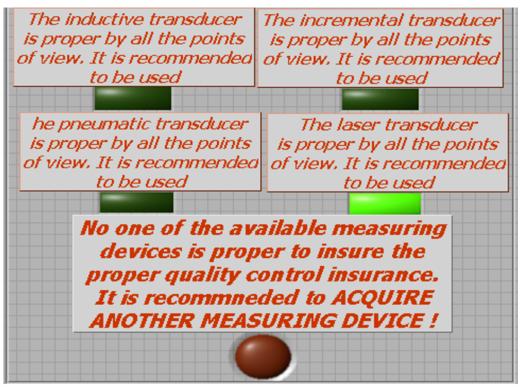


Fig.13. The recommended measuring device as optimum for a proper and an efficient quality control insurance

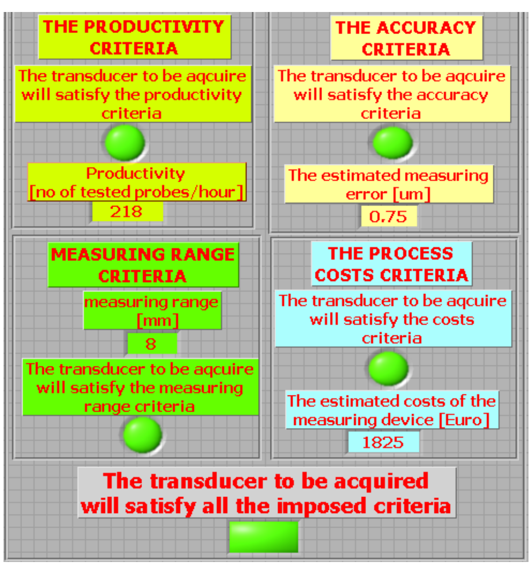


Fig.14. The information on the performances of the measuring device to be acquired

3. CONCLUSION

The proposed application is characterized by a very high flexibility so that for any situation a correct and rapid decision can be taken, without supplementary costs to solve this problem.

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