ASPECTS REGARDING THE TYPES OF PROCESS CONTROL SYSTEMS

by
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Abstract. The paper intends to present the process control methods. The presentation refers to the ways in which they are implemented and namely to the planned control, the direct digital control, the supervised control.

The production process comprises the entire activity carried with the aim of obtaining finished products, by transforming the charge stock and materials. This activity is carried in an organized framework corresponding to the constructive particularities, the conditions and procedures used to obtain the product. Organizing the production process, determined by the kind of materials that are processed and by the technological processes, which have to ensure the obtaining of the respective finished product on the best terms.

Production programming refers to process operation control in production on the equipment, to the machinery and technological installations of the system. The technological process sequences must be known beforehand and they must cover the whole diversity of process conditions encountered in production and if possible, including the unpredictable ones. This control strategy uses most of the times the regenerative loop of the circuit for the control and confirmation of execution of each phase or technological operation. The process control takes place in an open circuit when not all the sequences require a reaction control.

The production programming is a component of the production planning and it consists of defining and using a production programmable control cycle, regarding the production of a piece or of a batch of finished products.

The sequential control is a form of production programming and it consists of the logical sequential control. The procedure is executed in a scheme where the decision is taken and executed following the appearance of random and predictable events in the production system. Such a system uses

timing and distribution relays, which determines when the production system outputs have to change.

The combinational logical system is used most of the times in the industrial process control and it uses schemata with anticoincidence gates with electromagnetic and electronic relays, programmable apparatuses, microprocessors, microcomputers and minicomputers.

The use of digital computers is convenient in the combinational and sequential logical control with switches.

An eloquent example of production programming is the CNC programming. This implies the direct use of the computer in the machine tools process control.

A process control system comprises the whole range of : equipment, computer programs, operating procedures. The computer's input is tied to its qualities as regards: the possibility to absorb and process high volumes of information; high precision of data process; the capacity to execute calculations of high complexity of calculus and intervention on the process.

The programmed process control is frequently used in industrial processes. The computer is used to start/stop a large industrial process as well as to control the process of qualitative transformation of the product in the series production, divided on conditioned operational sequences, in real time and with the minimization of the energy absorption. The process control suffers constraints in order to optimize the variables of the process in each technological phase.

In the manual operation process, the human operator decides and executes the intervention in the process through own means. The human operator can be helped in the process of manual adjustment by means of measurement and display with an allowable degree of accuracy on the values of the process variables. Through his action, the human operator makes direct corrections in the process, on the input variables in order to maintain the values of the output variables at the pre-established value and assuring a stationary functioning regime.

The analogical control allows automatic corrections, without the direct intervention of the human operator. The analogous control allows the monitoring of each output variable so that each desired value should maintain at the prescribed levels, by changing the input variables. In a complex industrial process, the number of regenerative loops increases significantly such that in certain industry branches there are hundreds of regenerative loops. The computer is used to replace the high number of analogical loops.

The direct process control implies the replacement of the conventional analogical control with the digital computer. The adjustment of the process is done by the computer in discrete times and sample data, individually processed by many continuous analogical elements, each working in its own pre-established procedure. In the direct digital control, the computer calculates the values of the input variables necessary to the process and transmits them to the process. The direct coupling of the process to the computer is called „direct digital control" and is the most efficient original means to execute this types of control activities as well as those replaced by the analogical type – continuous.

The analogical devices function on the basis of a mathematical expression, with which they operate in functioning. The digital computer is simpler, more easily adaptable from the point of view of the diversity of computers in the process control and more effective. Thus, the direct process control offers opportunities of a higher efficiency in the execution of the same activities as the analogous ones and allows a greater flexibility, in the control activities, such as reprogramming the future activities.

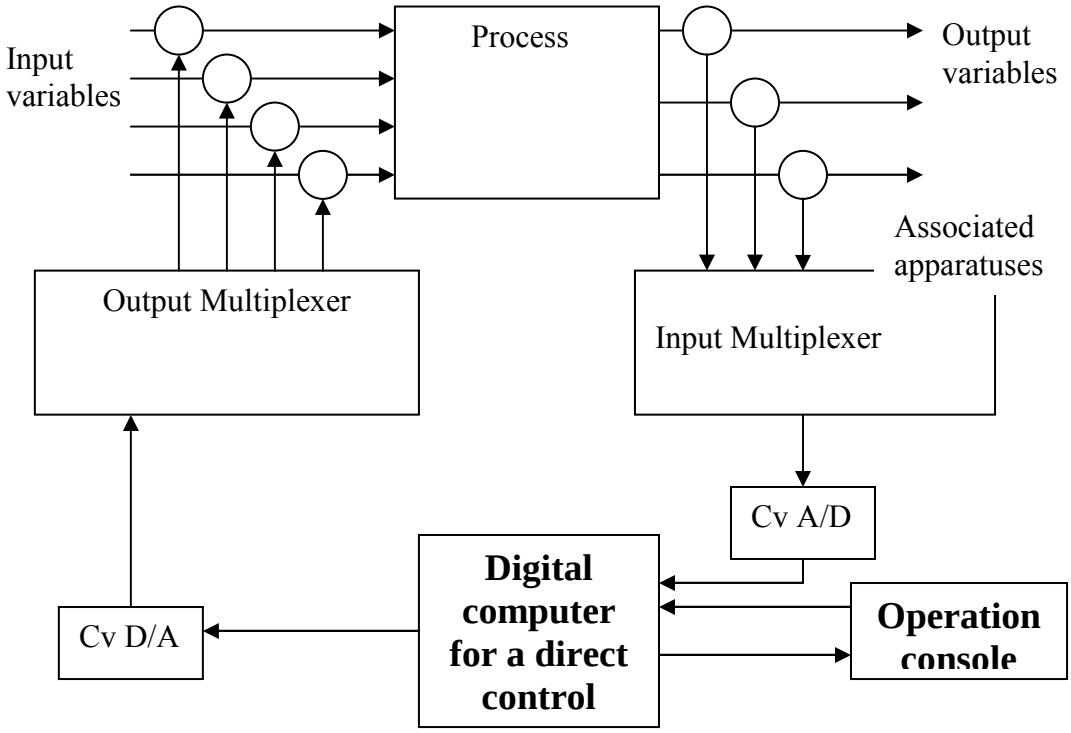

Fig. 1

By supervising we understand observation, coordination, super control

In the direct digital control, all the analogous components of the regenerative loop are replaced with the digital computer or with components that operate digitally. These are foreseen in the regenerative loop of direct digital control presented in figure 1.

Supervising with the help of the computer is a control system where the computer has the role of optimizing some performance indicators of the process's objectives. The objectives' performances refer to those functions objectives or main performance indices of the process.

The supervising control represents a superior control level in comparison with the programmed control, the conventional analogical control. These three types of process control are considered process control methods, where the computer operates directly in process. Opposed, the supervised control includes the operationing of the process level in a control system.

Among the strategies of computer-supervised control, we enumerate the following: the adjusting control, the positive reaction control, stationary optimization, adaptive control, and exploration techniques. The strategies are chosen depending on the process and their performance indices. These strategies are executed at the supervising level and implemented through a control system at a process level.

The adjustment reaction control is possible when their performances are measured in the conditions of ensuring the quality of the products; the quality must be maintained at a level established in the technical documentation.

The aim of the supervising control is to maintain quality at a constant level intended for the product. For its realization a reference signal is required for each loop that should correct the process perturbations. The adjustment reaction is a negative reaction applied to every individual loop in the process. The adjustment reaction bears the name of the controlled objective and can be on an individual or global loop on the whole process. The disadvantages of the adjustment reaction consist in the fact that its compensating effect is produced only after the perturbations have affected the process out. The adjustment reaction action is initiated after an error appeared on the process out, expressed through the difference between the real value on the process out and the preset one.

When the perturbations are measured before the production of actions on the process, the supervising control is one with a positive reaction. In the ideal case, the collective action compensates the influence of perturbations and

deviations from the value desired for the outing are prevented. The advantages of the system are presented in figure 2.

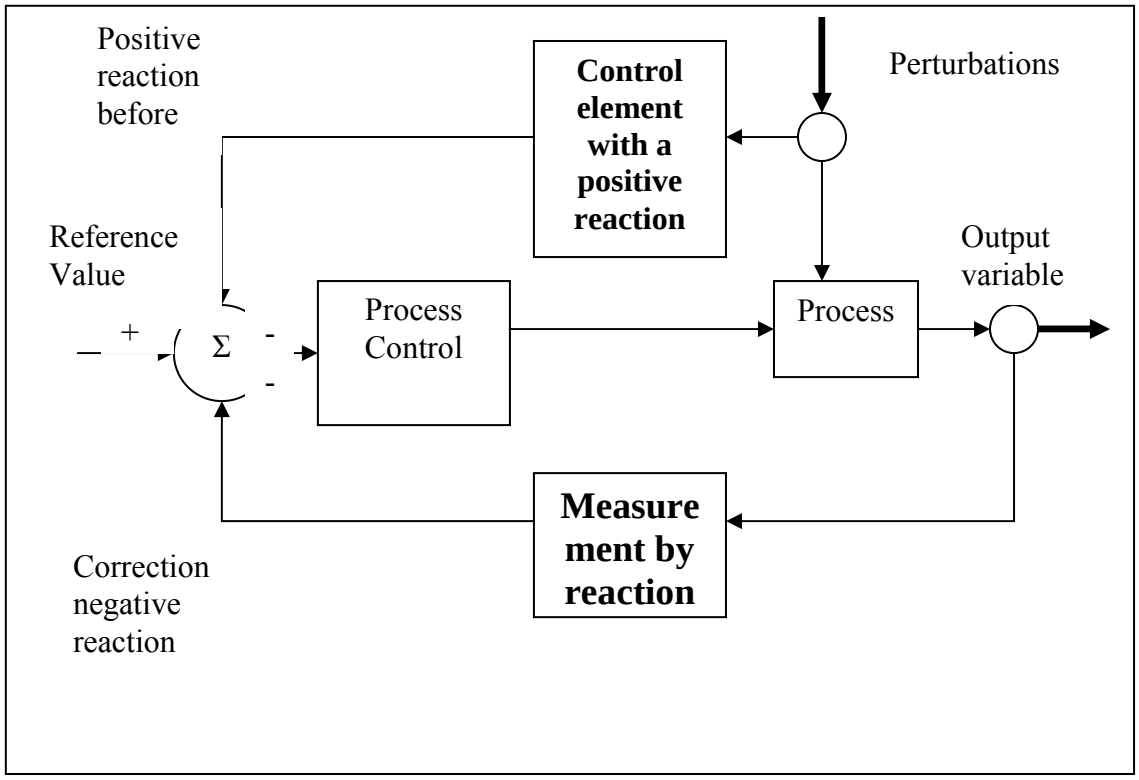

Fig. 2

Conclusion

Instruments used in direct syntheses are useful only in solving some particular problems, which underlies the importance of simulation methods and industrial process control. We can notice the availability of computerized, automated stations that will contribute to the control and supervising of the whole process.

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