INCREASING PRODUCTIVITY AT THE LEVEL OF THE POWER PLANT BY OPTIMIZING THE DISTRIBUTED SYSTEMS AND HIERARCHICAL SYSTEM

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ABSTRACT: This paper presents aspects of distributed and hierarchical control systems that the current way of implementing automation applications for the large or complex processes, such as a power plant. This implementation can achieve a significant increase in productivity in the functioning of the whole complex industrial process.

KEY WORDS: distributed systems, hierarchical systems.

1. THE PRINCIPLE OF TECHNICAL IDEAS

The technique of control the industrial processes have been developed more and more complex control algorithms, algorithms that need a lot of information about the process and also the processing of information is very complex and must be done in real time.
Because of a level of automation evolved at a power plant, appears the following possibility:
In the block diagram of a control loop of Fig.1. which already operates the automation system, we are able to go in inverse sense, that knowing ***R - the control law*** *what works in real time, knowing* H_0 ***- the real-time dynamic response of closed loop system****, it can go the inverse way, ie evaluate* ***P - the process****.*
The global control loop (feedback) is:

$$H_0 = \frac{R \cdot P}{1 + R \cdot P} \qquad (1)$$

From the previous relation (1), considering that H_0 - is the dynamics that characterize the current functioning of the process in real time and can be obtained from the assessment of actual plant responses to different operating modes, we can consider it as known.
Basically, this is what happens in the case of the current implementation.
Also of the previous relation (1) is well known mathematical function ***R*** that is actualy implemented, and works in the control loop.
Having known these things (H_0, R), we have principled relationship arising from equation (1), which will be the basis for estimation and identification processing:

$$\Rightarrow P = \frac{H_0}{R \cdot (1 - H_0)} \Rightarrow P = f(H_0, R) \qquad (2)$$

The principled relationship (2), shows that the mathematical model of the process ***P*** can be obtained by following the inverse steps.
knowing the control law ***R*** that work now, and measuring different responses of the real control loop will generate the knowledge dynamics H_0.

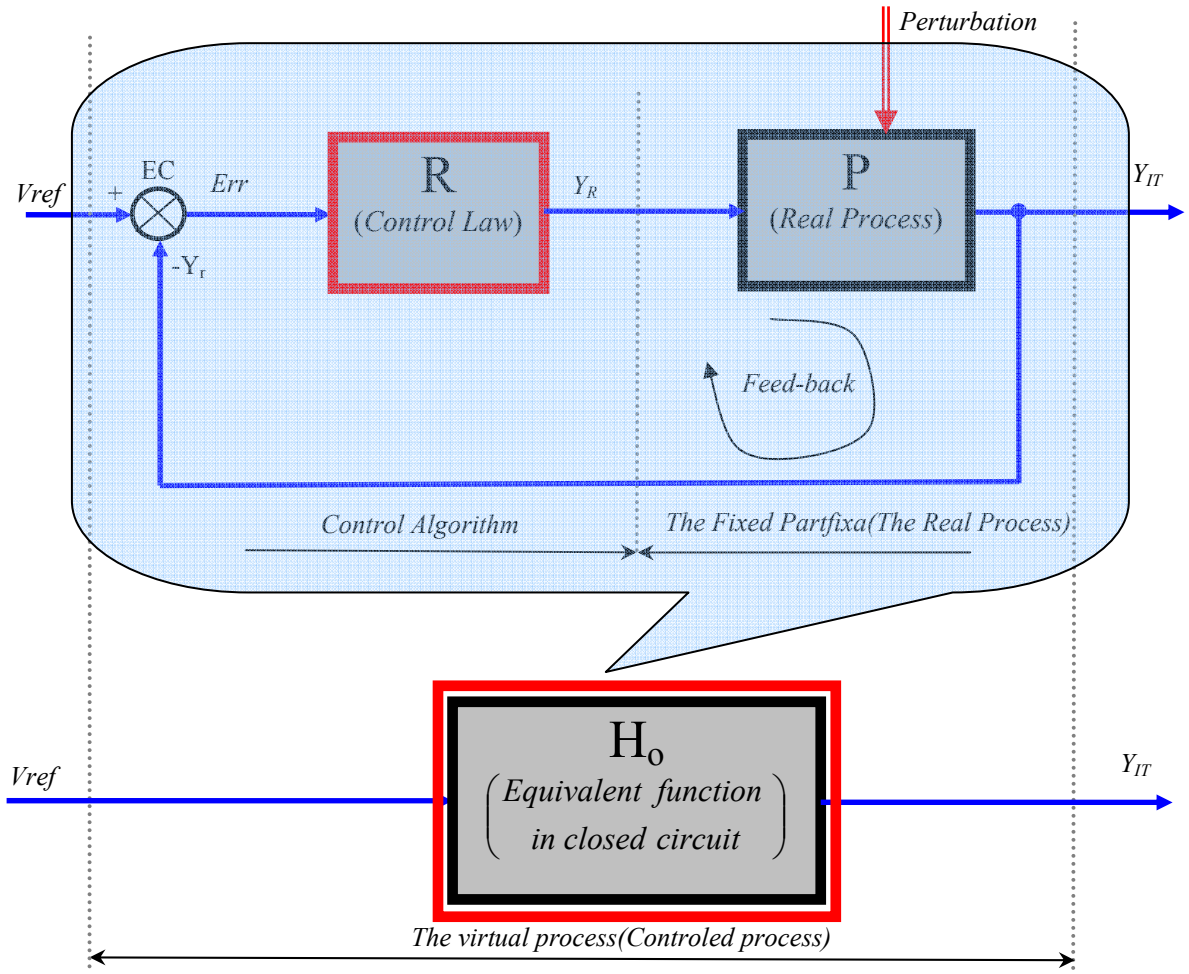

Fig.1. Structure of control loops running at the power plant

2. METHOD OF IMPLEMENTATION

Thus ***"knowing"*** the process, modeling the power plant based on the idea presented, we can redesign some existing control structures, redesign existing control laws, designing a distributed and hierarchical control structures that take into account interactions between different real physical signals or control loops.

In a distributed and hierarchical control structure can be achieved global power plant operation with high performance for optimality and stability.

This ***can lead*** to a significant increase in the productivity of the power plant.

The principle underlying the concept of distributed and hierarchical system is outlined in *Fig.2.*

Dividing a complex process into sub-processes (distribution) is done in accordance of the functional group of process elements, but primarily to respect real time constraints. By processing in parallel by multiple microprocessor system of information from the process is obtained a total processing time lower.

Distributed systems are designed to maintain the advantages of both opposing trends that have marked the evolution of alternative automation systems - ***centralization and decentralization.***

Distributed and hierarchical control systems is one of the most profitable compromise between these two approaches.

Hierarchy of information processing algorithms is done vertically in that complex algorithms (time-consuming) departs from the direct control of the process, while simpler algorithms are nearer to the direct of control the of the process[1], [2], [4].

A possible structure and hierarchical distributed on 5 levels [2] is shown in *Fig.3.*

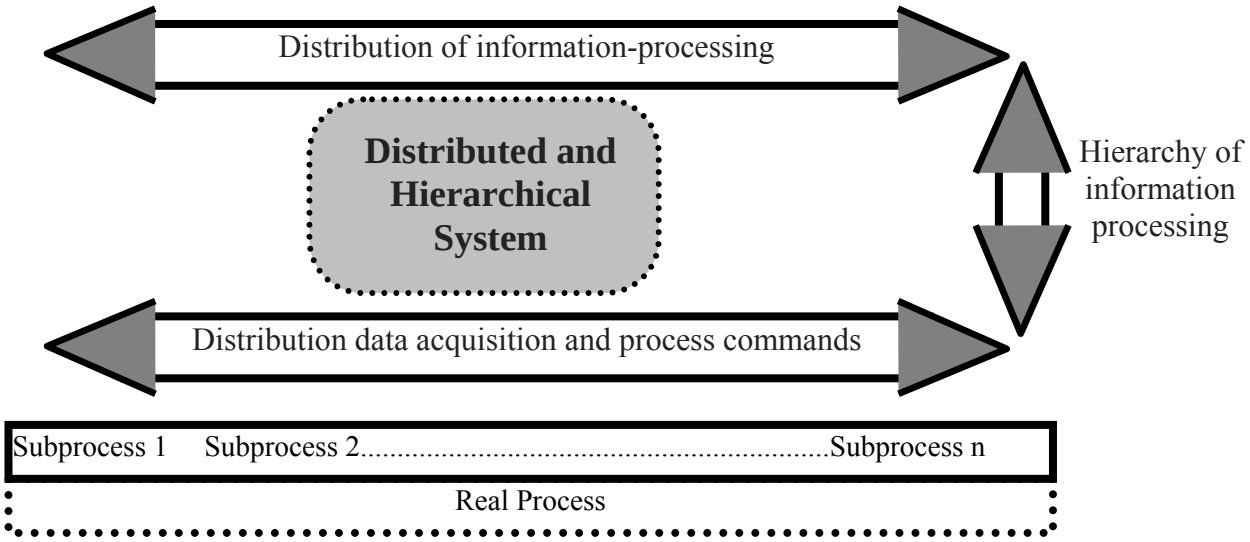

Fig.2. The principial structure of a distributed system and hierarchical system

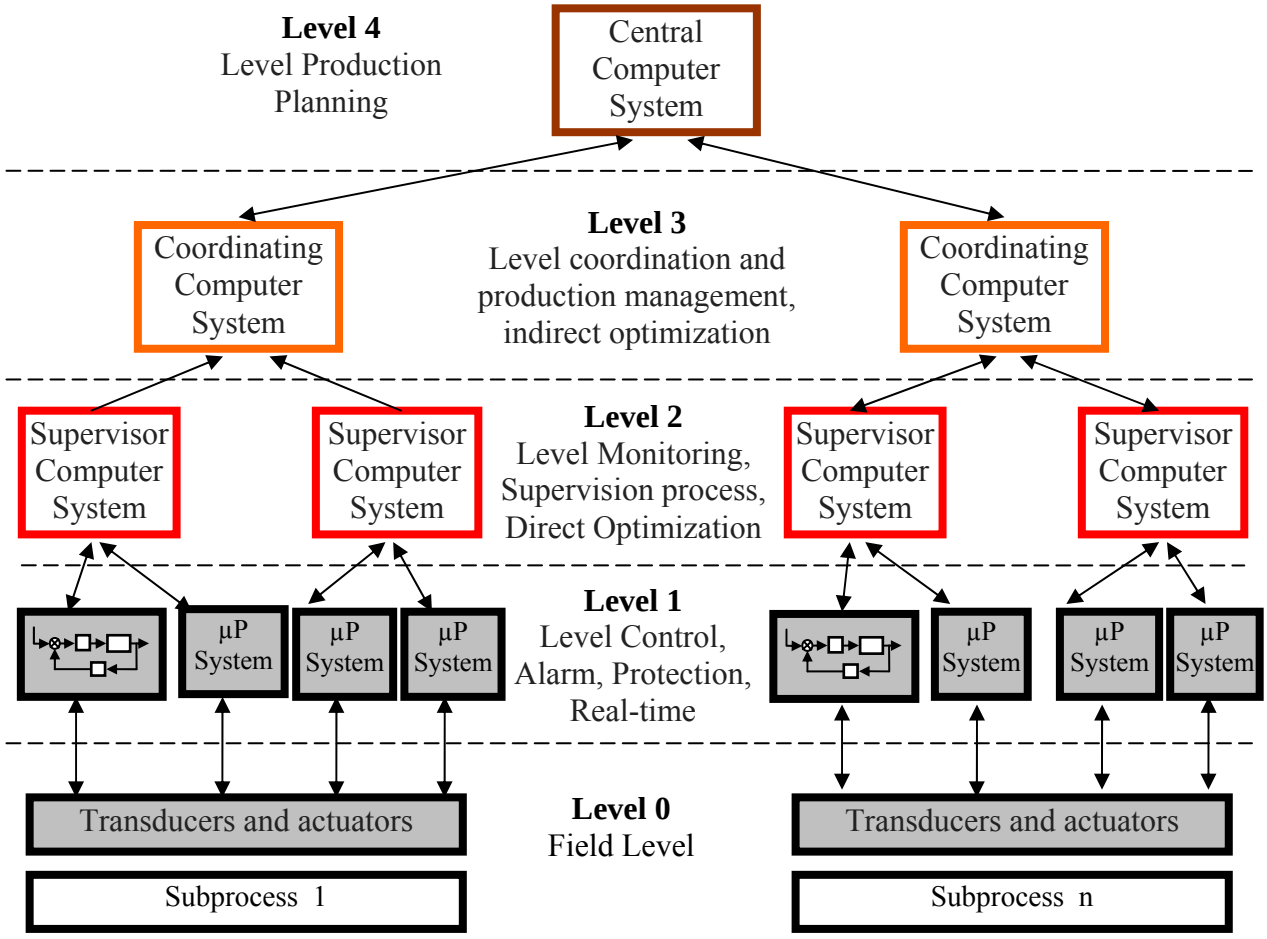

Fig.3. Distributed and hierarchical control structure organized in 5 levels[2]

In *Fig.4.* is presented in a general way of the principial structure of distributed system and hierarchical system that currently operating. One can see this Level 0, characterized by modern sensors and actuators, and the presence of mainly only Level 1, characterized by a data acquisition system where the control loops are implemented. The levels 2, 3, 4, are in a rather low from the point of view of optimization functions, it is not really implemented as a hierarchical levels of the actual information processing in the process from The levels 0 and 1, but

mainly are made to send in a appropriate format, the ON-LINE requirements of the National Dispatcher.
By implementing higher levels will be able to coordinate the entire power plant as a unitary whole in terms of optimality and stability[1], [3], and can lead to a significant increase in productivity.

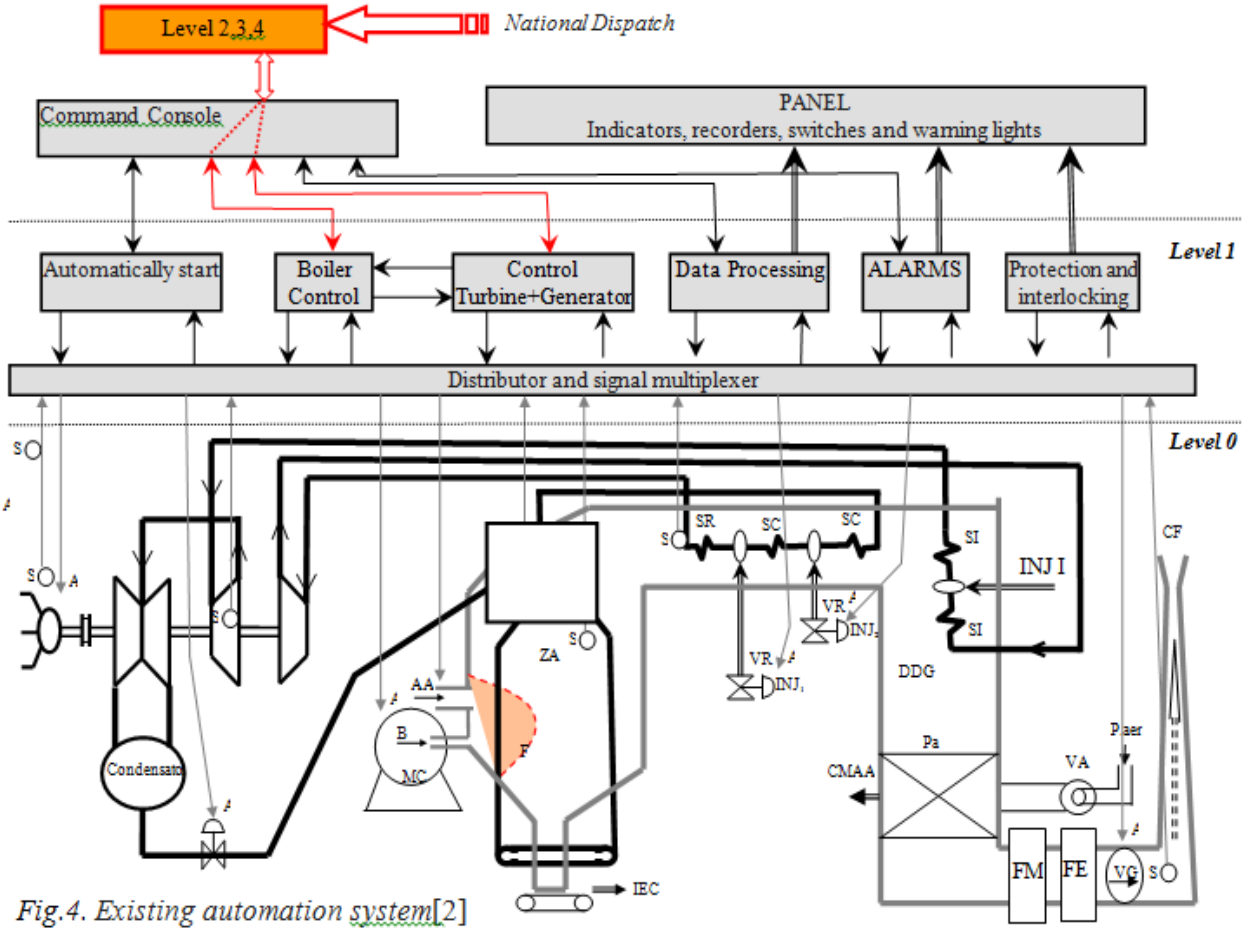

Fig.4. Existing automation system[2]

3.CONCLUSION:

-Currently at a power plant are about 100 independent control loops that work. During operation, the control loop is influenced one another, leading to instability over time, and as power plant stops.
Basically, in time, each loop start ***"wrong"*** by little and because of interactions between controlled signals, can reach ***a "resonance phenomenon"*** that inevitably leads to instability of the whole system.
- After identification / accurate modeling of the real processes can be obtained a resizing control algorithms so that to obtain an significant increase of productivity.
- Design Validation Levels 2,3,4. can be achieved without perturb the activity of power plant, meaning that a simple computer can connect into the existing system, computer will retrieve all signals measured in real process, and will also simulate real process in parallel everything that is projected functionality.

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