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The automated operational control system for the food industry

Introduction. The use of computerized system technology is expected to continue to grow in the food industry as the cost of components decrease, equipment and manufacturing processes in an attempt to produce high quality, high value products and continue to update production facilities. Process food industries represents all measures in which mass, energy and information are transported, transformed or stored. Control system for a process processing industry, in general represents, control elements, sensors and actuators are assigned to the process, they form the base of observation, visualization, diagnosis of the process and the actuators possess the task of intervening into the process in order to achieve the desired result.Control system food industries that encompasses several types of control systems used in industrial production, including supervisory control and data acquisition systems, distributed control systems, operational control system and management and enterprise resource planning.

Problem statement. Modern automation systems require distributed structure because of the distributed nature of industrial plants in which the control instrumentation is widely spread throughout the plant. The efficiency of the system work as a whole depends on the efficient functioning of each subsystem on every level, this is why approach to the analysis and designing of the system not in terms of hierarchy, but as how a single mechanism in which every detail is important. Collection and prepossessing of sensors data requires distributed intelligence and an appropriate field communication system. The variety of plant automation functions to be executed and of decisions to be made at different automation levels require a system architecture that due to the hierarchical nature of the functions involved has also to be hierarchical. The efficiency of the system work as a whole depends on the efficient functioning of each subsystem on every level, this is why approach to the analysis and designing of the system not in terms of hierarchy, but as how a single mechanism in which every detail is important[1].This is due to complexity of the new manufacturing processes, the need to optimize costs, the increasing of the complexity in managing resources, the need to improve performances, the aspects tied to the information exchanges, the manufacture of complex products(Fig. 1). Then the Manufacturing Enterprise

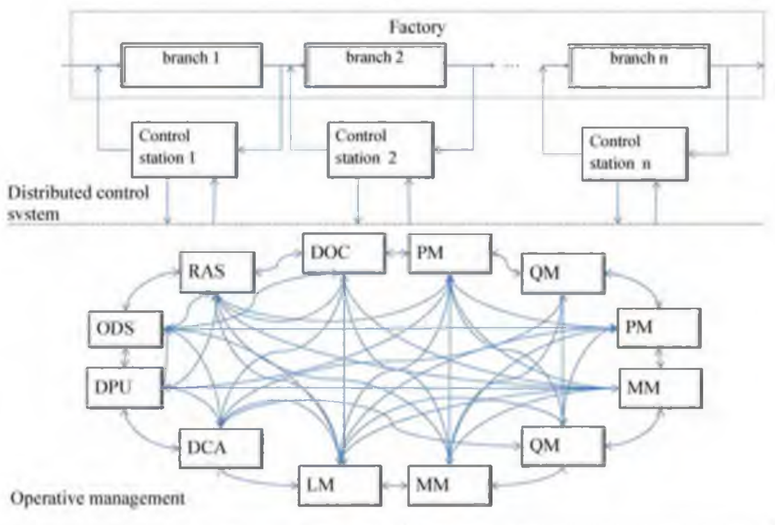

Figure 1. Block diagram of the operative management of the plant

Solutions Association (MESA) introduced some structure by defining 11 functions that set the scope of manufacturing execution systems (MES): RAS – Resource Allocation and Status, ODS –

Operations/Detail Scheduling, DPU – Dispatching Production Units, DOC – document Control, DCA – data Collection/Acquisition, LM – Labor Management, QM – Quality Management, PM – Process Management, MM – Maintenance Management, PTG – Product Tracking and Genealogy, PA – Performance Analysis[3]. This can be control and coordination of several interconnected unit operations that make up the total process, manufacturing cell or system level: control and co-ordination of groups of machines and supporting equipment working in co-ordination [2]. Operative control system and management,this is computerized systems used in manufacturing, to track and document the transformation of raw materials to finished goods. She can provide the right information at the right time and show the manufacturing decision maker "how the current conditions on the plant floor can be optimized to improve production output.

Solution. `wrapfigure` Parameters are interconnected through total process and twinning between operations and some other functions in process. A management is solved by a sequence of actions that can be represented with a tree structure (Fig.2). Each subtree associates a graph vertex with a set of tree nodes. To define this formally, we represent each tree node as the set of vertices associated with it. Graphs may be solved efficiently by dynamic programming for graphs of bounded treewidth, using the tree-decompositions of these graphs, by uses forward and backward recursion [4]. Such algorithms have a first step that approximates the treewidth, constructing a tree decomposition with this approximate width, and then a second step that performs dynamic programming in the approximate tree decomposition to compute the exact value of the treewidth.

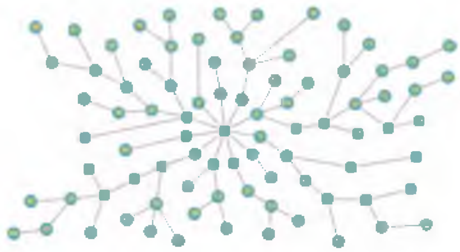

Figure 2. An tree structure in theoperative management for industry

Let m_i, be the value for the variable of item i in the area operative management (Fig. 1) and define r_i and w_i as the revenue and of the cost of funds per unit for the variable of item i. Problem has the form.

$$\text{Maximize } r_1m_1 + r_2m_2 + \cdots + r_nm_n \to \max \tag{1}$$

Define $f_i(x_i)$ = maximum return for stages i, $i+1$, and n, given state x_i. The simplest way to determine a recursive equation is a two-step procedure [4].

Step 1.

$$f_i(x_i) = \max_{\substack{m_i=0,1,\ldots\frac{W}{w} \\ x_i=0,1,\ldots,W}} \{r_im_i + f_{i+1}(x_{i+1}),\}, i = 1, 2, \ldots, n. \tag{2}$$

Step 2.

$$f_i(x_i) = \max_{\substack{m_i=0,1,\ldots\frac{W}{w} \\ x_i=0,1,\ldots,W}} \{r_im_i + f_{i+1}(x_{i+1} - w_im_i),\}, i = 1, 2, \ldots, n. \tag{3}$$

Conclusions.. Operative management covers all functions of direct control of all process variables, monitors their values, and enables the plant engineers optimal interaction with the plant via sophisticated man-machine interfaces. That can be represented with a tree structure, and be performed efficiently by dynamic programming, a recursive equations of the two-stage procedure.

References. **1.** Richard L. Shell. and Ernest L.Hall., Handbook of industrial automation. Marcel Dekker, Inc., New York, NY 10016, 2000, p.p. 202-214 **2.** K. Mihlbachler (2015). Integrated Downstream Processing. An Enabling Manufacturing Approach [Online]. Available: http://www.lewa processtechnologies.com/sites/default/files/ assets/files/LEWA White Paper Integrated DSP v3 Combined Series Final.pdf. **3.** Manufacturing Enterprise Solutions Association – MESA Model. Http://mesa.org/en/modelstrat egicinitiatives/MESAModel.asp **4.** Taha, Hamdy A. "Operations research: an introduction —8th Univ. of Arkansas, Fayetteville,, New Jersey, Upper Saddle River NJ-07458, 2007 ed. p.p. 399-406.