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Mathematics Models on the Size of Flexible Manufacturing Systems, Performance Indicators and their Components

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Abstract:- Flexible manufacturing systems represent a different machine system that performs coordinated work from a major command center. This command system is made by the main servers. As a main component, the machines with which the processing process is carried out can be taken. Machines used in the system must be numeric or computer-controlled. This is shown in all the figures given in the paper.

Keywords:- *FMS, Mathematics Models, Components, Flexible Line, CNC, Work Stations.*

I. INTRODUCTION

This flexibility is generally considered to fall into two categories, which both contain numerous subcategories. The first category, machine flexibility, covers the system's ability to be changed to produce new product types, and ability to change the order of operations executed on a part. The second category is called routing flexibility, which consists of the ability to use multiple machines to perform the same operation on a part, as well as the system's ability to absorb large-scale changes, such as in volume, capacity, or capability. Most FMS consist of three main systems. The work machines which are often automated CNC machines are connected by a material handling system to optimize parts flow and the central control computer which controls material movements and machine flow. The main advantages of an FMS is its high flexibility in managing manufacturing resources like time and effort in order to manufacture a new product. The best application of an FMS is found in the production of small sets of products like those from a mass production.

Fig 1:- Flexible manufacturing system (FMS)

II. MATHEMATICS MODELS

Using of flexible manufacturing system determine medium load of work stations using the fllowing expression:

$$WL_i = \Sigma_j \Sigma_k t_{ijk} f_{ijk} p_j \quad (2.1)$$

➢ *Performance Indicators System-*

An important indicator for performance assessment of flexible manufacturing system is production capacity for all parts, exploiation in other work stations and server number arranged in each work station. This indicator can be estimated assuming that flexible manufacturing system has opportunity of maximum production capacity:

$$R_p^* = \frac{s^*}{WL^*} \quad (2.2)$$

The maximum exploiation of each working station is proportional with time in which server work stacions work and aren't without value. This can be estimated based on this expression:

$$U_i = \frac{WL_i}{s_i}\left(R_p^*\right) = \frac{WL_i}{s_i} \cdot \frac{s^*}{WL^*} \quad (2.3)$$

The general medium exploiation of stations with medium value for all stations, including transportation system can be estimated based on this expression:

$$\bar{U} = \frac{\sum_{i=1}^{n+1} U_i}{n+1} \quad (2.4)$$

The most important indicator is the arranged number of servers in each working station. The value of their capacity can be estimated based on:

$$BS_i = WL_i\left(R_p^*\right) = WL_i \frac{s^*}{WL^*} \quad (2.5)$$

➢ *The size of flexible manufacturing system-*

Considering workplaces, number of servers for each station is determined in this way:

S_i= full minimal number $\geq R_p(WL_i)$ (2.6)

III. COMPONENTS OF FLEXIBLE MANUFACTURING SYSTEM

Base components of flexible manufacturing system are:

- work stations,
- the use of material in deposting system,
- control of computing system.

➢ *Work stations-*

Production and fitting of work supply, wich arte used in flexible manufacturing system, are depended from the work is done. If systems are used in flexible manufacturing system the basis of production system is reprezent to the machines CNC. Types of work places in productions systems are standard, wich aften can be this type: stations for loading and unloading, stations for machine processing, other stations for processing, stations for fitting, stations for measuring and control.

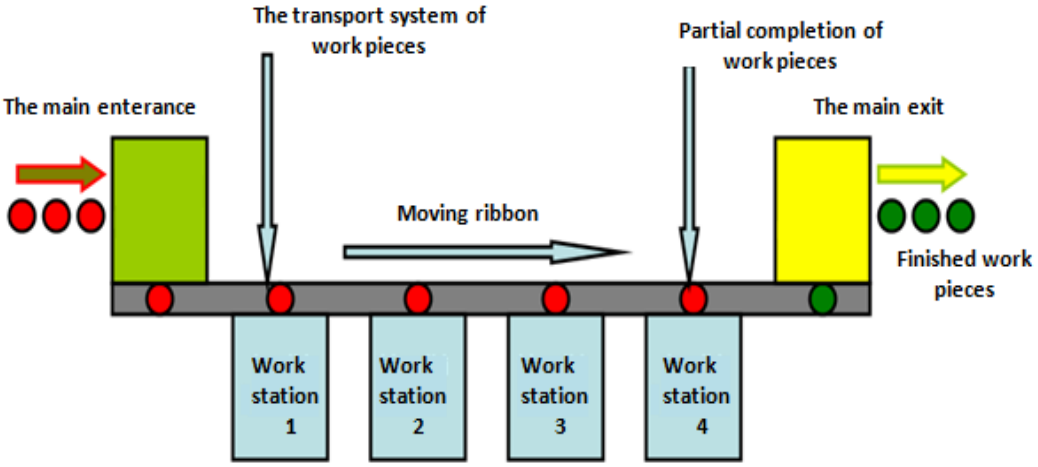

Fig 2:- Work stations

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➢ *System of computer control –*

Flexible manufacturing system work based of delivering computer system, which are connected with work stations, with system for treating material in storage and other hardware components. In typical computer system, flexible manufacturing system is consisted of main computers and microprocessors which do the machine control, special supplies and other components. The role of centre computer is to coordinate components activities to reach the last operation in system.

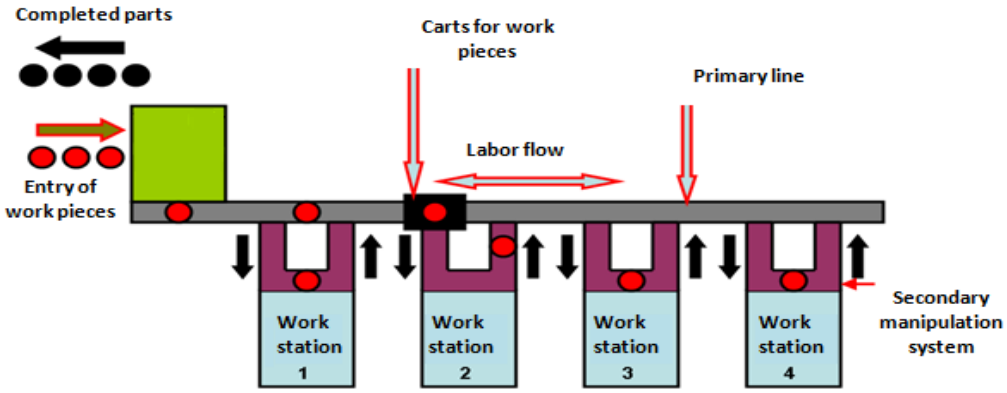

Fig 3:- Coordinating of work stations

IV. THE REALIZATION OF PRACTICAL WORK

Te realization of practical work is done in a venture for plastic and aluminium processing "Aluminium 2000". The flexible line which possesses this company is type Hollinger MSE Beckhoff PC 10 with computer control, computer program which is called EDV. This line consist of two work stations: for welding and cleaning. It has a size from 16m. Production capacity of this line is up to 250 piece a day.

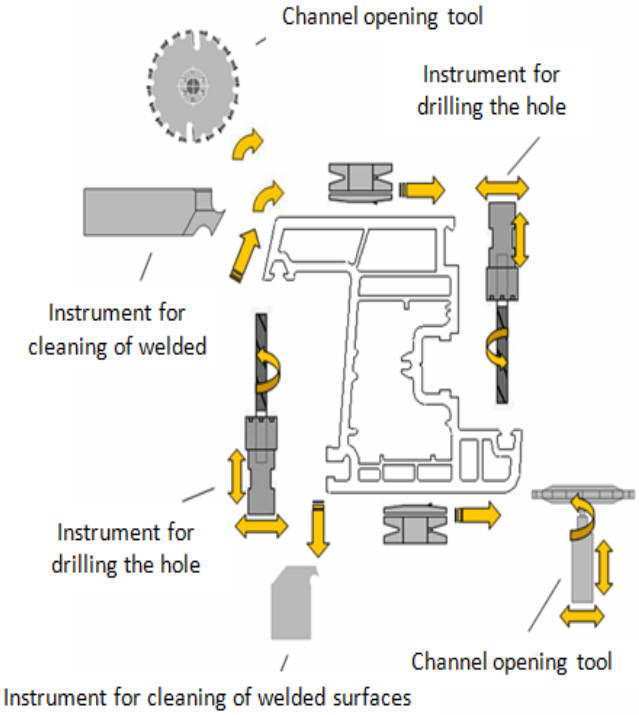

Fig 4:- Schematic view of the processing process instruments

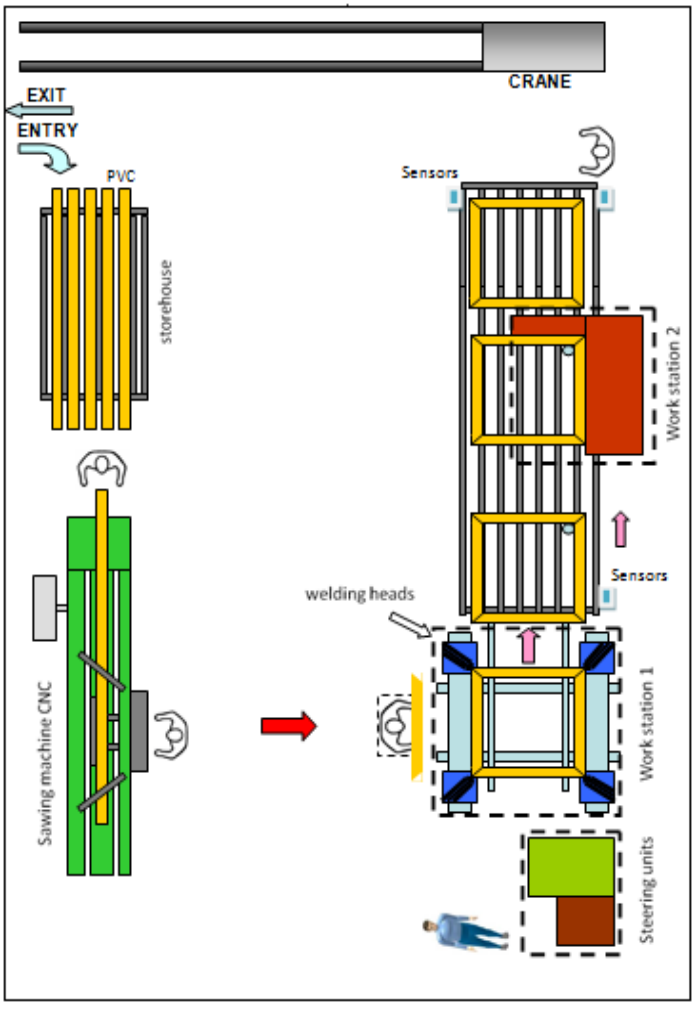

Figure 5. Flexible manufacturing line in the enterprise "Aluminium 2000"

➢ *Economic Effects*

Begining from the economic tutorial of different countries where the work price in hour of workers is still increasing, then each company efforts to rise production advancment and this can be acheived with technology based in artificial extended intellegence, which in majority are subtitute of human factor in work process. Advantages of production through flexible production system are a lot as: cost decrease for product production, rapidity in production, efficiency, effectiveness and rationalisation of time. In this aspect, we consider that in company "Aluminium 2000" are seen advantages for implementation of these lines, exactly because of productivity, production cost and their functionality.

V. CONCLUSION

Availability with systems and different computer programms and the continued decrease of prices does its application, in large companies, medium and small as well, still even more reasonable. This impacts not only in organization structure, but also in competitive ability in the country. The organization of production in the "Aluminium 2000" company, it is oriented in these new forms of production in computing way from which it is expected: quick reaction in changes of market demands, quick adjustmentof new developments in market,quick acceptance of change in construction number, without stopping to increase the pieces production number, shortage of production cycle, increasing the level quality, the opportunity of decreasing the number of workers, obstacles, mainly the minimal outage in production.

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