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MODELLING OF ROBOT MANIPULATION IN INTEGRATED PRODUCTION

Urgency of the research. *Cell production has become one of the most important studies of the arrangement of production systems. This production philosophy is based on the fact that the products are similar in shape and production processes. This allows parts to be grouped into groups that they share during their processing, ensuring an economic effect.*

Target setting. *Automated production systems are built with large investments. The result is small-scale production automation cells, including industrial robots, including handling automation. These automation islands did not meet expectations in terms of costs, commissioning dates, meeting production deadlines, achieving planned performances, so attention must be paid to integrated production.*

Actual scientific researches and issues analysis. *Integrated production reduces material handling and transport time. By making the product more time on the machinery and less time on the road. Because the parts move in the chamber and not in the entire factory, travel time and distance are reduced, leading to a reduction in material handling costs, which represents between 20 and 50 % of the total operating costs.*

Uninvestigated parts of general matters defining. *Most articles and other publications on the problem of modeling integrated manufacturing alleviate the problem of modeling a specific cell. In my article I will solve a production cell in general without specific properties.*

The research objective *This paper focuses on the integrated and logistic of the style of material flow, suitable for realization manufacturing and logistics network. Solution base is defining of mission, objectives and goal integrated of the style of material flow. The core of solution is analysis of strategy on integrated. The result of solution is to define tools integrated and formation evolution profile of the style of material flow.*

The statement of basic materials. *In general, the key to building integrated production is group technology based on the principle of material flow analysis. The problem of modeling integrated production points to possible variants of solutions based on the analysis of material flows. However, considering only this criterion is insufficient for practice, because it does not consider e.g. about the number of pieces.*

Conclusions. *These relationships are representative of some approaching the importance of parameterization, which remains open and accessible to address other tasks to optimize the production system.*

Keywords: *material flow; manipulation technical; integrated functions.*
Fig.: 4. Table: 1. References: 13.

Introduction. Development of automation assembly systems makes the question of efficiency and optimization, which can be addressed with regard to external conditions and internal conditions. One of the determining factors is the automation of manipulating and flexibility of material flows that are important in adapting manufacturing systems for large-scale changes in market quality and reducing production costs. The requirements of flexibility and quality production, low implementation costs lead to the creation of expediency handling equipment and structures based on nature of phenomena associated with the implementation of functions and activities [2].

For this purpose, to accede to the development of manipulating systems perspective as a basis for the creation of flexible material flows. These are being diverted away from graphical, analytical and parametric models and then used to design effective and efficient elements, equipment manipulating and ensembles [1; 3].

Model of integrated production. Addressing integrated handling due to the fact that the function of the material handling time and the number required to provide a process or department material producing devices as well as time to settle differences and inequalities, which have created in integrate technology operations in a coherent process [10].

For medium-sized enterprises in manufacturing structures for small series as well as large enterprises with a variety of simple tasks in the handling of workpieces is under considerable pressure to reduce production costs by all means and purposeful automation. For these areas it is advisable to develop an integrated material flow solutions. Flexible automated handling the machine and automatic supply of individual production cells are still scarce. Towards an integrated manufacturing system automation modules are still missing. Even in exceptional cases specifically addressing the use of automation of handling general fail and the concatenation of certain types of components and the high costs incurred in individual solutions. Only by developing the production-transmission systems, and in particular concatenation of grouping of workpieces can create cost-effective systems that meet the established requirements [4].

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The strategic objective is to achieve a more comprehensive application of automation engineering and manufacturing into one compact unit production logistics chain- Fig.1. profiling under the integrated material flow. This trend makes the deployment of advanced concepts of the transport storage and handling systems that ensure a high degree of automation and modularity. Handling, transport and storage technology is indispensable for those goals, but far from forming an integrated system. Equally important is a well-organized flow of material. While the system applies the principle of integration objects to avoid unnecessary handling operations, respectively to be easily automated. The rational is needed to automate operations such level of integration to secure the required handling functions and to avoid duplication and thus unorganized production [5].

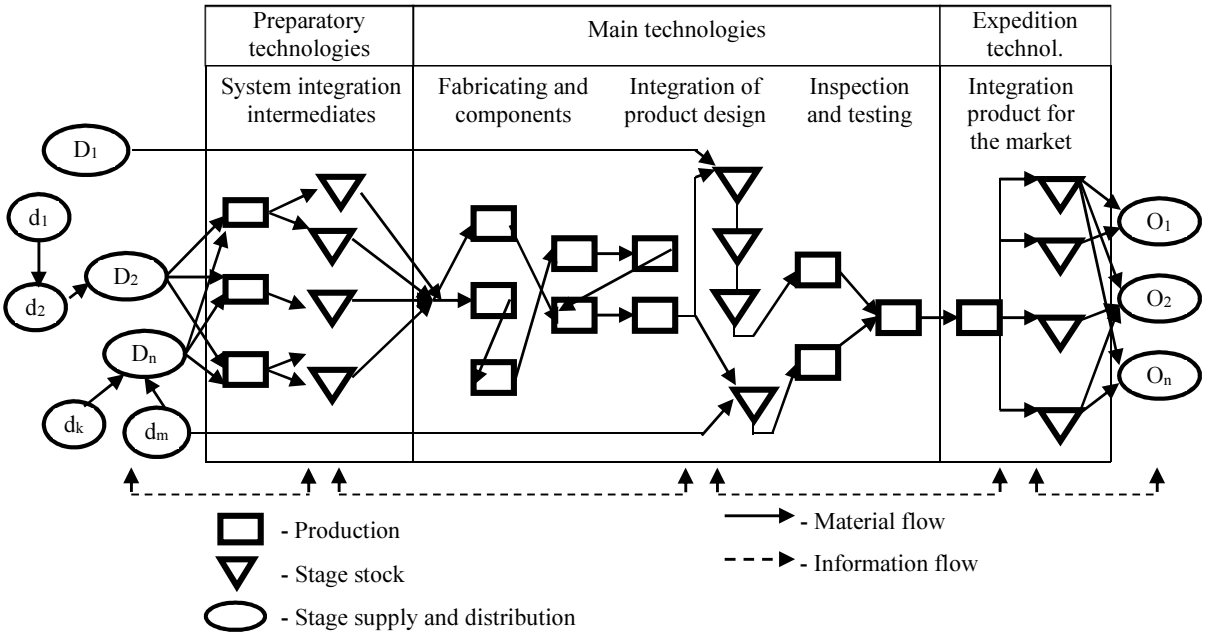

Fig. 1. Production logistics chain

Creating an integrated handling system, and hence more real integrated production and assembly is, undoubtedly, the systemic nature of the creative question. This leads to the search for answers on how to create complex technical systems, which currently require only a significant increase in the level of automation, but also the design of appropriate means of forming system [2].

Description of the solution. In modelling and parameterization tasks, automated handling assuming availability of exact methods of system analysis, in methods for the registration system using a formal mathematical apparatus. Mathematical modelling is one tool in addressing the tasks of analysis, design and management of handling systems, which have a material effect on its efficiency. It is an abstraction model that is based on the allocation and modelling of critical information, material and physical communication in circulation (Fig. 2) [6].

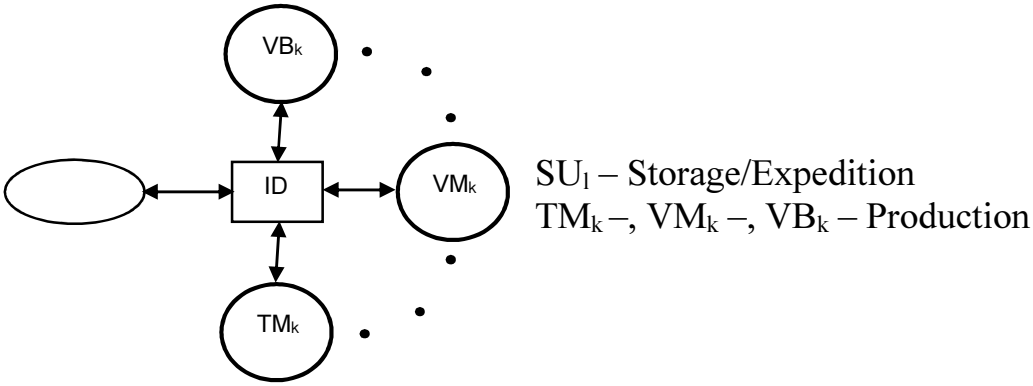

Fig. 2. Form integrated production system

Modeling. Creating the material flow logistics solutions precedes the description of communication material and registration material communications network, describing the track mounting system. Based on the decomposition of the manufacturing system of an indirect link between the storage node-handling hub-production unit with its own handling equipment. For a description of the material define the communication nodes (marking O), and ". joining the (sign ---). Depending on the status and role of the studied functions handling system varies the number of nodes, their state and mutual relations. Therefore, the model must represent the communication material such registration, to determine the starting node (U1), the target node (U_n) and Centre knots (U_2, ..., U_{n-1}). Then material communication network is the sum of flows in all the roads leading from node U1 to node Un. If the communication system of the material in any sub- U_1, U_2, ... U_n, defined as a structure of nodes U_1 (u_{11}, u_{12} ,..., u_{1m}), U_2 (u_{21}, u_{22}, ..., u_{2m}), U_n (u_{n1}, u_{n2}, ..., u_{nm}), Fig.3 then analyze the material flow system for the distinctive level nodes u_{ij} (operations, buffer), at nodes U_1, U_2, ..., U_n (central), or U level (operational, interoperable, central), Fig.4. [8]

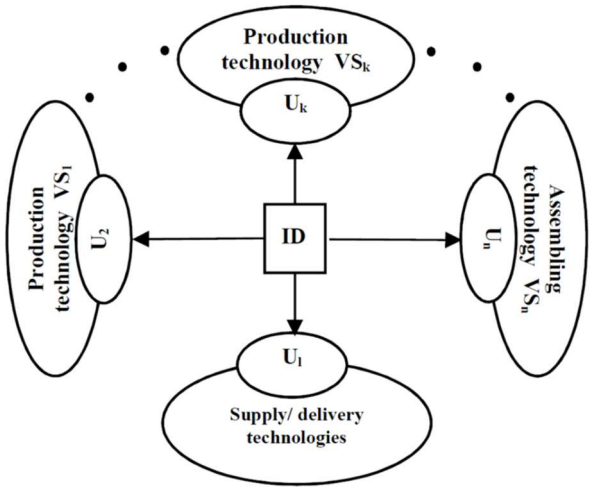

Fig. 3. Description of communication material – central level

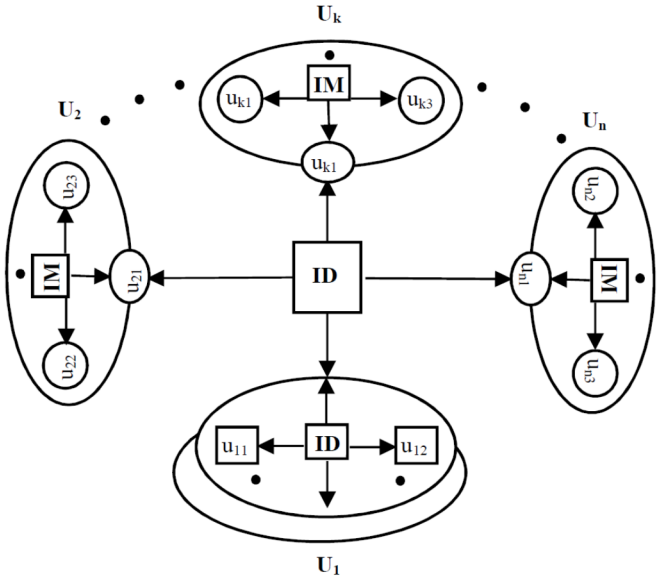

Fig. 4. Description of communication material – operational level

Where U_1 input-output store;

U_2,...,U_n – manufacturing/ assembly cells;

u_{ij} – technology/ storage space.

Writing a network of communication between the base material, the target node and the centre nodes can be transferred using the incident matrix and graph-oriented material flow [7].

Parameterization. The communication system can be blamed for the material type and position of individual nodes, the number of input and output material flow, the maximum vertical connection with the node creating the material pattern, the presence of loops and the occurrence of isolated node [9].

These methods of modelling material communications are limited to standard types of distribution operations, which characterize the intervals between arrivals and time requirements of handling a relatively simple structure of network communications material and simple rules for the operation. Cover wider ties information, material and physical communication is configurable options in material flow through the so-called the transport matrix, table.

Table

The transport matrix material flow

OD/DO	**U_1**	**U_2**	**U_k**	**U_n**
U_1		$\frac{X_{12}}{Y_{12}} a_{12}$	$\frac{X_{13}}{Y_{13}} a_{13}$	$\frac{X_{14}}{Y_{14}} a_{14}$
U_2	$\frac{X_{21}}{Y_{21}} a_{21}$		$\frac{X_{23}}{Y_{23}} a_{23}$	$\frac{X_{24}}{Y_{24}} a_{24}$
U_k	$\frac{X_{31}}{Y_{31}} a_{31}$	$\frac{X_{32}}{Y_{32}} a_{32}$		$\frac{X_{34}}{Y_{34}} a_{34}$
U_n	$\frac{X_{41}}{Y_{41}} a_{41}$	$\frac{X_{42}}{Y_{42}} a_{42}$	$\frac{X_{43}}{Y_{43}} a_{43}$	

Where X_{ij} – the number of objects (handling units);

Y_{ij} – distance respectively transit time between nodes;

a_{ij} – continuity operations and activities between the production and storage sites.

Rows respectively columns represent different points of the network once communication material, and the transition from one point to the second point is represented by the matrix element, whose index is the line end point (where), and a member of itself contains a value which is given by elements x, y, a. Parameterization problem can be further used to determine the number of transport and handling units and the organization handling the arrangements [13].

In determining the number of vehicles (ID) and manipulation (IM) units of the production system based on: the relationship (1) if it is the flow of materials between storage nodes and production units in direct custody or between nodes and storage nodes handling of individual production cells with indirect link (central level).

$$ID = \frac{X_{ij} \cdot Y_{ij}}{60 \cdot p \cdot s \cdot \eta} \quad (1)$$

Where X_{ij} – the number of objects (handling units) transported per hour;

Y_{ij} – transit time between nodes [min];

p – the number of pallets in the transport dose;

s – the number of components in the palette;

η – access toη transport units in the system.

These relationships are representative of some approaching the importance of parameterization, which remains open and accessible to address other tasks to optimize the production system [12].

Conclusions. These relationships are representative of some approaching the importance of parameterization, which remains open and accessible to address other tasks to optimize the production system.

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МОДЕЛЮВАННЯ АВТОМАТИЗОВАНИХ ОПЕРАЦІЙ В ІНТЕГРОВАНОМУ ВИРОБНИЦТВІ

Актуальність теми дослідження. *Групове виробництво стало одним з найважливіших напрямків в організації виробничих систем. Ця філософія виробництва грунтується на схожесті виробів за формою та виробничими процесами. Це дозволяє згрупувати деталі в групи, за якими вони діляться під час їх обробки, забезпечуючи економічний ефект.*

Постановка проблеми. *В автоматизовані виробничі системи вкладають великі інвестиції. Результатом є невеликі ділянки автоматизованого виробництва, включаючи промислові роботи, а також автоматизацію переміщення. Ці автоматизовані ділянки не виправдали очікувань щодо затрат, строків введення в експлуатацію, дотримання строків виробництва, досягнення запланованих показників, тому необхідно приділити увагу інтегрованому виробництву.*

Аналіз останніх досліджень і публікацій. *Інтегроване виробництво скорочує час на обробку та транспортування. Завдяки тому, що виріб більше часу знаходиться на обладнанні та менше часу витрачається на транспортування. Оскільки деталі переміщають по ділянці, а не по всьому виробництву, час та довжина переміщень скорочуються, що призводить до зниження затрат на вантажно-розвантажувальні роботи, які становлять від 20 до 50 % від загальних експлуатаційних витрат.*

Виділення недосліджених частин загальної проблеми. *В багатьох статтях та інших публікаціях з проблеми моделювання інтегрованого виробництва розглядається проблема моделювання конкретної групи. У цій статті розглянуто моделювання інтегрованого виробництва загалом.*

Постановка завдання*. Ця стаття зосереджена на інтегрованому та логістичному напрямках матеріального потоку, придатному для реалізації виробничої та логістичної мережі. Основа рішення – у визначенні міссії, цілей та задач. Інтегрованих в напрямок матеріального потоку. Сутністю рішення є аналіз стратегії інтеграції. Визначено завдання, а також зроблено аналіз стратегії інтеграції. Результатом є визначення інструментів інтеграції та формування шляхів удосконалення напрямків матеріального потоку.*

Виклад основного матеріалу*. Загалом, ключем до побудови інтегрованого виробництва є групова технологія, заснована на принципі аналізу потоку матеріалів. Проблема моделювання інтегрованого виробництва вказує на можливі варіанти рішень, заснованих на аналізі матеріальних потоків. Проте врахування лише цього критерію недостатньо для практики, оскільки він не враховує наприклад кількість виробів, що виготовляються.*

Висновок відповідно до статті*. Ці взаємозв'язки демонструють в деякому наближенні важливість параметризації, яка залишається відкритою та придатною для вирішення інших задач з оптимізації виробничої системи.*

Ключові слова: *матеріальний потік; керування виробничим процесом; інтегровані функції.*

Рис.: 4. Табл.: 1. Бібл.: 13.

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