Trendy a inovatívne prístupy v podnikových procesoch „2017“, roč. 20
Trends and Innovative Approaches in Business Processes “2017”, Vol. 20

PROCESS OF CREATION THE SIMULATION MODEL OF MATERIAL FLOW WITH SOFTWARE TX PLANT SIMULATION

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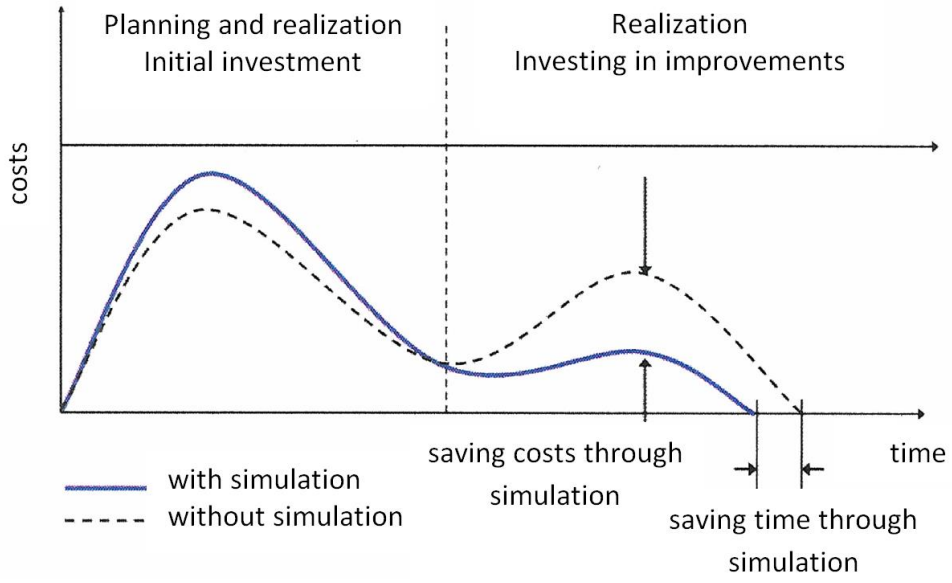
Abstrakt: *Article deals with the creation of material flows in the context of the phenomenon of current time Industry 4.0. Of the many tools that support the digitization of business processes, the article focuses on using Tx Plant Simulation. From a practical point of view, this is an efficient tool, suitable for modeling and simulation of complex material flows in production plants.*
Keywords: process, model, simulation, material flow

Introduction

Present trends in designing or optimization of production and logistics processes, is the use of software and their accessories that are designed to simulate the processes. Using these programs helps businesses maintain and increase business competitiveness. This is thanks to increased flexibility and increased production productivity, while reducing costs.
However, a number of manufacturing plants are still using advanced engineering methods in industrial engineering for optimization. These methods must be correctly implemented, otherwise there may be minimal resp. no improvement of the process. This risk is reduced when using simulation programs, while facilitating decision-making processes.
Fig. 1 shows the processing development of cost by using simulation tools and without their implementing. Despite the fact of high initial investment, there is a clear cost savings in the use of simulation tools, which is reflected later, in the implementation phase of specific projects.



Obr. 1 Development of the cost with and without using simulation tools

Current methods of material flow creation

Simulation programs are currently used as tools for analysis and testing of individual production, communication, service, logistics and other processes resp. systems in the enterprise. Computer simulations help managers predict system behaviour when booting, designing new processes. During simulations can change the external or internal conditions, resp. the criteria of the individual processes which are observed and evaluated. From the results of the simulation experiments performed, it is possible to evaluate, for example, utilization of machinery and equipment, detection of collision situations, determination of optimum capacity of warehouses and warehouses, etc. The advantages and disadvantages of using simulation software in practice are described in Tab. 1.

Tab. 1 Advantages and disadvantages of using simulation software in practice

Advantages	Disadvantages
• comprehensive view of the system • solution of complex production systems • shorter time of acquisition the results • possibility to explore a large number of variants • simulation of a non-existent process • better understanding of the real system • testing of extreme parameters	• time-consuming data processing • relatively high labor costs per employee • high acquisition cost of equipment (SW, HW) • cost of maintaining and operating the system (license fee, energy, material, etc.)

Characteristics of Tx Plant Simulation

Tx Plant simulation is a software tool for modelling, simulation and optimization of logistics systems (e.g. production, assembly, supply, transport, etc.). It is transparent, object-oriented, hierarchical structure software that uses the inheritance of object properties. It provides relevant information based on reality and allows the user to perform experiments without physical intervention in existing production.

Possibilities of using Tx Plant Simulation:

1. **simulation of assembly, manufacturing processes** - it is possible to create a production or assembly model. Consequently, changes in production are monitored according to the specified parameters. The great advantage this system has is that it allows you to use drawing documentation.
2. **simulation of logistics processes** - Proper planning of material flows is very important. Using Plant Simulation, it is possible to verify logistics in the enterprise before real production starts. When simulating logistics processes, it is possible to solve the problems:
    - testing changes in the transport system and their impacts on the production / assembly system
    - testing change of the type of transport equipment and its capacity on the system
    - testing changes in transport priority tasks on the ability of the system to ensure the required products
    - tracking of cross-roads and traffic junction solutions for conveying equipment

- the impact of random occurrences on the overall level of storage capacity created by the enterprise due to the maximum utilization rate of the warehouses
- the impact of worker shifts in different parts of the systems on the maximum store level simulation of human resources - since human work is also the source that is found in the enterprise, it can be simulated. It is possible to simulate, for example servicing the devices by the human.

3. **3D simulation of logistic and production processes** - Plant Simulation can create 2D models as well as 3D models, which representing a higher level of simulation model.

Creating a production process model using the Tx Plant Simulation module

The main phases of the simulation study include:

1. **Preparation** – it consists of activities such as deciding on the suitability of simulation, formulating task and goal, estimate effort, data determining, data analysing,
2. **Modelling** - for creating individual parts of a digital business is to develop a library of so-called digital designs of products, machines and tools whose use is planned for future production. With NX, you can create digital products that are modeled in 2D form. Later, they must be rendered in 3D. For this, any CAD system is used. The user can control and use the digital product from Siemens PLM Software 3DSync, which provides the user with customization of models created in programs such as: Autodesk Inventor, Solid Edge, SolidWorks, Catia V5 and others.
3. **Experimentation** - for creating the required simulation is managing and archiving the steps and procedures for creating it. For this is serving Teamcenter Manufacturing Process Planner software package. It aligns all the information and steps that have been taken so far throughout the life cycle of production and maps all manufacturing and product developments. The experimentation involves also activities as creating the experiment design, realizing statistical analysis, result interpretation and documentation, design alternatives.
4. **Implementation -** practical implementation of optimal simulation results, Fig.2.

Fig.2 Insight into the environment Tx Plant Simulation

Conclusion

Tx Plant Simulation is part of PLM / Product Lifecycle Management software that enables you to effectively and efficiently manage information throughout product lifecycle, from initial design, manufacturing and service delivery to disposal. The individual PLM elements create a coherent digital platform that is a prerequisite for moving to the next stage of digital development of company, i.e. real-world imaging in the virtual environment to creation of a digital factory.

This article was created by implementation of the grant project *KEGA 030TUKE-4/2017 Implementation of innovative instruments for increasing the quality of higher education in the 5.2.52 Industrial Engineering field of study.*

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