

SIMULATION AS PART OF THE DIGITIZATION IN PRODUCTION PROCESSES IN CREATING OF DIGITAL FACTORY

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Abstract

The paper deals with simulation and her forms of use in designing of production systems. Points to the possibility of using software can help in planning and subsequently in other phase of the lifecycle production and products. Article informs about some of the advantages of this type of software and his options. Sets out some theoretical knowledge of simulation and in the practical part presents some frequently used simulation software. Current trends in the development of a dynamic and turbulent world economy are largely digitization. Once upon the implementation and application of new production, made the setting and testing of variants

directly to the production lines for their full operation. First production tested, set its standards and then began the production program. These procedures were but very costly and lengthy and on-going businesses big money and precious time. Gradual deployment of various software techniques, these processes are transferred into digital form. Technology has come to the point that all business and production processes nowadays we can make this into a digital form. In this way we manufacture everything in detail and test plan prior to the launch date line. Such technology is called Digital Factory.

Keywords:

simulation software, digital factory, digitization, planning, production

Introduction

The trend of rapid shortening life cycle of products and innovation, which today is normal in almost every area, it is necessary to look for, means fast design of production systems. Digital factory is a virtual reflection of the real company that shows business processes in a virtual environment. Digital factory mainly supports planning, simulation, optimization and performance prediction manufacturing complex products. Basically, the digital firm serving the thorough preparation of production before it begins physical production. Digital enterprise systems represent an innovative step in the gradual creation of methods and tools to support business processes in the total life cycle of the product. Just for this purpose it is appropriate that simulation capabilities that enable us to verify several possible variations, as has given by production look and eliminate any narrow spots in advance.

Simulation of production processes

Simulation ranks among leading technology industrial engineering techniques (Fig.1). Large expansion began to experience at the end of the twentieth century and the development and application is significantly visible also in currently. This is due to the fact that the increased complexity of the problems, which the industrial engineering resolves. When building a production system operates a variety of different factors which cannot be described by exact mathematical equations. Even before designers begin with the construction of the enterprise, it is necessary to focus on narrow spots in the enterprise, the main risks and crisis situations:

- From an economic point is of view necessary to focus on minimizing costs in general.
- From a management perspective, it is necessary to focus on the consequences project approval, meet the deadline and prices, causes of high stocks and intermediate times.

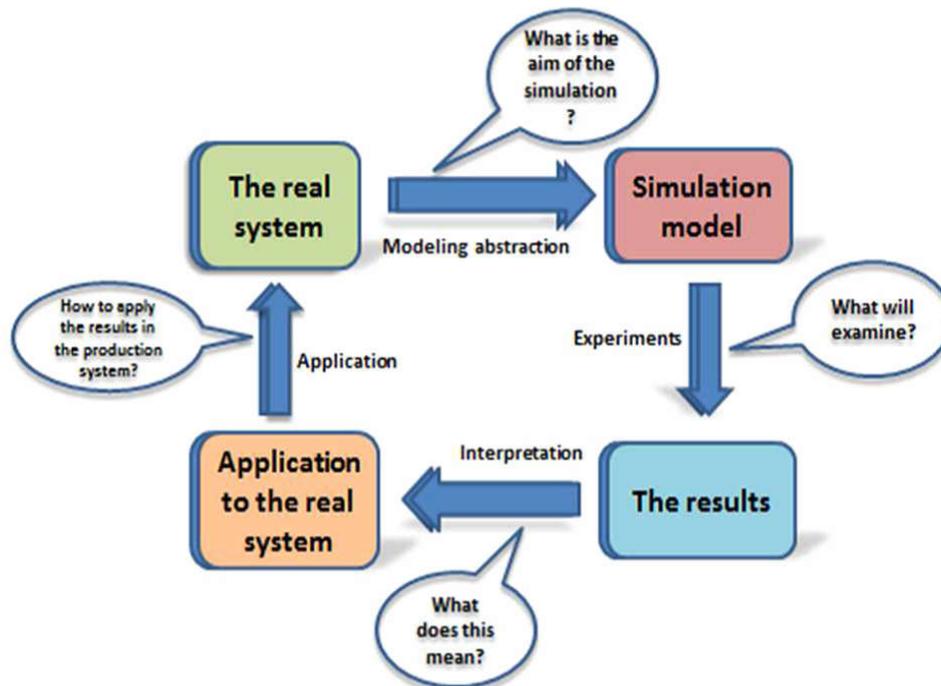
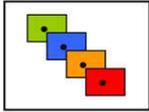


Fig. Principles of computer simulation

Simulation is able to remove all the shortcomings of analytical methods, but it is more demanding to time (the design model, model testing, planning and carrying out experiments) and the preparation of input data and by this it is also more expensive. This method overcomes many boundary conditions and limitations of analytical modeling procedures and its use is appropriate in particular in cases where other possible solutions have failed. The simulation is actually an experimental method, based on which the experiments with the model of the production system on the computer. Model production system typically consists of the following types of objects:

- Dynamic temporary objects (moving elements that enter the system, moving between the static parts of the system and at some point the system the leave the - parts and pallets).
- Static lasting objects (immobile parts of the system which are permanently active - machinery, warehouses, etc.).
- Elements of interconnection with the surroundings (the place where the input dynamic objects in the system and where the system leave the). Simulation may rank among the statistical experimental methods because it works on the same basis as theoretical methods of mathematical statistics. When it is impossible to examine the whole extensive set, selects a sample that represents the characteristics of our sample set (statistical sampling). This sample is statistically analysed and the analysis result is then applied to the entire file. Similarly, in the simulation takes place as the real system simulation model. This model includes only those characteristics of the real the system, which is interesting in terms of analysis. From experiments with a model it can be concluded about the entire real system. Simulation can be divided into:
 - Deterministic - simulation model does not use random variables,
 - Stochastic - simulation model uses also random variables. Based on the principle which is used in the preparation of simulation model distinguishes these types of simulations:
 - A continuous simulation - the values of state variables are changing continuously in a given time interval. Value is determined variables are determined by solving differential equations that describe the behaviour of the simulated the system in a very short time steps (numerical solution, usually using the method RungeKutta).
 - Discrete simulation - also called event-oriented simulation. From the perspective simulation in this case will simulate only the points in time (events), in which there is a change of state quantities the system. Examples of discrete systems are the majority of production and logistics systems.
 - Combined Simulation - contains elements of discrete and continuous simulation. The basic types of simulation are shown in Fig. 2. Even in the simulation of production systems dominated discreetly processes are sometimes combine the principles of discrete and continuous simulation. Some chemical or thermal processes in the production are changing continuously, but in mass production are many discrete processes (e.g. conveyors, lines with plenty of continuously moving material).

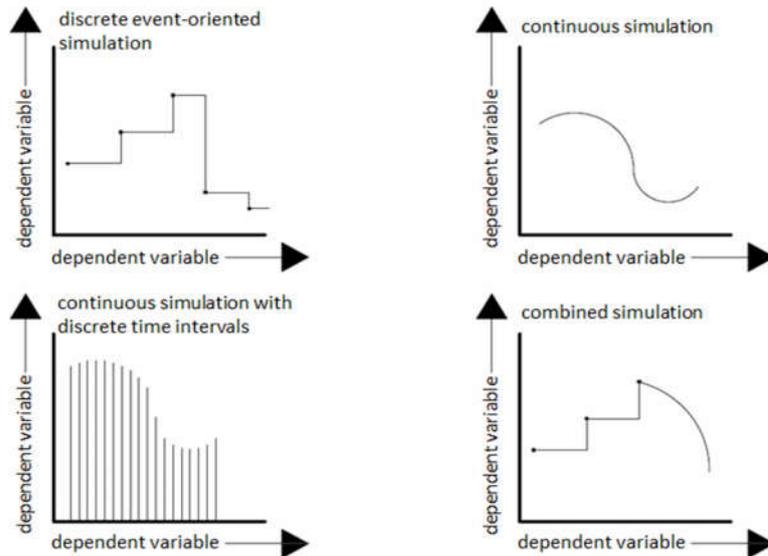
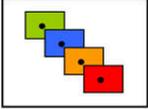


Fig. Basic types of Simulation

What Is Digital Factory?

Digital factory is mainly corporate strategy. It is an integrated and coherent set of software tools, processes and methods aimed at reducing the times swell up new production, accelerating the change to increase its efficiency. Works with digital models of real production, in which the forward in the digital environment verify and optimize the products themselves, all processes, activities, material flows and tools. To be well analyzed, processed, optimized set, and then put into physical production. Digital Factory concept begins with the formation of the product, its proposal. The product should be constructed from the start so that it is the easiest and most efficient to manufacture. Nowadays designers to work using CAD systems, it is very rare that the models or drawings on paper physically draws on the drawing board as it was in the past. Creating digital data are put emphases on design methodology taking into account the needs of production and assembly. It is important that the data that are essential to running your business flowed in the right direction and be available whenever and wherever they are needed. Important part in the development of digital businesses are technological preparation of production and design, in which the design and simulate all and set for further processing. The effect of all the above mentioned processes and tools take effect their integration into a single cooperating whole. Currently on the market a large number of software products that provide these options and their expansion are comparable with the period when they began to introduce CAD systems, which are now a common tool in many enterprises. Digital Factory concept is promoted mainly due to large manufacturers, especially automakers. Advocates out there that have high batch manufacturing. Successfully, however, also used on routes where there is little serializability where you need to change quite often and converting lines. It is commonly used in the production of larger piece products. Gradually covers a wider range of types of production. It is very well applicable and wherever it is planned to hand made, or where a person enters into production, whether occupational activity, or simply as a supervisory body. It is intended wherever it is necessary to increase the production of production, reduce costs and increase efficiency.

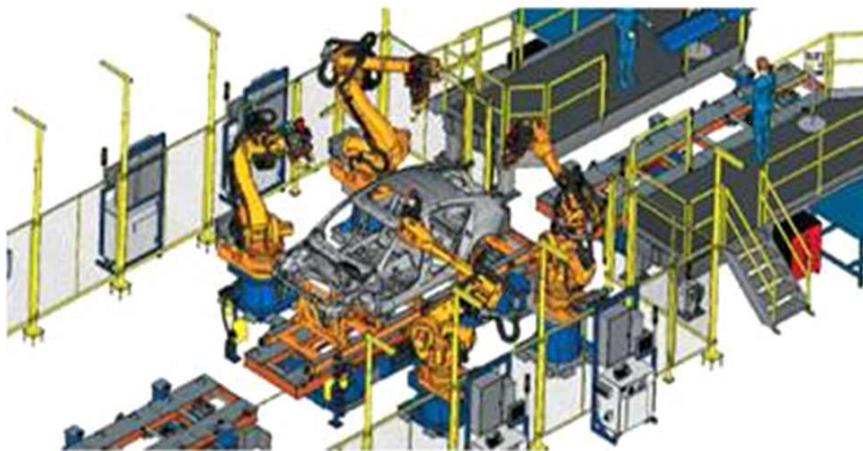
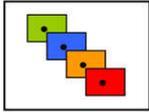


Fig. Simulation as part of the Digital Factory



Advantages introduction of digital enterprise:

- cost savings through better use of resources of 30%,
- cost savings achieved by optimizing material flows 35%,
- reduction in the number of machines, tools and workplaces by 40%,
- the total output growth in manufacturing by 15%,
- reduce time to market for new products by 30%.

As already mentioned, currently on the market and the number of providers of products are falling within the digital enterprise. One of these providers is also Siemens PLM Software and its products.

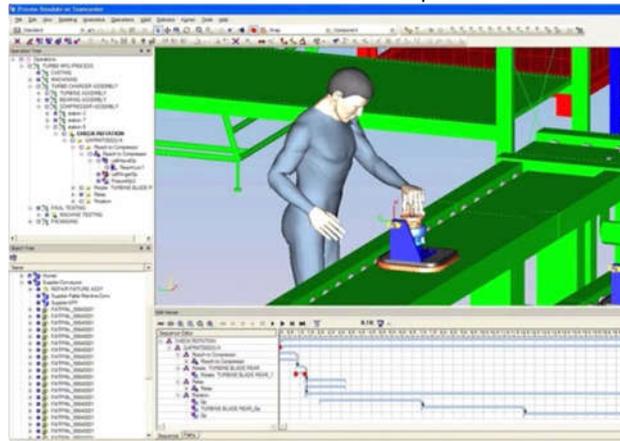


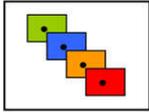
Fig. Simulation of people in the digital factory

Tecnomatix as a tool for creating digital factory

NX improves productivity through product development, delivering faster, more flexible modeling of individual components and assemblies, higher performance of several CAD applications used at the same time, more efficient digital simulation and more efficient manufacturing PLM Software Teamcenter connects people throughout the lifecycle with a single source of knowledge about products and processes Velocity Series is a comprehensive family of modular, yet integrated solutions across the product lifecycle management (PLM) in the midmarket. Medium allows manufacturers to compete effectively with larger companies with more funds available. Add to portfolio Velocity Series, Siemens falls Solid Edge with synchronous technology - is a complete 2D/3D CAD software based on the properties with excellent modeling of parts and assemblies, drafting, transparent data management, and inclusion of finite element analysis (FEA). 3DSync - is a tool designed to edit 3D CAD data, which, thanks to the synchronous technology facilitates designers to work with imported data engineering components and assemblies. It is intended for use in conjunction with existing CAD system helps engineers to reuse the data, thus reducing the cost and time needed for processing Tecnomatix™ is a broad portfolio of digital manufacturing solutions that offer an innovative approach by linking various manufacturing engineering disciplines with the product, from the layout and design, process simulation and validation after implementation registration Siemens PLM Software includes several software tools for different areas of production, which can be interconnected. Tecnomatix suite of tools allow industrial companies to use in practice, the concept of the digital enterprise, thus producing plans and projects, design, verify and optimize manufacturing processes and resources in the digital environment. Precise digital modeling, simulation and spatial (3D) visualization allow professionals working in development visualize, analyze future production process, thus limiting the possibility of errors that could occur during the start-up of production. Tecnomatix product portfolio is very extensive. It is composed of interconnected, but also separately usable software products

Conclusion

Simulations are after their introduction of a correct application for the enterprise a big competitive advantage. The advantage lies in several areas, in the planning of new products or product innovation, also in the field of marketing. Simulations are suitable for the presentation of products and processes for their preparation before customers or potential investors in companies. An essential advantage of simulation is cost savings in many ways. This is a saving in production planning, which is in the preparatory phase can be verified several possible options, as well even at the stage of an existing production, which can detect problems and bottlenecks and with the help of the simulation can be removed and transferred into production in already optimized form. Therefore, simulations play a crucial role in the creation of Digital Factory



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