MODELING WITH TECNOMATIX PLANT SIMULATION

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Abstract

The article was to present the possibilities and examples of using Tecnomatix Plant Simulation (by Siemens) to simulate the production process (increase production, eliminate idle time, etc.) and by applying simulated output in real manufactoring processes.

Keywords: modelling, simulation, computer simulation, Tecnomatix Plant Simulation.

1 Introduction

Today, one of the most advanced technologies that can make a significant contribution to increasing competitiveness and efficient management of manufacturing businesses is simulation. Its deployment possibilities are very broad, basically you could say that the testing of components in the development phase to simulate complex manufacturing systems, such as digital enterprise.

Simulation greatly helps in planning, managing and continually improving production processes, is a great help in increasing productivity, efficiency and flexibility. It's just the flexibility to respond to ever-changing customer demands in global market conditions, making it an advantage for companies using advanced technology.

2 Simulation method

Simulation is an experimental method where the real system is replaced by a suitable computer model. Consequently, it is possible to perform a number of experiments on this model and evaluate them. Alternatively, the model can be optimally optimized and then applied to the real system. There is no other "method" or "theory" that would allow experimentation with a complex system before it was put into operation. There is no other algorithm that would allow for a complex process to be simulated on the computer in a short space of time (in a few minutes), which, in real-world conditions (real operation), lasts considerably longer, weeks or months. Ultimately, it is the ideal tool to support decision-making at various levels in the business. [1]

When simulating, we encounter the need to answer some of the types of questions, the wording of which is as follows: Where are the "tight spots" of the project? Where are the main risks? What happens when ...? From the economic point of view, it is the answer to the question: Where and what is the "extra" project? From the managerial point of view, it is necessary to answer e.g. To questions like: What happens when I receive this order? Can the deadline and price be met? Why do I have higher costs than my competitors? Do we have high stocks and long lead times? But what is their cause?

The principle of computer simulation is shown in Fig. 1. The first and perhaps most important step is the correct definition of the simulation objectives. The next step is to build a simulation model. Model Verification will be performed and experiments will be performed to look for different system enhancements and verify their impact on the model system. Based on the experiments, the results are determined, which should be interpreted correctly and used to improve the real system at a later stage. The overall summary of this fact is that simulation is not an instrument that directly allows us to get the optimal solution, but rather a support tool to test the impact of our decisions on the simulation model. [2]

As mentioned above, it is very important to correctly define the simulation goal. Typical examples of goal definitions can be:

- Increase of production (production) by 20%,
- Reduced production by 10%,
- How many carts do I need for a given performance, ...

Next, it is necessary to define the details of the project. In general, the rule applies according to which it is modeled with the minimum number of elements that are necessary to achieve the desired goal. Even before the simulation model is constructed, it is necessary to collect (collect) data (data) that are needed to simulate and perform experiments. [3, 4, 5]

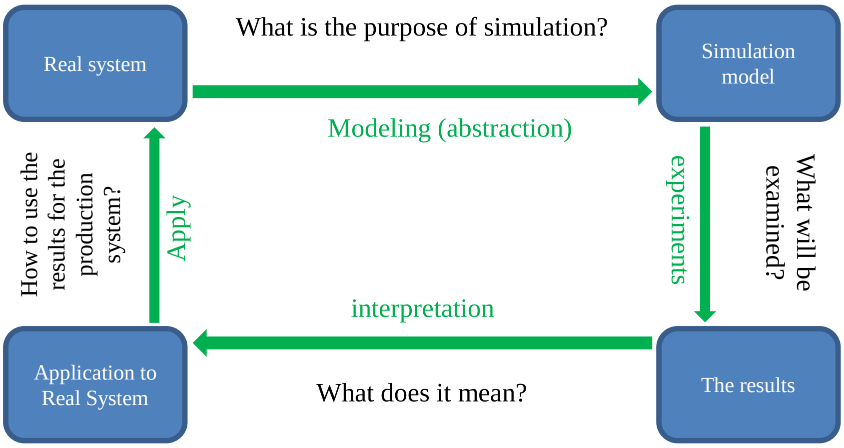

Fig. 1 *Principle of computer simulation*

Basic input data for simulation include:

- Machines and their capacities,
- Number of production, logistics personnel, maintenance personnel and their allocation to individual activities,
- Contracts (quantities, terms),
- Product data (technological processes, BOMs),
- Changes, breaks,
- Traffic and handling equipment,
- Management system, fault management, constraints,
- Distribution of production facilities, areas, material flows,
- Fault statistics, device availability, ...

If the model structure is defined, then the modeling process itself, i.e. Modeling in a PC. This should be done in small steps. Programming, testing, and documenting itself should run at the same time, it is only in terms of work efficiency. In addition, verification and validation of the model should be followed, in order to verify the internal logic of the model as well as the accuracy of the resulting model and its ability to meet the objectives of the project. [6]

Verbal connection the simulation experiment represents a group of simulation runs (behaviors) that may, for example, occur in the input variables. In this case, however, it is not a random test of the model using the "trial-error" method, but on the contrary, very careful preparation of experiments is needed, in which the period during which the simulation (number of changes, days, etc.) Behaviors, setting initial conditions, and so on. At the same time, it is necessary to prepare a plan of simulation experiments. The variables that will change in the model (acquire values from a certain set of honesty), the extent and order of these changes. The aim of simulation experiments is therefore to get as close as possible to the defined objectives of the simulation project.

3 Using the simulation model in the manufacturing process

As an example, there is a demonstration for PCB boarding (PCB) components. The throwing itself takes place in two workplaces. Consequently, it is necessary to equip the mounted PCB with different connectors to which the next workstation serves. The last workplace is the workplace controlling the PCB functionality, where PCB is discarded as a non-fulfillment if the required properties are not met. All workplaces require service staff.

The model itself is implemented using different blocks that are interconnected in a mutually appropriate manner. Input blocks are used that represent entities of the PCB itself, subunits and connectors, and are centered in stacks, where simulation shows the current number in the stack, which is displayed with a numeric value.

Only one PCB and 15 consignments enter the workplace that represents the component placement itself. The total time to perform this operation is from a time interval of 5 minutes. Up to 6.5 minutes, and the availability of the operation is 95%, with an average repair time of 2 minutes (MTTR). Subsequently, the PCB that is set up in this way enters the operation where the connectors are connected to the PCB. The connection operation is performed in a time interval of 1 minute. Within 2 minutes, where the availability of this operation is 98% with a MTTR of 1 min. And a total of 5 connectors are mounted on the mounted PCB.

The last operation is to perform a functional PCB test that takes place over a period of 1 minute. Within 1.5 minutes, with the error being 2%.

The simulation was performed for one work change in 8 hours. The first model shown in Fig. 2, represented the production in question in the way that two PCBs were installed. All workplaces required staff to be oblued, with no precise assignment of a particular worker to a particular operation, but there is a possibility of a combination of workers and operations depending on availability. In 8 hours were produced 154 pcs of PCBs and 3 pcs did not pass the control test. In Fig. 3 in the left-hand time it is possible to see the workload of the workers and on the right hand the use of individual operations. It is clear that two workers are drawn to 100%, one to 39%, and one of the workers (Worker 4) is unloaded, so a modification of the model was considered, where only 3 employees were considered.

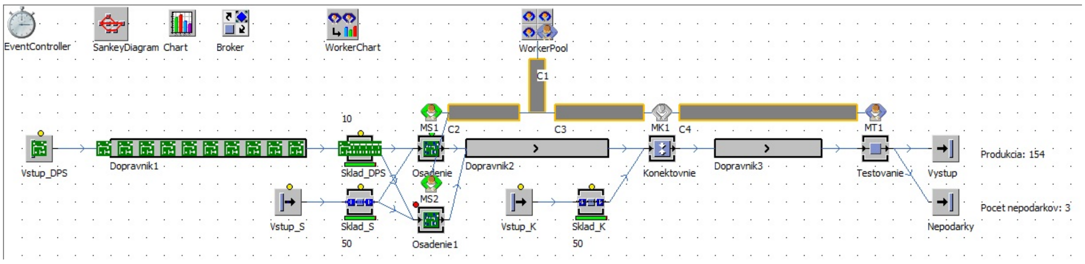

Fig. 2 *The first variation of the production process model*

For the modified model where the number of workers was reduced to three, the number of PCBs made in 154 and 3 non-cartridges was reached. The graphical view matches the view in Fig. 3. It can be said that one worker was superfluous.

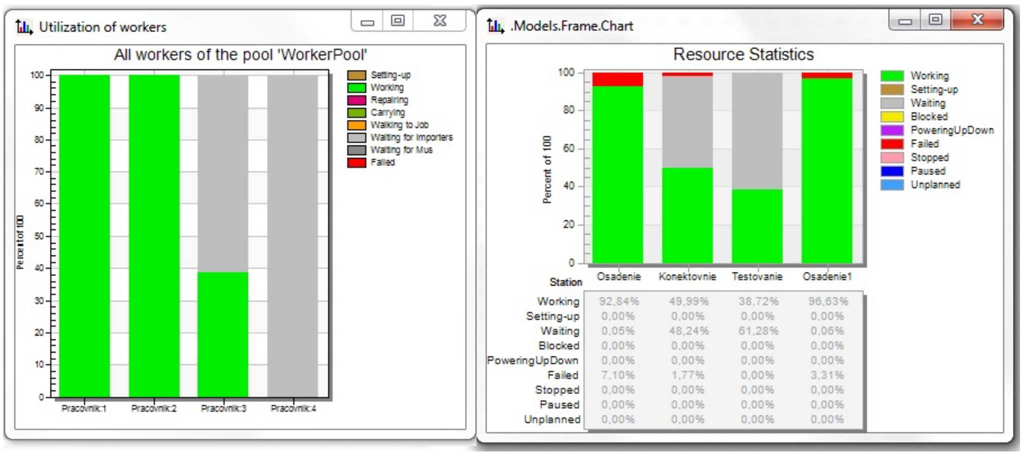

Fig. 3 *Graphical representation of individual workers and operations*

Another modification of the model was to add another workspace for the PCB installation operation, so the number of workplaces with this operation was extended to 3. The number of workers remained from the original model, so there are 4 workers in the model and the total number of operations requiring a worker to increase 5. The modified model for further simulation can be seen in Fig. 4. After the simulation, 234 pcs of PCBs and 5 pcs of non-products were produced, ie production increased by 51.95%. In Fig. 5 shows the worker's capacity, where three workers are loaded at 100% and one at 59%, so he might be allocated something else to take advantage of the unproductive time of his work.

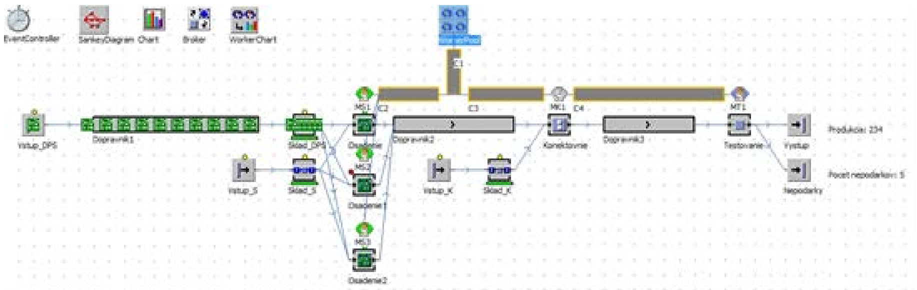

Fig. 4 *Modified production process model*

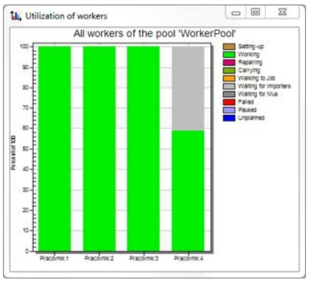

Fig. 5 *Graphical view of individual workers' workloads for the modified model*

4 Conclusion

In this paper, attention was paid to the simulation modeling of the manufacturing process, namely the PCBs with different parts and connectors, and then the functionality check was performed. For this process, a simulation model has been created, which has been modified to achieve higher production and optimize worker outreach. After an 8-hour simulation of the manufacturing process, it can be said that the modified model optimized the workload of the workers as a whole and the production increased by 51.95%.

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