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Trends in Simulation and Planning of Manufacturing Companies

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Abstract

Increasing the efficiency of production planning is a very hot topic from the perspective of introducing lean production into manufacturing. Simulation study dealing with simulation application for production planning support is a fundament for enhancing production systems and reduction of bottleneck occurrences. The article describes the possibilities of using computer simulation during production scheduling. A developed simulation model is adapted for dynamic loading of production plans for a given time period. Based on the simulation output, it is possible to verify production process and conduct additional simulation experiments. Changes in simulation model inputs result in changes on simulation (production) outputs, these can be easily compared with outputs of the original versions of production plans due to their archiving. The aim was to develop a simulation model which, after consequent adapting, will be used for creation of production plans in the future. The created model is ready for swift loading of incoming data and their consecutive evaluation through simulations with subsequent imaging diagram and output statistics. The developed simulation model can be fully controlled via a GUI (Graphical User Interface) which is fully opened for implementation of further optimization and scheduling algorithm with the aim of future enhancement of the simulation model.The simulation was created in collaboration with INNOV8 Ltd. via Plants Simulation software.

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1. Introduction

The priority of each company is to achieve profit. To achieve profit the efficient productivity or production are necessary. The efficient production means such a production where the machines or devices are utilised at their maximum while the idle time is minimised as well as the production time. Nevertheless, as the results of practice show, at present not every company is able to meet these requirements completely.

Currently, the companies are oriented on meeting the clients' requirements which calls for using many tools and methods necessarily utilized in production planning. Due to constantly growing client´s requirements, the companies utilise not only the plans prepared on the basis of standard capacity and statistical calculations but various systems such computer-aided planning.

For planning needs also several systems have been were developed, e.g. MRP (Material Requirements Planning). The systems are focused on controlling the production supply using a simple production model where the transformation of inputs into outcomes is given by the continuous production time. For subsequent optimisation linear programming is utilised [1].

For the needs of production optimisation, the computer simulation is used more and more frequently. It can be used also used in developing and verifying the production plans.

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2. Simulation

Simulation is the imitation of the system and its dynamic processes included in the model able to simulate the experiments in order to acquire knowledge applicable in real. In a discrete, event-oriented simulation the changes of model components´ states occur only in certain time periods, i.e. not continuously. Entering causes the change of model components´ states and controls the whole simulation. These events are carried out gradually – discretely. The advantage is represented by the fact that the time changes within the sequence of given events [2,3]. Due to these properties it is possible to execute dynamic monitoring within the simulation, where in contrast to static calculations through average values it is possible to monitor the given system behaviour in time. Suitably designed simulation model provides an amount of substantial information allowing thus executing the corrections in production planning. The following figure shows an example of filling the buffer in time, where due to dynamic monitoring it is possible to see critical values of the buffer.

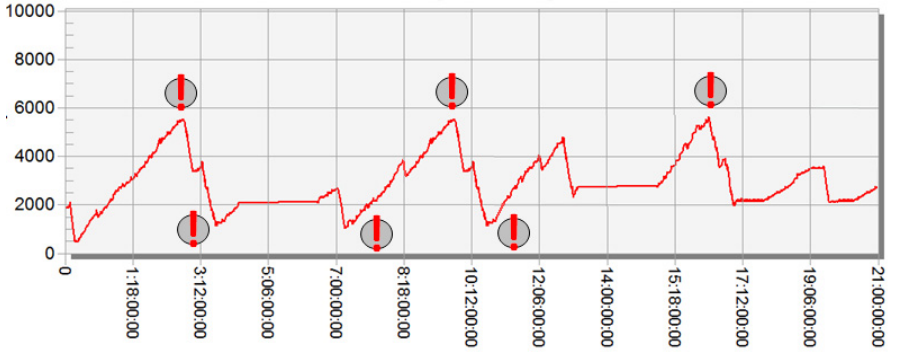

Fig. 1. Development of buffer state.

The graphs with the percentage of machines, workforce or logistic operators' exploitation or table reports with information on orders processed can provide further outcome information as well as Sankey diagram, or Gantt chart.

In the process of the simulation model development it is necessary to carry out the verification of the model developed so that the user can trust the model. Fig. 2 illustrates the relationship of the computer simulation model and reality.

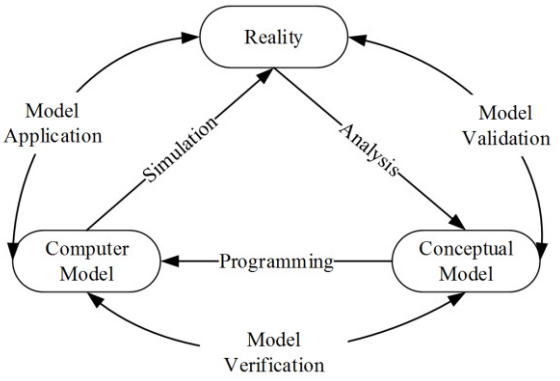

Fig. 2. Relationship of simulation and reality [3].

Currently, for the needs of computer simulation new programs trying to meet as many requirements and characteristics as possible are constantly developed, to mention just few of them available, e.g.: WITNESS, Plant Simulation, Simio, Automod, SIMUL8, ARENA, QUEST, etc.

For the needs of a suitable simulation tool development that could be flexible in supporting the production planning, in cooperation with INNOV8 Company we chose Plant Simulation program made by Siemens. Its advantage was in the support of object oriented programming using SimTalk programming language which allowed developing of flexible methods to ensure correct model functions [4,5,6]. Each object within the simulation had many predefined attributes and methods which can be