Research Paper Engineering

Optimization the Logistic Chain by Using Simulation Program Extend

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ABSTRACT

The article is drafted on the basis of knowledge of modelling and simulation in the logistics chain. The aim of the study was to analyze the simulation capabilities of the logistics chain enterprise with subsequent application to a particular problem. The main benefit of simulation techniques in designing of logistics systems is to limit the risk by the creation, operation and making changes to these systems. Using simulation methods for the analysis and optimization of production, service and logistics systems should be in the near future commonplace.

KEYWORDS productivity, efficiency, optimization, logistic, simulation,

Introduction

Enterprise engaged in manufacturing of rotating parts manufactures products for foreign manufacturers. Simulation is applied to a production line with a computer operated lathes (CNC), with parallel layout. The problem originates with the material before facilities which create a queue. Appropriate tool to resolve the problem of efficiency in production is a simulation of the production process. This simulation creates three proposals.

The necessary input data are listed in Table. 1

Tab. 1 Measured values by components production

Numberofmeasurements	Productiontime			
	1.machine	2.machine	3.machine	4.machine
1	205	234	221	275
2	238	257	233	254
3	284	240	278	269
4	239	285	259	243
5	246	271	264	251
6	237	242	206	249
7	211	263	297	238
8	225	298	280	227
9	241	246	273	273
10	268	213	247	262

On the production line are parallel arranged four CNC lathes (Fig. 2), each of which has the same parameters. As can be read from the table (Tab. 1), the production of these of components has a medium sized scattering of temporal characteristics. These time differences (Fig. 1) are taken into account when entering data into the simulation program.

Creation of model parallel multichannel system by program Extend can be based on two methods:

- each device separately modelled using blocks "Delay Activity", Fig. 4,
- facility will be built on a single composite block "Multiple Activity", Figure 3.

In order to accurate comparison the results will be created models of both variants. The first step to the models creation is creatinga schematic brand of simulation models using diagrams depicting the basic parameters of the model. After creation of the scheme follows create a model with the addition of first blocks for multichannel block "Multiple Activity" and then for the individual blocks' Activity Delay ".

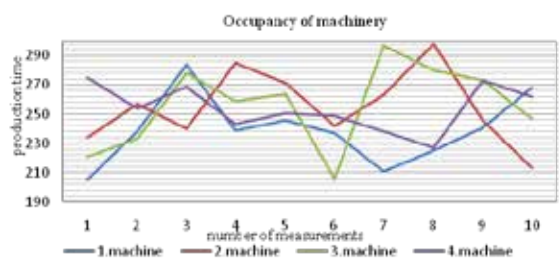


Fig.1Dispersion ofthe measured values

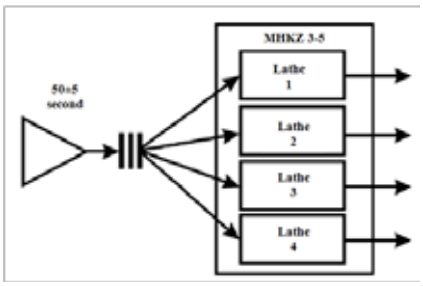
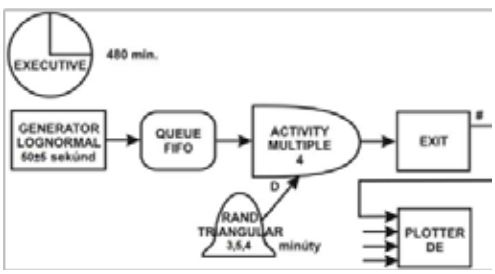


Fig.2Schematic multichannel facilities of production line



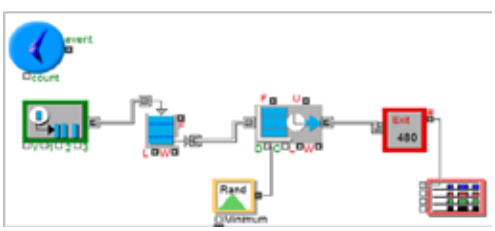
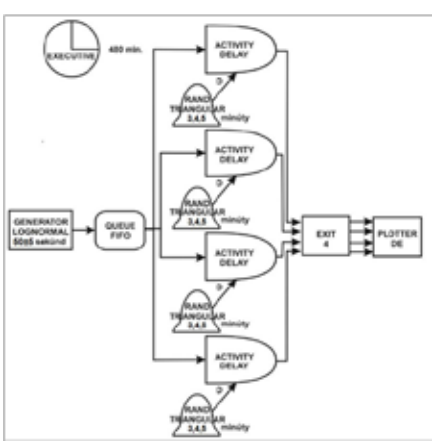


Fig.3 Simulation scheme and model for facility with a common block "Multiple Activity"



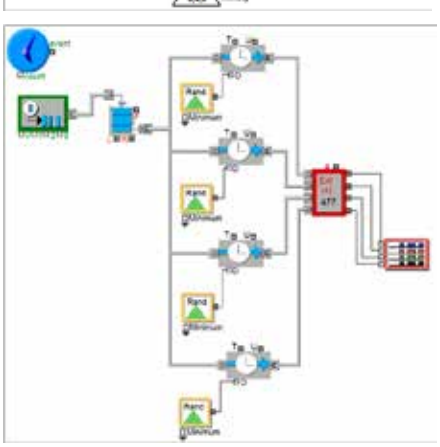


Fig.4 Simulation scheme and model for facility with a single blocks "Activity Delay"

The next step for both models will set the parameters of the individual blocks of the model. Will be selected universal time unit - minute.As a final step it is necessary to set the simulation time. The initial value is 0 and the final value of 480 representing the eight-hour operation of the production line. This applies to both types of models. After setting starts the simulation. It also provides the possibility of animation, because each flow of part depicts green dot, which helps to understand simulation. This option but significantly prolongs the simulation.

After simulation follow summarizing of results. The results for both types of models should be the same but potential smaller deviations are caused by random variables flowing there through into the facility. The results depicted in blocks Exit and Exit 4 (Fig. 5) show that the production line of CNC lathes is able by the specified parameters during the 8-hour working time produce about 480 of components.

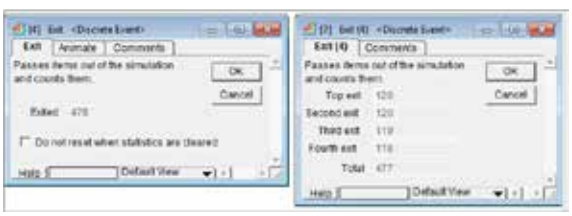


Fig.5 Outputsfrom the simulationof theproduction lineblocks "Exit" and"Exit 4"



Fig.6Use ofranksin thesimulation model

According to the outputs of the FIFO-queue blocks (Fig. 6) for both types of models, it is clear that the system enters approximately 580 requests for processing of components, and a number of leaving are just around 480 requests by usage of queue on 100%. From these characteristics, it is evident that the CNC production line is not fast enough to process incoming requests, so it is probably necessary to buy other machine tools for the production of rotating parts, which can process requested queue of products.

The advantages of equipment with the common block "Multiple Activity" is the ability of immediate adjustment of the model parameters by simply changing the number of processed requests. The advantage of simulation model for single blocks"Activity Delay" is to obtain information on any standalone device, but the second type of model is able to portray only a summary.

Due to the fact that are not sufficient to produce components four lathes, will be carried out simulation with five machines (fig. 7), which could lead to solving the problem of processing the queue. Into block "Multiple Activity" menu is installation the number of machine 5.

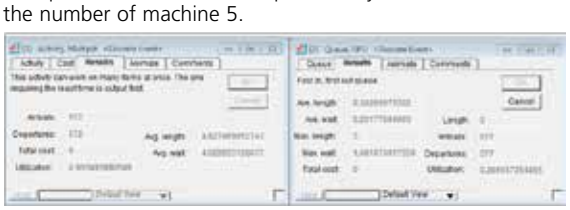


Fig.7 Processing requirements after adding another machine

After adding another CNC machine tool in a production line

and subsequent simulation show that such a production line would no longer able to process all requests coming into the system, the use of production facilities represent 96.5% and utilization of queue on 28.5% . This variant of buying a machine for economic reasons is yet not preferred.

As a further possibility of solving the problem of queuing could be shortening the time of production parts. The scattering chart of the measured values (Fig. 1) shows that production times have relatively large variance in production, which is due to the production line with CNC machines surprising. These variations are most caused by diversity of the produced parts with non-standard dimension, clamping these components between centers or chucks or adjustment of the machine parameters. From results shown in table Queue-FIFO and Exit is apparent that the shortening of the average production time of components from four to three minutes by using four machines means that the use of production machines represent 89.4% and utilization of queue on 6.8%

It is difficult to anticipate that shortening of the average production time of components by one whole minute ensure the production of rotating part. The use of this option is unlikely.

The third variant solutions are considering the possibility of reducing the number of requirements. By entering the requirements at a frequency 50 ± 5 seconds with an average production time 4 minutes per part four CNC machine don´t prosecute serve a queue. For this variant is chosen frequency of requirements in one minute, the consequence should be shorten queue of production requirements and relief for the production machines. In this step, however, can be reasonably expected decrease in production of components.



Fig.8Simulation result after prolong the time frequency of requirements

The last variant (Fig. 8) shows that, although the device prosecuted serve a number of requirements by utilization of machines represent 99.3% and queue 79.9%, but prolonged time of frequency means decreased the number of requests by almost one fifth which would result in significant reduction in the number of produced parts .

The following graph (Figure 9) depicts a comparison of utilization of production machines and requirements among different variants.

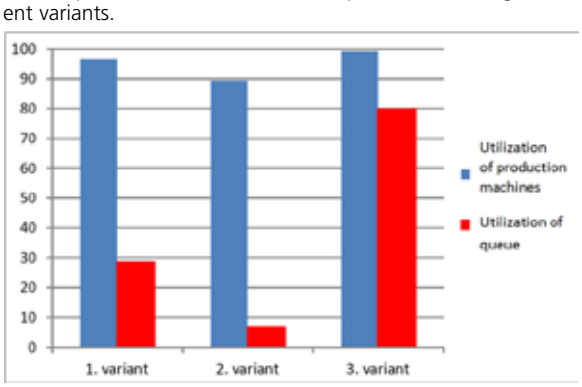


Fig.9Comparison of utilization of machines and queue for different variants

The chart (Figure 10) shows average length of queue and average waiting time of requirements. In the second variant is evident that after shortening the average time of parts production were given values to the minimum level. By contrast, in the third variant after the increase frequency of requirements from 50 to 60 seconds occurred increase the waiting time and length of queue.

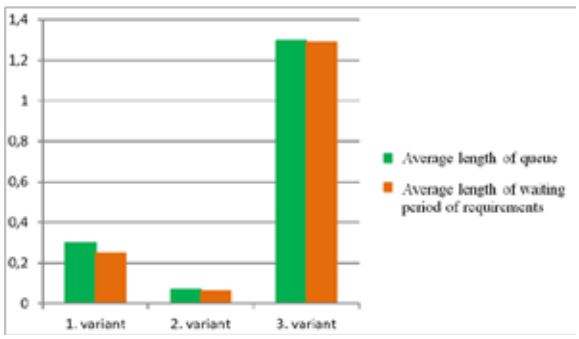


Fig.10Comparing the values of the length of queue and waiting period of requirements

From these three options is the most appropriate variant No.1, ie. purchase of a new machine tool, but it required financial investment. Costs of implementing solutions represent purchasing new CNC equipment worth € 15,000 and the cost of the operator - training for use of the equipment in the amount of € 200. The total cost for the implementation of solutions represented a value of approximately € 17,200. Taking into account these facts, the company pays to invest purchase equipment; the payback would be very quick. Investment in new equipment is to be expected even higher customer satisfaction and increase in orders.

Variants 2 and 3 have disadvantage, variant 2 because is clearly not realistic in terms of temporal characteristics and variant 3 reduces the production of products for 8-hours operation.

conclusion

The aim of the simulation project was to assess several possible alternatives by queue creation and thus provide a basis for decision-making in the way they choose solutions. Development of simulation tools in the near future become a standard tool of industrial engineers and logistics experts.

ACKNOWLEDGEMENTS

This article was created by implementation of the grant project VEGA no. 1/0102/11 Experimental methods and modeling techniques in-house manufacturing and non-manufacturing processes.

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