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DESIGN OF DIGITAL GRAPHIC SYSTEM

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1. Introduction

This work analises design of graphic procedures in dependance on bottlenecks in production line. By quantitative determination of the work ammount, that is a reason for the lack of speed and job accomulation, it is possible to correct and improve the present state. Simulation of flow of planned activities is based on real data measurement in digital printing house. On the basis of measuring and result analysis optimal parameters for graphic production are designed. The new approach in observation an evaluating graphic ingeneering area is given, and this is reflected through a better usage of present graphic equipment. Researches are initiated by a new situations in integration of digital and conventional printing and graphic designers demands for more demanding graphic product.

2. The defining area of bottlenecks

Past experiences which are tried to simulate the graphic production and evaluation of speed and efficencies are very weak. Practically the every piece of graphic production from prepress to final production is possible to transforms in the model which will be quantitative evaluated.
Under these work we try to treat the problem in the part of prepress production. For the analysis and evaluation successfulness it is separated the area of digitization of original with assiociated distributions on different places for the processing. Depending upon the exit size, kind and presentation of file the workplace is conditioned by different time intervals for the processing. It is defined that from the total number of original 10 percentage goes on the processing, which time is the longest in time of 27 +- 8 minute (priority would be conditioned with the size of file and necessary corrections). Thirty percentage of digitised originals are processed shorter in time of 14 +- 4 minutes and the others 60 percentage are processed the shortest in time of 7 +- 2 minutes (the figure 1).

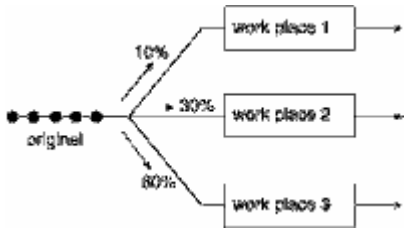

Figure 1.

Under time which is defined for the single workplace it is included reading and writing of the file. It can notices that in some situations comes to touching of time intervals of single digital original from the different groups for the processing. Reason of this is less quality sample (older or screening of the original) or additional prepress work.

The process of digitizations and writings of job file (or some other way of distribution) is determined on the variable interval from 2 to 7 minute, which depends on output sizes of file and kind of presentation. The simulation of that part of graphic production is made for 23 working day than according to 8 the hour. It is determined the quantitative size which change with the bigger speed of digitizations. By that comes to the creation of queues of files on the single workplace, which in the some moments can not be processed.
In the basic model is developed the situation where it is not conditioned the size of accumulation in queues by mean of the rejections of original. With the simulation of measurements of time it is determined the usage of place and avrage number of files in queue for single workplace. (table 1. and figure 2.)

Table 1.

kind of work	usage of place [x 100 %]	avrage number of files in queue	generate of transaction [Δt, min]
1	0,851	3,581	
2	0,983	10,716	2
3	0,966	20,944	
1	0,853	1,547	
2	0,994	13,026	3
3	0,983	20,621	
1	0,735	0,671	
2	0,951	14,762	4
3	0,951	5,161	
1	0,948	0,227	
2	0,813	1,409	5
3	0,822	0,746	
1	0,547	0,148	
2	0,602	0,239	6
3	0,710	0,179	
1	0,514	0,159	
2	0,541	0,171	7
3	0,591	0,041	

1 - time of work 27+-8 min, 2 - time of work 14+-4 min, 1 - time of work 7+-2 min

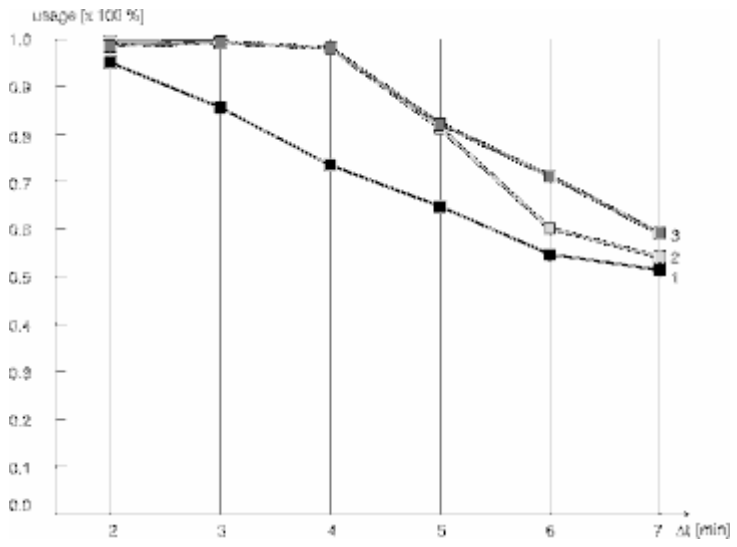

Figure 2.

3. Experimental part

In the intervals where is the digitization was short (2 - 4 the minutes), the load of single workplace has been big (for 4 the minutes: the place 1=73.5%, the place 2=98.1%, the place 3=98.1%), but the average accomulation is so much that many originals are waiting on the processing (for 4 the minutes:

the place 1=0.671%, the place 2=14.762%, the place 3=5.161%). After this interval has come the stabilization in the average accomulation, but with this has come to the unloading of single workplace. Analysing the results of simulation we can develop the model in a few directions. One way is to quantitative restriction of the sizes of queues on the determined amount and then to throw away the rest. Other way is simillar but the rest will be transfered to some workplace and third way is that on the workplaces will be installation of the additional device for the processing. In this project is realized analyze of the first suggested way. In one case maximal size of queue is 2, in the other situation is 3 and in fourth is 4.
There is introduced the situation where is added the section with a name "non-work file" in respect to the basic model. There are also presented the results from simulation, the utilization of workplace and statistics of rejected originals (tables 2, 3,4 and figures 3,4,5).

Table 2.

kind of work*	usage of place [x 100 %]	non-work files [x 100 %]	amounts of transaction [Δt, min]
1	0,981	0,328	
2	0,969	0,515	2
3	0,965	0,575	
1	0,850	0,101	
2	0,864	0,510	3
3	0,968	0,280	
1	0,735	0,073	
2	0,961	0,142	4
3	0,961	0,119	
1	0,944	0,079	
2	0,813	0,032	5
3	0,922	0,030	
1	0,647	0,017	
2	0,703	0,046	6
3	0,710	-	
1	0,516	-	
2	0,541	0,008	7
3	0,561	-	

1 - time of work 27+-8 min, 2 - time of work 14+-4 min, 1 - time of work 7+-2 min

In the table 2. are presented the percentages of usage the single places for the processing and percentage of rejected files which is not treated in the this cycle. In this case accumulation of files in queue is restricted on 2, and the rest has thrown away.

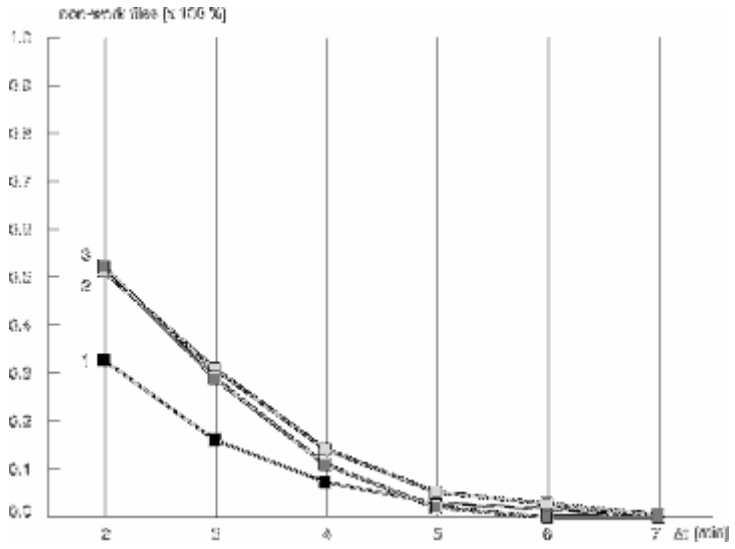

Figure 3.

This situation is not acceptable because in the area of frequent arrivals of transactions (2 - 4 minutes) the big number of originals are thrown away i.e. would be refused for the work (figure 3.) But in next intervals (from 4 the minutes furthermore) the model is very usable and gives acceptable results in the relation of load of workplace and rejected work for the processing.

Table 3.

kind of work*	usage of place [x 100 %]	non-work files [x 100 %]	generating of transaction [s, min]
1	[illegible]	[illegible]	
2	[illegible]	[illegible]	2
3	1	[illegible]	
1	0,351	0,116	
2	0,365	0,273	3
3	[illegible]	[illegible]	
1	[illegible]	[illegible]	
2	[illegible]	[illegible]	4
3	[illegible]	[illegible]	
1	0,363	-	
2	0,771	[illegible]	5
3	[illegible]	[illegible]	
1	[illegible]	-	
2	0,576	[illegible]	6
3	0,566	-	
1	[illegible]	-	
2	[illegible]	-	7
3	[illegible]	-	

1 - time of work 27+-8 min, 2 - time of work 14+-4 min, 1 - time of work 7+-2 min

In the table 3. are presented results when the number of originals (the transactions) in the queue are restricted on 3. We have observed times which are generated in the range from 2 - 7 the minutes. Comparing the results of tables 2. and tables 3. we can conclude that is more loading of the workplaces in the cases where is waiting defined on 3 originals in the queue.

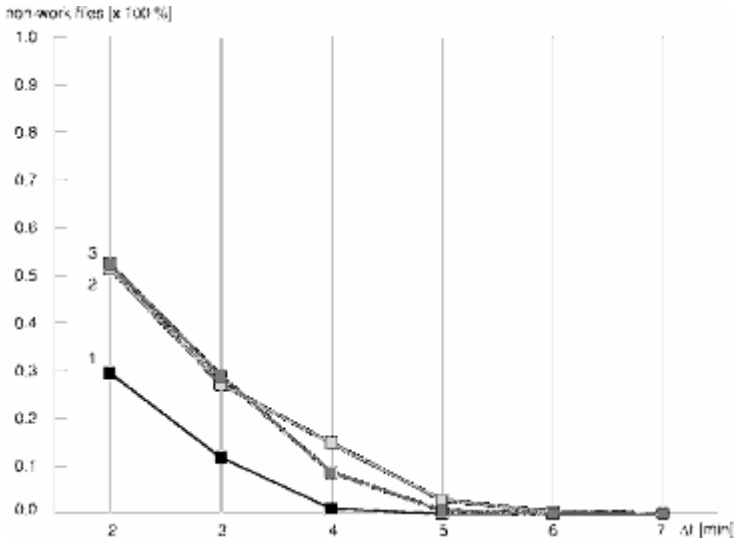

Figure 4.

From the figure 4. we can conclude that the intervals from 2 to 3 minutes have the biggest percentage of rejected files, so that the proposal is to avoid this casas regardless what utilization of this places is big. The situations in the next intervals (3 - 4 minutes) are more acceptable because there are bigger number of originals which not have been refused for the work (the average enlargement than 20%).

Table 4.

kind of work*	usage of place [x 100 %]	non-work files [x 100 %]	generation of transaction [Δt, min]
1	0,994	0,295	
2	0,994	0,511	2
3	1	0,524	
1	0,903	0,078	
2	0,997	0,250	3
3	0,939	0,293	
1	0,686	0,015	
2	0,943	0,099	4
3	0,959	0,072	
1	0,595	0,010	
2	0,735	0,014	5
3	0,842	-	
1	0,494	-	
2	0,675	-	6
3	0,686	-	
1	0,493	-	
2	0,568	-	7
3	0,605	-	

1 - time of work 27+-8 min, 2 - time of work 14+-4 min, 1 - time of work 7+-2 min

Table 4. represents results of percentage of utilization of workplace and percentage of rejected files in the situation when the number of originals is not restricted on more than 4 in the queue.

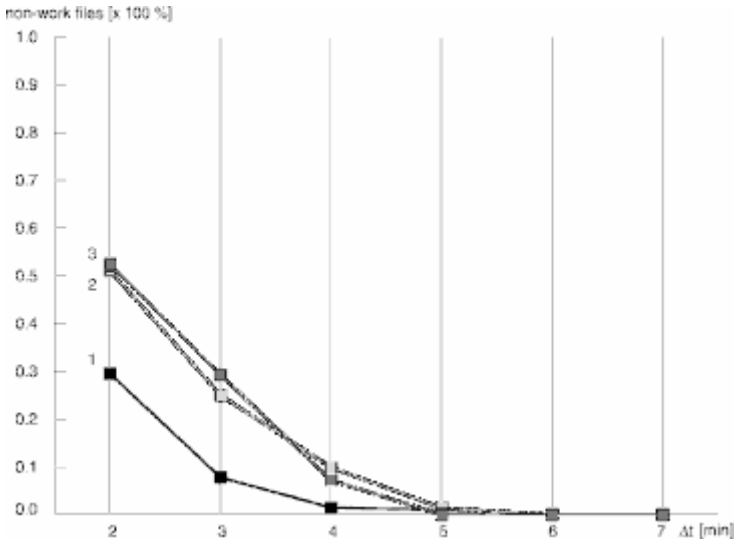

Figure 5.

Compare the gotten graphs, we can conclude that in the area of fast arrivals of transactions (2 - 3 the minutes) the results are very similar, but in the moments from 4 to 7 minutes the results are different. This difference is more visable in the last case when above 3 minutes is the number of rejected files in decreasing i.e. the refused original for the processing. In practice, for the getting better utillization of workplace with smaller rejected works we propose precise recording of times of generating the transactions. The model can be adoptet to every situation where will be the need for more utilization of resource.

4. Conclusion

The results of this research lead us on the conclusion how the method of simulation gives the new way of solving problems in the area of designings digital graphic systems. This problems are manifest themselves in the insufficient utilization of single production components, the insufficient possibilities of testings, and scholling of personnel for the work. In this research we developed the production line

which is brought to the marginal value of utilization. We designe the optimal model which fullfill existing digital architecture. It is also the contribution for new areas in graphic engineering, in the first place for concept of virtual production components in the printing. The results presenting the big discrepancy in the design of digital graphic systems, what realistic has been expected.

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