

Logistics Production Lines Optimization Analysis Based on Flexsim

Hai Dong^{1, a}, Zishuo Wang^{1, b}

¹School of Mechanical Engineering, Shenyang university, Shenyang, China

^adonghaizxh@163.com, ^b1011488971@qq.com

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Abstract. According to the characteristics of the logistics, production lines and function of flexsim simulation software, the two important logistics production lines simulation optimization problems was raised, clarifying the optimization methods that is used flexsim simulation software to analyses the logistics production lines , and used a factory four logistics production lines simulation example of optimization analysis, illustrates the logistics production lines production optimization analysis process that is based on flexsim simulation software.

Introduction

Studies have shown that only 10% of the time used for manufacturing and processing, and the surplus 90% of the time is used for storage, loading, waiting for processing and transmission in the process of production. So, increase productivity, reduce logistics cost is very important. And the application of computer simulation technology to make up for the defects, become the logistics production system manager an effective tool. This article used the flexsim software to simulation and modeling for someone manufacturing enterprise logistics production lines, through the operation of the 3D model to find out short board and the bottleneck process, and then put forward logistics optimization scheme to improve the efficiency of the logistics production lines.

Based on Flexsim Logistics Production lines Simulation Optimization

Based on FLEXSIM Steps of Simulation Optimization of Logistics Production lines of the general steps as shown in figure 1:

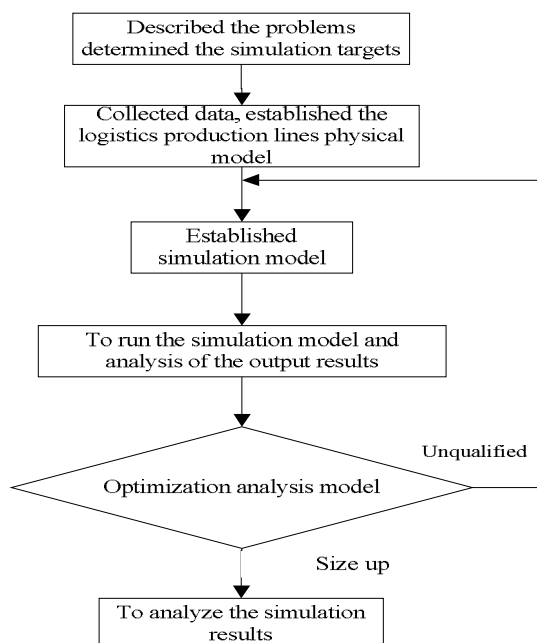


Figure1. Steps of logistics production lines based on FLEXSIM

Examples of Application

Factory A is a fixed-point military factory that is production important military products in our country, and it is the machining enterprises of the state supports. Due to the original production pattern tend to scientific research and development of new products, so most of the original product is multiple varieties and small batch production. Now, with the rising market demand, enterprises adjusted their mode of production, product by many varieties of batch small turn to many varieties of mass production. Now need to carry on the optimization to the enterprise of four logistics production lines. **Collection of Data.** The four logistics enterprise production lines with the principle of "a flow" layout. The first logistics production lines has 18 procedures (GX101 ~ GX118), the second logistics production lines has nine procedures (GX201 ~ GX209), the third logistics production lines has 20 procedures (GX301 ~ GX320), article 4 of the logistics production lines has 14 procedures (GX401 ~ GX414), each working procedure and with only a device and a staff to clamping and processing.

Control Model Analysis. Stock up time and cost is:

$$TD = \sum_{i=1}^i TP_i(Q_m + Q + Q_n) \quad (1)$$

The cost of raw material produced in the process of transportation time is: $Y_m \times Q_m \times T_m$

The cost of raw material produced in the process of transportation delay time is:

$$\int_0^{Q_m} pf_m(p)c_p \times y_m \times t_m \quad (2)$$

All the cost of raw material produced in the process of transportation time is:

$$W_1 = \sum_m \left[C_m \times Q_m + Y_m \times Q_m \times T_m + \int_0^{Q_m} pf_m(p)c_p \times y_m \times t_m \right] \quad (3)$$

Production of finished goods in the process of the total time cost is:

$$W_2 = \left\{ \begin{aligned} & C \times (Q - v) / V + (c \times v) / V + \sum_m Q_m \times T \times L + Q \times t \times l + \\ & \sum_n (Y_n \times Q_n \times T_n) + \sum_n \left[y_n \times \int_0^{Q_n} kf_n(k)c_k \times t_n \right] \end{aligned} \right\} \quad (4)$$

The shortage loss of time cost is: $D_n = \int_0^{Q_n} kf(k)c_k \times d_n \times t_n \quad (5)$

$$W_3 = \sum_n \left[\int_0^{Q_n} kf(k)c_k \times d_n \times t_n \right] \quad (6)$$

The time cost of inventory strategy is:

Control Model Establish. Stock up time cost control model is:

$$\min TD = \sum_{i=1}^i TP_i(Q_m + Q + Q_n) \quad (7)$$

The total time cost control model is:

$$\min W = \sum_m \left\{ \begin{aligned} & \left[C_m \times Q_m + Y_m \times Q_m \times T_m + \int_0^{Q_m} pf_m(p)c_p \times y_m \times t_m \right] + \\ & \left[C \times (Q - v) / V + (c \times v) / V + \sum_m Q_m \times T \times L + Q \times t \times l + \right. \\ & \left. \sum_n (Y_n \times Q_n \times T_n) + \sum_n \left[y_n \times \int_0^{Q_n} kf_n(k)c_k \times t_n \right] \right] + \\ & \left. \sum_n \int_0^{Q_n} kf(k)c_k \times d_n \times t_n \right\} \quad (8) \end{aligned} \right.$$

Optimal control model is:

$\min \mathfrak{C} = \min TD + \min W$

$$= a \sum_{i=1}^i TP_i(Q_m + Q + Q_n) + (1-a) \sum_m \left\{ \begin{aligned} & \left[C_m \times Q_m + Y_m \times Q_m \times T_m + \int_0^{Q_m} pf_m(p)c_p \times y_m \times t_m \right] + \\ & \left[C \times (Q - v) / V + (c \times v) / V + \sum_m Q_m \times T \times L + Q \times t \times l + \right. \\ & \left. \sum_n (Y_n \times Q_n \times T_n) + \sum_n \left[y_n \times \int_0^{Q_n} kf_n(k)c_k \times t_n \right] \right] + \\ & \left. \sum_n \int_0^{Q_n} kf(k)c_k \times d_n \times t_n \right\} \quad (9) \end{aligned} \right.$$

Simulation Model Establishment. Assumption the raw materials is purchased by fix time interval. And through the process of more number of failure GX310 conduct statistical analysis, and shows that the equipment failure time myopia the normal distribution, its average for $X = 39.5$ (min), $Y = \sqrt{225.9} = 15.02 \approx 3/8 \times 39.5 = 15.02$ (min). So in order to simplify the modeling, and other equipment approximation submit the assume-deviation 3/8 normal distribution. Modified and "compile" model in order to ensure the normal operation of the simulation, the simulation model is set up as shown in figure 2.

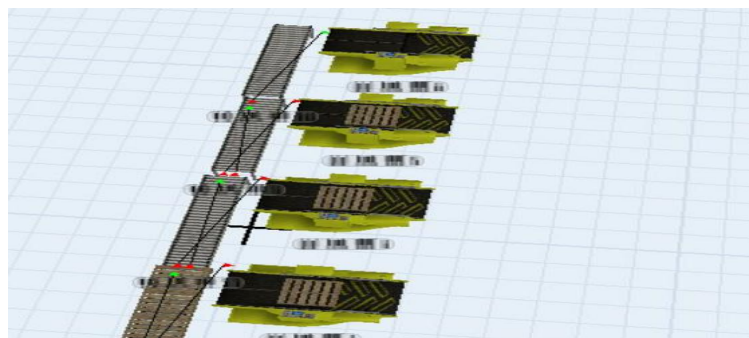


Figure 2. Simulation model of FLEXSIM

Analysis of Optimization Results. Be gotten by calculating optimum simulation times is eight times, the simulation results are shown in table 1.

Table 1. The simulation results for the first time

The production lines Times of the simulation	The production lines							
	1	2	3	4	5	6	7	8
1	160	160	160	150	160	160	160	160
2	200	190	190	200	200	190	200	205
3	130	130	125	130	130	150	130	130
4	150	140	140	145	145	140	140	150

The average of each logistics production lines:

$$A1 = \frac{160+160+160+150+160+160+160+160}{8} = 158.75, \quad A2 = 196.86, \quad A3 = 131.86, \quad A4 = 143.75$$

The productivity of each logistics production lines are as follows:

$$B1 = \frac{158.75}{530} \times 100\% = 29.95\%, \quad B2 = 37.14\%, \quad B3 = 24.87\%, \quad B4 = 27.12\%$$

As we can see from the results, four logistics production lines of productivity is very lower. Clear the longest of each logistics production lines process as the bottleneck process. Such as GX101, GX104 GX110 GX408, GX113 etc. The optimized simulation model is shown in figure 3



Figure 3. Optimized simulation model of the first time

But must be to the overall logistics production lines optimization again. The optimized layout is 3-2-4-1. The optimized simulation model assuming that running as shown in figure 4.

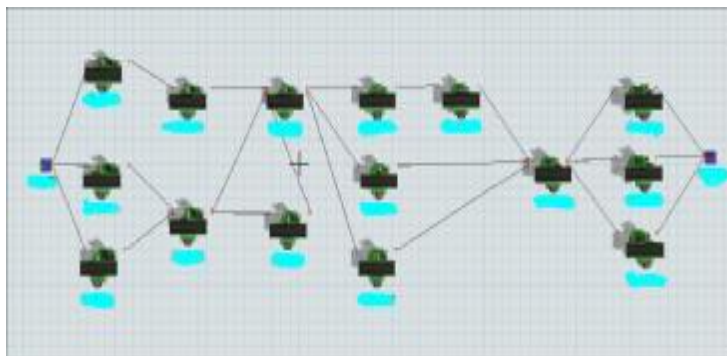


Figure 4. Optimized simulation model of second time

The output of each logistics production lines are as follows: $A^1=185$, $A^2=200$, $A^3=20$, $A^4=230$. Productivity for $B^1=34.9\%$, $B^2=37.73\%$, $B^3=41.5\%$, $B^4=43.4\%$. Although, the optimized output in the case is not much change, but it is increasing the logistics production lines balance rate, reducing the processing equipment and the number of staff, thus created the profit and reduced the cost.

Conclusions

For this paper reveal that the FLEXSIM simulation software was applied for factory A logistics production system to conducting quantitative analysis and optimization design is a kind of effective method. Through the modeling simulation optimization, reduced the staff and saved the time, make the system run more smoothly and to balanced the whole production system production capacity and reduced the cost, then improved the production efficiency and competitiveness of enterprises. Above examples, using the simulation technology can undertake simple modeling. Using the simulation technology can quickly, accurately and effectively optimize the logistics production lines running and complex system.

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