International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Research Article

Development of Computer based Production Planning System on Simulated Production Data of Manufacturing Unit

Abhinav Whatte†*, Ganesh Jagadale†, Vikas Yerrawar‡

†Mechanical Engineering Department, Marathwada Mitra Mandal's Institute of Technology, Lohgaon, Pune-47, India
‡Mechanical Engineering Department, D.Y. Patil School of Engineering, Charholi, Pune, India

Accepted 01 Oct 2016, Available online 05 Oct 2016, **Special Issue-6 (Oct 2016)**

Abstract
Production planning is the process of proper utilization and control of all resources like manpower, machine, raw material and power source. This paper focused on study of production planning system which has been developed using simulated production data of manufacturing unit. The required inputs like master production schedule, material resource planning, production cycle time are considered while developing an algorithm and computer program for production scheduling. This system has been applied and validated on the simulated data of manufacturing unit.

Keywords: *Cycle time, Lead time, MPS, MRP, Scheduling*

1. Introduction

Production control focuses on achieving production targets, optimum use of available resources, increased profits through productivity and better economic goods and services. Effective production control system requires reliable information, sound organization structure and a high degree of standardization. A sound production control results into or assures a more positive and accurate completion and delivery of customer's orders. Delivering an order on time is obviously important to the customer and to develop customer's goodwill. Effective production control also maintains minimum inventory level and makes saving possible in both labour and material investment. Thus, good production control helps a company to operate and produce product more efficiently and achieve lowest possible costs.Review has been studied according to different aspect of planning and control like multistage production with different types of product, optimum capacity utilization model, order acceptance and production planning for short term and long term production planning. Production control is mainly subdivided into two categories as capacity control by focusing on capacity of the plant and priority control based on the priorities of customers (L Caccetta *et al*, 2003).

The work starts from a point where a master production schedule (MPS) and material requirement plan (MRP) have already been prepared using simulated data of the customers' orders along with the desired quantity and expected delivery date. At the production control stage a review needs to be carried out to see if the materials and capacities are available as per the requirements of master production schedule. Many times because of the flaws in the MRP system, some materials may not be available because of which rescheduling of orders has to be carried out which results in deviations from the MPS, because of this the costs tend to rise. In this work, a computer program is developed which reschedules the orders in a logical manner based on the actual availability of materials (Mario T. Tabucanon *et al*, 1990).

2. System Development

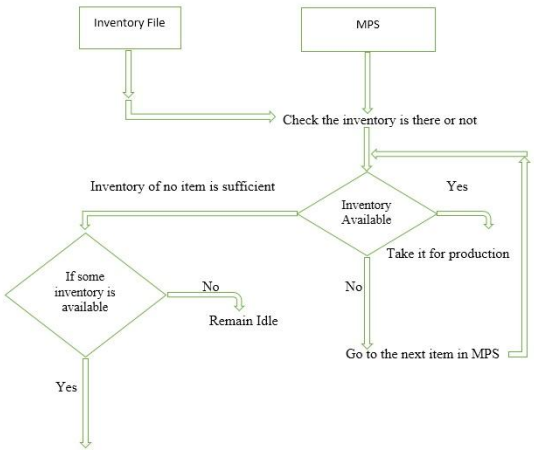
The simulated data has been used to prepare Master Production Schedule (MPS) and Material Requirement Plan (MRP). The data is retrieved from previously generated MPS and MRP for preparing the master database for production planning and control activity. The algorithm and computer program generated for production control start with the first order listed in MPS and schedules it for production if the material is available. If material is not available it goes to the next. If the entire list gets exhausted and no product can be manufactured as its components have not arrived in stock then the program picks up the product for manufacture for which at least some components are available and the product can be made up to some stage. This action uses the capacity efficiently but results in higher in process inventories. The system also calculates the loss due to higher inventories and also the extend up to which the orders have to be rescheduled. Table 4.1 shows the data collected from

*Corresponding author: **Abhinav Whatte**

Master Production Schedule along with quantity of orders, cycle time of production, order date and delivery date.

After the result from MPS has been generated, data is retrieved by the system from MRP. Once the list of orders is received, actual quantity required for each order is calculated by MRP system by considering different parameters like scrap rate and first time yield (FTY). The net required quantity of each component, material receipt date is given by MRP system by considering the lead time for procurement. Accordingly the production date for each order is scheduled by production control system. The data collected from material requirement plan along with the new required quantity, lead time, material receipt date and available inventory.

For the generation of production control system, the required data is collected from previously generated MPS and MRP. The algorithm and computer program generated starts with the first order listed in MPS and schedules it for production as per the material availability. In this system, factors like capacity control and priority control are considered to find the net requirement of capacity and to maintain the order priorities. A program is developed which reschedules the orders in a logical manner based on the actual availability of materials. The system will simultaneously work on Master Production Schedule (MPS) and Material Availability. First, system will consider MPS and get the list of orders. Then check the inventory of each product from the inventory file and find out the inventory available or not for the respective product and also check if it can be available for production before due date. While finding the inventory of each product the system may face three different situations. If inventory is available for a particular order then system will take such product for production as per the order list.



While in other case if no inventory is available for an order then system will go for the next order in the order list and check the inventory for the same. If some inventory is available for a product then produce the same product up to the stage for which components are available. The system will go up to the last item in MPS and find such products having insufficient inventory. All those product which were made up to a particular stage have to be completed when the remaining components are available. Accordingly if no single inventory is available for a product then production process will remain idle and put in MPS the date of being idle.

1. Produce the product up to the stage for which components are available.
2. Go up to the last item of MPS and keep changing the MPS.
3. All those products which made were up to a particular stage have to be completed when remaining components are available.

Figure 1 Flowchart of Production Scheduling

2.1 Algorithm

Step 1: Retrieve the MRP and MPS data.

Step 2: Calculate the net order quantity required
Required Quantity = Order Quantity – Available Quantity

Step 3: Recall the Inventory file from MRP
Calculate the total required quantity considering the FTY and Scrap Order quantity.
Total required quantity = [(0.02) +FTY)*Order Quantity] + Order Quantity – Available Quantity

Step 4: Calculate the required quantity of respective parts of each order.
For Example: No. of End caps required = Order qty. - Available qty.

Step 5: Check the inventory of each product from inventory file.
a) If inventory is available then the system will not change the order and go the next product in order list.
b) If no inventory is available then go the next product in order list.
c) If some inventory is available then check the availability of each part

Step 6: Calculate the material receipt date
Material Receipt Date = Order Date + Lead Time

Step 7: Check the inventory of each product from the required intake and also check the material receipt date of the same order, so accordingly calculate the production start date by putting one condition as (Start date > receipt date)

Step 8: Calculate the production end date
Production End Date = Prod. Start Date + (Cycle time * No. of Products)

3. Testing & Validation of System

An organization is considered which manufactures automobile filter. Company produces different sizes and different models of filter as per the customer's

requirement. Company manufactures 26 different types of filters. It has capacity of manufacturing one lakh filters per month. Out of these 26 products, some products are manufactured on regular basis and some of them are manufactured against specific order from customers.

Company has variety of customers and so they are categorized according to their importance to the company and rank are given to them. If one of the important customer placed an order then company has to deliver the order on time even that customer fails to place an order on time. So while scheduling production customer priority is considered as an important parameter. Further, all the products are made on the common production line and machines by changing the tooling and affecting setup change over as per the requirements. The setup changes over takes a different time for changing the production of one product to another type of product (Marta Susana Moreno *et al*, 2008). Company has divided all products into three categories according to their frequency of order in a month or according to their requirement as Hot Moving, Medium Moving, Slow Moving products. Hot moving products are always kept in stock whereas medium moving and slow moving products are to be manufactured as the order comes from customer to avoid the excess inventory level.

After Collection of data by considering the different products and their processes, using this data individual probabilities are calculated for each events or process. And based on these events using simulation, data of the future orders is generated. This data is then utilized for generation of Master Production Schedule (MPS) and Material Resource Planning (MRP). After the generation of MPS and MRP, certain parameters are to be taken under consideration for the effective production planning. System has considered various parameters while retrieving the data like Order ID (orders sorted on basis of customer rank , delivery date , order date), Product ID, Customer ID, Order date and Delivery date, Quantity ordered, Customer importance, Product and part available inventory, Actual quantity Required, Lead time, Cycle time

4. Results and Discussions

Final result of the system will be displayed in the table format which will give the current status of the inventory available as well as it will give the material receipt date for each order. Accordingly the system will arrange the orders as per the material receipt date.

If inventory is not available for an order then it will move to next order in the order list. And it has been observed that the inventory is available for the next order, so the system schedules the production start date for that next order on the same day. Simultaneously it will also calculate the production end date by using the cycle time of that product. Now by comparing the production end date for the current in process order and material receipt date of previous order, the system will decide whether the previous order should take for production or next order. In this way system will go up to last order in the order list and arrange the order list in a particular sequence. From the results it is observed that, orders have changed their sequence according to the material availability and priority of the dates. And different important terms can be calculated from the obtained results like machine idle time, excess material carrying cost, change of sequence of order, number of orders having insufficient material. Various observations are investigated and findings from these results are explained. The system has arranged the orders as per their material availability for scheduling the production date and many orders have not changed their sequence while remaining have changed their sequence. It is also observed from the result that some orders have received their material too early which implies that they are carrying inventory for excess days before production start date. This leads to unnecessary storage of inventory which directly affect the inventory storage cost. In this way number of orders affecting the cost can be calculated. The result of the system is shown in Table 1

Table 1 Result obtained for the production schedule

				Required				Available				Intake								
orderid	prodid	orderdate	req_qty	endcaps	iretainer	oretainer	gasket	endcaps	iretainer	oretainer	gasket	ecaps	iretainer	oretainer	gasket	Tripdays	Recpt_date	Start date	End date	Sequence
2	2	18/02/2013	6955	6955	6955	6955	6955	4500	2500	0	6000	2455	4455	6955	955	3	25/02/2013	26/02/2013	28/02/2013	2
3	22	18/02/2013	10080	10080	10080	10080	10080	9000	4000	3500	0	1080	6080	6580	10080	5	21/02/2013	21/02/2013	25/02/2013	1
5	15	20/02/2013	1675	1675	1675	1675	1675	4500	2500	4500	0	0	0	0	1675	1	28/02/2013	01/03/2013	01/03/2013	3
6	17	21/02/2013	4660	4660	4660	4660	4660	3500	3000	4500	0	1160	1660	160	4660	2	25/02/2013	02/03/2013	03/03/2013	4
10	10	22/02/2013	7600	7600	7600	7600	7600	3500	0	3500	4000	4100	7600	4100	3600	4	05/03/2013	05/03/2013	08/03/2013	6
9	5	23/02/2013	7250	7250	7250	7250	7250	9000	3000	4500	6000	0	4250	2750	1250	3	05/03/2013	09/03/2013	11/03/2013	7
11	25	25/02/2013	2105	2105	2105	2105	2105	3500	0	2000	4000	0	2105	105	0	1	28/02/2013	04/03/2013	04/03/2013	5
12	19	28/02/2013	4815	4815	4815	4815	4815	4500	0	3500	7000	315	4815	1315	0	2	17/03/2013	12/03/2013	12/03/2013	8

It has been observed from the result that some orders have insufficient inventory. If no inventory is available then system will move to the next order. But sometimes it may happen, if some inventory is available for a product then produce the same product up to the stage for which components are available. The system will go up to the last item in MPS and find such products having insufficient inventory. All those product which were made up to a particular stage have to be completed when the remaining components are available.

Conclusions

The proposed production control system is user friendly and gives accurate results when compared with the manual method of calculation. The system eliminates all the difficulties arising due to manual method of computation and provides accurate scheduling of orders. The main advantage of the proposed algorithm is that it takes into account all the situations and parameters that are essential in the process of scheduling.

With the use of this system, industry can achieve reduction in inventories and satisfy delivery commitments to their customers. In addition, the supplier of raw materials can be given order notices early enough so that they make up for the needed supply and reduce the possibility of delay in delivery. The output of this algorithm can be further used for producing final master production schedule, priority control, capacity control and for future production planning.

References

Marta Susana Moreno et al, (2009), A Multiperiod model for production planning and design in a multiproduct batch environment, *Mathematical and Computer Modelling*, 49, 1372-1385

L Caccetta et al, (2009),A Positive Linear Discrete-Time Model of Capacity Planning and Its Controllability Properties, *Mathematical and Computer Modelling*, 40, 217-226

Mario T. Tabucanon et al, (1991), Production planning and scheduling for an iron and steel production system, *Appl. Math. Modelling*, 15, 217-226