Production Process Optimization Using Multidimensional Optimization

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ABSTRACT

The decision of production planning is decided by the top management of manufacturing company. The objective of production planning is to make decisions that would produces the best overall performance of company. In this paper modified the optimization process for this integrated optimization. Because of the dynamic nature of the problem, the size of its solution is variable. To deal with this variability and find an optimal solution to the problem, MOPSO with new features in fitness constraints, velocity and cost selection as well as algorithm structure is developed herein. The modified multi-objective optimization algorithm used for the cost reduction of production unit. The modified optimization algorithm simulated in MATLAB software and used three worksheets of 9,15,20 days and estimated the compilation of job and compare with MOGA. The modified optimization technique gives better result instead of MOGA.

Keywords- GA, MOGA, MOPSO, LCM.

INTRODUCTION

Modern production systems rely on optimal and effective planning and scheduling for their elements. It is a usual practice to plan for one element, independent of the others and to disregard their possible mutuality. Furthermore, this independent planning is done through separate functional teams. The resulting plans of a specific function may disrupt other function plans. For example, the maintenance function assigns a scheduled shutdown. The timing of this shutdown will be communicated to the production unit.

Production scheduling consists of deciding which blocks should be extracted, when they should be extracted, and what to do with the blocks once they are extracted. Blocks that are close to the surface should be extracted first, and capacity constraints limit the production in each time period. Since the 1960s, it has been known that this problem can be cast as an integer programming model. However, the large size of some real instances (3–10 million blocks, 15–20 time periods) has made these models impractical for use in real planning Dr. V.N. Bartaria Head Department of ME LNCT Bhopal, India

applications, thus leading to the use of numerous heuristic methods[5].



Figure 1: Classical planning for production.

The suggested maintenance may maximize the machine availability, but will affect production plans. Similarly, production schedulers may have the tendency to utilize machines to their full capacity to meet demand. Under this condition, productivity may increase, but machine availability will decrease, due to having more breakdowns. Figure shows the possible interactions between different elements of a production system that will be clearly visible at the shop floor level[16]. A production system needs more than coordination to increase productivity and reduce costs. This work is motivated by this need and provides a state-of-the-art model for the integration between production planning, scheduling, maintenance and quality. Integrated models are expected to offer savings in operating costs, in addition to a better utilization of resources. This review defines interrelated models as models where the decision variables are only concerned with the original function. The input of the other function is only affecting the constraints of the original model. Integrated models are defined as models where the decision variables are for both functions[16].

Most papers in the scheduling field are based on the assumption that machines are continuously available. Adiri et al. (1989) studied the single machine non-preemptive scheduling problem of minimizing total completion time of jobs for both stochastic and deterministic cases. The single machine is not available for the entire scheduling horizon. To solve the problem, a shortest processing time heuristic algorithm was discussed[3]. In Schmidt (2000), a review was presented, pertaining results related to deterministic scheduling problems, where machines are not continuously available for processing. Sadfi et al. (2005) studied the single machine total completion scheduling problem subject to a period of maintenance. In Ji et al. (2007), the objective was to find a schedule that minimises the makespan subject to periodic maintenance and non-resumable jobs. Low et al. (2008) studied a single machine scheduling problem, with an availability constraint, under simple linear deterioration for both preemptive and non-preemptive cases. The objective was to minimize the makespan in the system[16].

2. PRODUCTION AND MAINTENANCE PLANNING

Production and maintenance interrelated models consider models of production planning that take into consideration a given maintenance policy, or maintenance model that takes into account production plans. In the following, they consider maintenance models under the direct effect of production requirements model but that do not provide changes to the original production plan. The production system may be planned to have an excess amount of production (buffer) to overcome shortages due to unexpected production interruption due to machine breakdowns. There are a number of models that discussed production systems with buffer.

Finch and Gilbert (1986) presented an integrated conceptual framework for maintenance and production, in which they focus especially on manpower issues during corrective and preventive work. Duffuaa and Al-Sultan (1997, 1999), extended Finch and Gilbert (1986) and casted the maintenance scheduling problem in a stochastic framework. For a multi-purpose plant, Lou et al. (1992) and Dedopoulos and Shah (1995) considered a multi-product manufacturing system, with random breakdowns and random repair time. They offered an interrelated production and maintenance model that determines the relationship between failure and profitability, as well as, the costs of different maintenance policies. Vaurio (1999) developed unavailability and cost rate functions for components whose failures can occur randomly. Dijkhuizen (2001) discussed the problem of clustering PM

jobs in a multi-component production system that has multiple setups. Cassady et al. (2000) presented the concept of selective maintenance, where production systems are required to perform a sequence of operations with finite breaks between each operation. Rishel and Christy (1996) studied the impact of incorporating maintenance policies into the material requirement planning (MRP) system.

Four performance measures were used to evaluate the impact of merging maintenance policies with the MRP system: number of on-time orders, scheduled maintenance actions, equipment failures and the total maintenance costs. Six different MRP systems were used to determine if integrating scheduled maintenance with the production schedule would improve the performance measures. Brandolese et al. (1996) considered the problem of planning a multi-product made up for flexible machines operating in parallel. They developed a model to find the optimal schedule for both production and maintenance check points. Cheung et al. (2004) considered a plant with several units of different types, where there are different shutdown periods for maintenance. The problem was to allocate units to these periods, in a way that production was least affected.

3. PROBLE FORMULATION

The complexity of planning processes makes most of companies develop the enterprise resource planning (ERP) system to deal with it [1]. However, as the core planning module of ERP system, material requirement planning (MRP) has its limitations. MRP generally makes plan according to finite material requirements and infinite capacity requirements, meanwhile the production lead time which is depending on production planning is predetermined. To cope with these limitations, advanced planning and scheduling (APS) has evolved from both software developers and academics. Compared to these traditional planning systems, APS systems offer the advantage that plans can be optimized within the boundaries of material and capacity constraints [2].

> any product made after the deadline for more than 10 days will not be accepted by the customer and it will be returned to the company;

> any product made within the deadline gives 10 points of customer satisfaction index;

 \triangleright each day after the deadline of a product incurs a penalty of 1 point of customer satisfaction index;

> the company can work on only one product at a time; the proceedings from selling products will only be available for next month, so they should be ignored for the current planning horizon - current month;

 \succ the company can select any mix of products to produce each month, as long as its selection contains at least 20 different ones;

The company can work 24h/day, 7 days/week.

Problem is to do the planning for next month by selecting what products to produce and in what order to maximize the profit of the company as well as its customer satisfaction index while satisfying simultaneously all constraints above.

4. PROPOSED METHODOLOGY

Genetic algorithms are inspired by Darwin's theory about evolution. Solution to a problem solved by genetic algorithms is evolved. Algorithm is started with a set of solutions (represented by chromosomes or also called string) called population. Solutions from one population are taken and used to form a new population. This is motivated by a hope, that the new population will be better than the old one.

The process of feature optimization and multi-objective function takes several processes such as population, fitness function, mutation and crossover for propagation of selection algorithm. some steps are divided into six phases.

SOLUTION MODEL

Step 1 Transformation of decision parameter labor, cost and material

Let us consider { D(i,j) Ii = 1, 2, ..., n; j } is the mapping function by equation (1) and equation (2)

For mapping, multi objective swarm function

$$G(i,j) = (1)$$

Mapping feature data validated the attribute of agent for the processing of planning:

$$R(i,j): \tag{2}$$

Where the minimum agent for the reduction , and is the dynamic change attribute for the processing of reduction.

Step 2 Calculate the reduces set for the processing of next data

 $\{R(Is mapping of data for the processing of grouping for the work through Grouping <math>G = [G(1), cas:$

$$K(i) = \sum_{j=1}^{n} g(j) k(i, j), \quad i = 1, : \quad (3)$$

Then, is the relative data for the processing of planning. (4)

Where is the level derivation of relation data of ; is the decision sample for define class in formula (5):

$$\begin{cases}
L_z = \sqrt{\frac{\sum_{i=1}^{n} (z(i) - E(z))^2}{(n-1)}} \\
DT_z = \sum_{i=1}^{n} \sum_{j=1}^{n} (R - r(i,j))u(R - r(i,j))
\end{cases}$$
(5)

Step 3 Defining as the relative production of material

$$d(z(k), z(h)) = \sqrt{(z(k) - z(h))(z(k) - z(h))} \quad (6) = ,$$

$$k = 1, 2, \dots, N; h = 1, 2, \dots, N$$

is evaluation level of class. And
D is used to training pattern of data of
group
G_p
Step 4 Determining MOSPO

Step 5 Finally measure the work completion sheet.



Figure 2: process block diagram of production planning optimization using MOPSO

5. EXPERIMENTAL RESULT ANALYSIS

In this paper we proposed an MOPSO worksheet planning for production and job completion. Our job selection mechanism is inspired with multi-objective genetic algorithm and the search a job for process allocation is Particle Swarm Optimization.

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Figure 3: show that the size of worksheet is 20 * 17 in matrix form.



Figure 4: shows that main windows of our simulation process with number of labour-37, value of material-15 and working capital cost-176 using MOGA technique for job scheduling for production planning.

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 Table 1: comparative output result in 20*17 worksheet

 production planning.



Figure 5: gives the comprative result analysis of worksheet20*17 for all method of job schduling. The graph result shows that MOGA and MOPSO proposed technique for job scheduling is better in comprassion of all method.

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Figure 6: gives the comprative result analysis of worksheet15*15 for all method of job schduling. The graph result shows that MOGA and MOPSO proposed technique for job scheduling is better in comprassion of all method.

6. CONCLUSION AND FUTURE WORK

In this paper solve complex production arranging and planning issues existing in discrete parts producing ventures and process businesses. We consider a multi-arrange, multiitem, multi-machine bunch preparing condition. We think of some as new complexities in the generation condition that have not been tended to in the writing on creation arranging and planning. This examination is study the issues required in explaining the creation arranging and planning issue, as an incorporated issue. A solid model for tending to generation arranging and planning choices is hard to comprehend. The computational exertion required to explain is additionally colossal. Another issue in an incorporated critical thinking methodology will be to guarantee consistency between the creation arranging choices, and planning choices.

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