Reconfigurable Manufacturing system for Machine tool scheduling

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ABSTRACT
In spirited manufacturing atmosphere, performance modify and doubts in the production scheduling is a key dispute Reconfigurable Manufacturing system (RMS) afford an valuable and hopeful solution in favor of this challenge. This exposition gives a narrative be evidence for of production scheduling allowing for the reconfigurable machine tools. In dedicated Manufacturing lines (DML) and flexible manufacturing systems (FMS) do not convene the challenges positive to predictable level because of little comings in their completion procedurals similar to need of sustain for product difference, scalable production capacity plus high production cost, RMS afford the resolution in designing a innovative manufacturing system by way of scalable flexibility and functionality which is wanted in the manufacturing industry. In this paper current a variety of understanding of RMS concept, characteristics in relative to production scheduling along with its role in the manufacturing industry and also recognized dissimilar challenges which be opposite in the performance of RMS in production scheduling. To explain the presented problems in the production scheduling unusual metaheuristic move toward are developed for simulation models are estimate for the performance.

Keywords: *Reconfigurable Manufacturing System (RMS), Production Scheduling, Dedicated Manufacturing Lines (DML), Flexible Manufacturing Systems (FMS).*

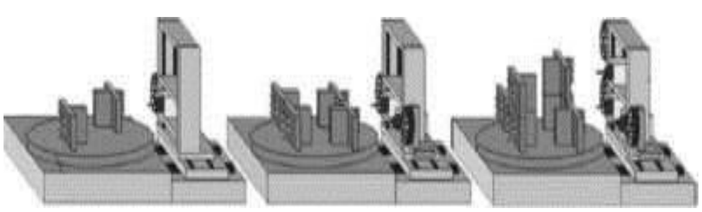
1.1 Literature review

Manufacturing trade be the way out compute in favor of the industrial nation along with Reconfigurable manufacturing systems (RMSs) be the additional pace in manufacturing on behalf of sudden adaption in support of market variations within production functionality among capacity during reconfiguration system. The thought of RMS involve the system is designed for the part family production. Accordingly, the function of RMS face the most important challenges is the utilize grouping technology scheduled standardization with unity of parts, product structure along with sequence of operations within Manufacturing Systems at this time today's manufacturing atmosphere, manufacturing industries proposed the better attention in the flexibility on behalf of production of a broad variety of products furthermore base on the promote demand designed for the immediate adaption i.e. sudden responsiveness. This require aggravated meant for the expansion of the manufacturing systems above the years. During the current scenario, nearly all manufacturing industries adopt the dedicated manufacturing lines (DMLs) and Flexible Manufacturing Systems (FMSs) to make their products. However mutually manufacturing systems experience from key limitations. The DML suffers since require of scalability. Going on the additional hand the purpose of FMS leads to elevated unnecessary cost. This is suitable toward the information to the machines used within this system are universal intention machines in categorize to afford sufficient flexibility to hold the beginning of latest parts (Koren, Heisel et al. 1999). Changeable market leads toward frequent changes during manufacturing systems necessities. RMS was inauguration headed for gather these requirements moreover near afford a level of capacity scalability along with functional adaptability. The uniqueness of DML, FMS as well as RMS are outlined along with together paradigms be compared (Koren 2006) in Table 1.

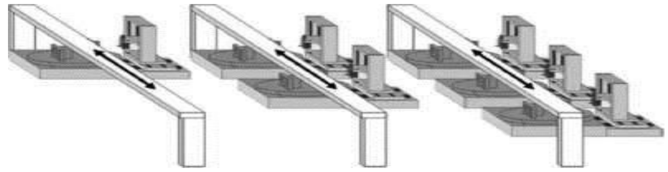
	DML	FMS	RMS
System	rigid	adaptable	adaptable
Machine	rigid	permanent	adaptable
System	Part	Machine	Part Family
Flexibility	rejection	large	Customized
Scalability	rejection	agreed	agreed
Simultaneo	agreed	agreed	agreed
expenditure	small	elevated	Intermediat

Table 1 evaluation uniqueness of DML, FMS and RMS (Koren2006)

The mean of RMS beginning is toward join the elevated throughput of the DMD and elevated flexibility of FMS. A finest RMS shall contribute the required functionality with capacity, what time they are required. This able to achieve through implementing reconfiguration practice on together the machine as well as system levels (Koren, Heisel et al. 1999). The machines with the purpose of assist a RMS are called reconfigurable machine tools (RMTs). Spicer et al., (2002) initiate the thought of multi spindle scalable-RMT (Figure 1.1). This idea describes RMT since a machine bottom (e.g., computerized numerically controlled CNC machines) through numerous like modules (spindles and axes). This component is able to be additional or detached since the machine bottom to regulate the RMT capacity through functionality as necessary. Consequently, the reconfiguration procedure within RMS be able to look of; adding together/removing machines/stations to/starting the system, adding together/removing element (axes and spindles) toward machine tools, varying configuration of machine tools, varying the system layout, or varying



Spindles



CNC'S

The material handling systems (Landers et al., 2001). Mehrabi et al., (Mehrabi, Ulsoy et al. 2000) critical away the key characteristics that describe the reconfigurable manufacturing system

1. **Modularity:** which earnings to facilitate all system components (together software along with hardware) should enclose the facility to be divided and recombined
2. **Integrality:** These assets to facilitate the system and its works must be prepared for mixing and have the capability of adapt to innovative technology.
3. **Convertibility:** with the aspire of the system have the capability to modify simply between dissimilar products.
4. **Diagnosability:** The capacity of the system to notice the source of troubles key to amount produced products deficiency.

Customization: the facility of the system capability as well as flexibility to create the essential product family koren & Shpitalni, (Koren and Shpitalni 2010) statement the capacity scalability while an supplementary key characteristic. This refers to the capacity of simply modify the system capacity by adding up or removing manufacturing affluence. The purpose of the RMS need the propose of the entire system for reconfigurability. but the system as well as its machines are not planned initially for reconfigurablility the reconfiguration impulse long and not practical (Koren, Heisel et al. 1999).

1.2 Inspiration

The effort is available to perform in this research focal point on explain machine tool scheduling problem in the RMS background whereas capitalizing on the flexibility obtainable by the system and the RMT configuration.

RMS main reason is to plan a system capable of giving immediately the functionality and capability required at any given time. As a consequence the meaning of the machine tool scheduling in RMS have to make sure that the production of every feature the majority of the manufacturing system assets. These resources that the leading features of the machine tool function will decide the configurations necessary on both the machines and system levels. Therefore, the effectiveness of a RMS depends on the configuration of the most excellent set of product feature and the consequent system configurations. In further the application of group technology is necessary for the efficient application of RMS.

2.1 PROBLEM DESCRIRITION:

This manuscript Speaks about production scheduling issue inside machining shop. The machining of engine blocks (Milling, Drilling, Boring, Threading and honing) is a mutual continuous isolated production with process: loading and unloading the job, varying tools, changing job into dissimilar machines compute and examination the features make. Fig.1 gives a proposal of production lines in the machining shop. The production procedure consists of five production lines with ten dissimilar machines used for production of engine blocks.

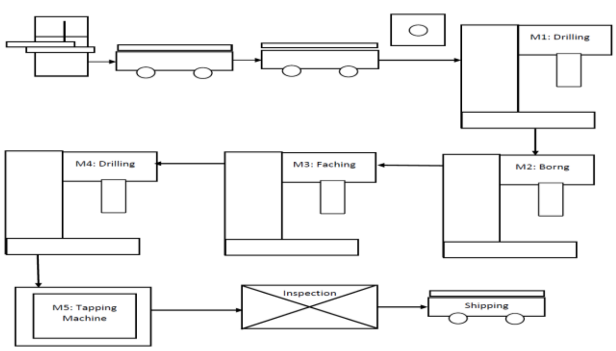


Fig.1 Engine Block Production line in Machine Shop

Every day jobs toward the production of engine blocks scheduling system :

- To evaluate the obtainable machining capacity for the whole of 24 hours,
- To grouping products according to parallel features
- To grouping products according to dimension of features
- To unlock production order with the similar features grouped as mentioned above
- To generate every day chart for production base on work shifts
- To schedule daily production for the lines and available capacities of machines

Machine shops basis restricted access. restricted access are recognized as significant manufacturing resources and scheduled first. The arithmetical model and algorithm for engine block machining scheduling is developed support on algorithm through alteration to the precise problem of scheduling machine shop.

The intention is to locate feasible production schedule

Let $F_o = \{i_a \mid i \in a\}$

features which can be formed by the similar machine and

$D_o = \{m_i \mid i \in F\}$

Thus the items are grouped to production order *O*.

The following notation is used

$$T = \sum_i K_i \text{ .... } (1)$$

Subject to:

$$K_i = \begin{cases} 0 & if\ dd_{i,o} \geq tz_{i,o} \\ tz_{i,o} & \end{cases} ; \ldots (2)$$

$otherwise$

$$q_{i,o} \geq \max\left(0,\ q_{i,t}^{n} - q_{i,t}^{z}\right) \text{..................} (3)$$

$$\sum_t q_{i,t} \geq q_{i,t}^{n} \qquad \forall i \text{ .... } (4)$$

$$\sum_m q_{i,f} = q_{i,o} \qquad \forall o \text{ .... } (5)$$

$$q_{i,m} \leq min\left\{q_{i,o}, \frac{q_{i,f,m}}{b_i} - q_{g,o}, b_g\right\} \text{ .... } (6)$$

$$\sum_a n_{a,t} . Q_{i,f,m} \leq K_{i,f,t}^{R} . K_{i,f}^{cap} \text{ .... } (7)$$

$$b_i . N_m^R \leq Q_{i,f,m} \text{ .... } (8)$$

$$K_{i,f,t}^{R} = \left[\sum \delta_{s,t} . n_s^h + O^h\right] . k_{i,f} \text{ .... } (9)$$

The objective function be toward minimize lateness of production order (1). Lateness can be convey by the term (2). Constraints (3) determines the order quantity for item *i* of production order *o*. constraint (4) ensures that the quantity of produced items in the horizon is equal to the total quantity of items *i* from all machines is equal to the production order quantity. Constraint (6) determines the quantity of item *i* for producing from machine *m* according to the available quantity of engine blocks. Constraint (7) determines that the total quantity of different features of engine block for period *t* is equal to or less than the available machine capacity. Constrain (8) ensures enough machine capacity. The mathematical term (9) determines the available capacity of machine *m* in production line *l* for day *t*. Constraint (10) guarantees that the consumption of the total required quantity of engine block for all production lines does not exceed the available machines. Constraint (11) ensures that the available machines does not exceed the available quantity of engine blocks. Constraint (12) determines the starting time of machining items *i* from machine *m* in production line *l*.

Constrain (13) endures that the starting time of subsequent of operations on item *i*(after machining on machine *m*). Constraint

3.1 DETERMINISTIC MODEL EVALUATION PROCEDURE

In this section briefly explains the evaluation of the developed model for minimizing the make span of the machining of engine block. This model need to be evaluated using advanced software's like CIPLEX for both similar features in size and complexities in producing them. In the present paper only considered for the study of the production scheduling problem in flow shop scheduling using RMS.

3.2 Information Gathering

The real data have been collected from the production head that is responsible for production planning for the flow shop scheduling problem. The data such as processing time, due date, weight of the job with demand and sequence dependent set up time for execution of developed model are shown in table.1. Using this collected data the developed model is going to evaluate in the next step and the same considered in the next paper.

Conclusion

The study has been done on the problem of scheduling of dissimilar operations in reconfigurable manufacturing systems (RMS). The statement which have be finished that a manufacturing system is available through set of machines. This manufacturing system is designed to manufacture diversity of features in some selected component. Here the system require reconfiguration to control from one feature of operation to one more feature, which needs some changes in the system. This changes are highly depends on the sequence of two consecutive features machining. An attempt has been made on studying this problem, by formulation of mathematical model by considering the sequence of operations.

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