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Rescheduling of Production Process by Flexible Manufacturing System Considering Tool Failure and Machine Breakdown in CNC

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Abstract: ***This paper describes in detail about the rescheduling of production process due to the failure of cutting tool or machine breakdown during an automated batch production. In general flexible manufacturing system is incorporated in the production process to achieve the desired rate of production without any distortions during the production process. Rescheduling of production process takes place due to the following factors; poor tool life, wear in machine component, poor tool grinding, tool breakdown and machine repair. In the above stated factors, tool breakdown is the most common problem faced during most of the machining operation/production process. This paper deals in developing a algorithm to reschedule the production process during cutting tool breakdown.***

Keywords: Flexible manufacturing system, production process, rescheduling, cutting tool breakdown

I. INTRODUCTION

In general the flexible manufacturing system refers to uninterrupted automated manufacturing. The flexible manufacturing system basically consists of two main phases namely design and production phase. The concept of flexible manufacturing system differs for each organization and it is dependent purely on the developer. The production phase consists of production planning, scheduling of plan and production controlling. Flexible manufacturing system consists of a group of automated machines that are being controlled by computer. These machines are generally incorporated with automated material handling system. The flexible manufacturing system reduces the human intervention in production process. As the CNC machines are equipped with Automatic pallet changer (APC) and Automatic tool changer to reduce the time associated with material handling and tool change, the breakdown of tool during the production process in CNC machines affects greatly the rate of production. The main objective of this investigation is to develop an effective production schedule in flexible manufacturing system at the time of tool breakdown.

II. LITERATURE REVIEW

The ability to handle changes and quickly manage producing and therefore the production system to make amends for external demands is turning into a very important competitive issue. The performance of the assembly system is essentially smitten by the power to be versatile furthermore as having the ability to reconfigure operations for brand new demands. The flexible manufacturing system and reconfigurable manufacturing system techniques plays a vital role in manufacturing organizations (V. Malhotra et al.). The types of flexibility include machine flexibility, material handling flexibility, operation Flexibility, process flexibility, product flexibility, routing flexibility, volume flexibility, expansion flexibility, control program flexibility, producti on flexibility.

FMS offers lower carryover effects once stations inter rupt, and also lowersthe cost of maintaining spare part inventories due to the fact that similar equipment can share components. FMS is really an automatic set of numerically controlled machine tools and material handling systems,capable of performing a wide range m anufacturing operations with quick tooling and instruction changeovers (Rohit Pandey et al).

FMS differs from the standard systems in terms of flexibility within the flow of materials from one tool to a different and playacting the operations as per the specified sequence. Flexible producing system, the word is simple to understand but indeed difficult to achieve.

Many companies didn't win versatile producing system, become history and firms who effectively achieved it, have pioneered themselves in manufacturing industry. The ultimate have to be compelled to versatile producing system arises from terribly basic rule of setting, nothing is permanent. The changing needs, choices, priorities and preferences of business or its stakeholder dynamic behaviour forces firms to be flexible enough to deliver what is required (Vivekanand S. Gogi et al). Based on the methodology followed, FMS operations literature could be classified in the following ways: mathematical programming approach, multi- criteria decision making approach , heuristics oriented approach, control theoretic approach, simulation based approach and artificial intelligence (AI) based approach (Chuda Basnet).

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The main advantage of associate degree FMS is its high flexibility in managing producing resources like time and energy so as to manufacture a replacement product. The best application of associate degree FMS is found within the production of little sets of product like those from a production (Mehrabi,M.,2005; Wilhelm,W.,1986). To put it in shell , the most benefits of FMS are: Reduced producing times, lower value per unit created, bigger labor productivity, bigger machine potency, improved quality, redoubled system reliability, reduced parts inventories, adaptability to CAD/CAM operations, shorter lead times (Ahmad Afsari). An FMS is a group of processing stations (predominantly CNC machine tools), which are interconnected by means of an automated material handling and storage system, and controlled by an integrated computer system.

III. IDENTIFICATION OF PROBLEM

The flexible manufacturing system in this case is developed for CNC machine. It is well known that the tool magazine of CNC machines has several tools, which are quiet suitable to perform specific machining operations. Each machine is assigned to perform specific operation and the tool magazine of machine is equipped with more than one tool, so that during the tool breakdown the tool can be altered with fraction of seconds. In this case the material loading and unloading is automated and the entire handling system and CNC machines are controlled by electronic control unit (ECU). The sensors fixed in the fixture ensure the material loading and the appropriate information's are transferred to the electronic control unit. In this investigation each machine performs specific operation using the tool available in the magazine. In all the machines the material handling is accomplished automatically and the machines are placed nearer. In addition, in this case a separate machine is placed in addition than the requirement comprising the tools of three machines and is named as "AM', any breakdown in the machine is sensed by the sensor and the information is then transferred to the electronic control unit. The electronic control unit then transfers the machining operation to be done by the breakdown machine to the additionally placed one. The additional placed machine thus completes the specific machining operation that has to be accomplished by the machine which is under breakdown with the help of signal and stored program of electronic control unit. The flexible manufacturing system developed in this case also helps in sensing delay in production time and dimensional errors in the finished product, which might help in prior identification of problem in the specific machine and its rectification. The schematic layout of flexible manufacturing system used in this case is shown in the figure 1.

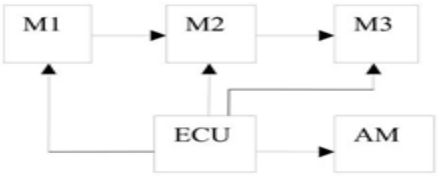

Fig. 1 layout of FMS

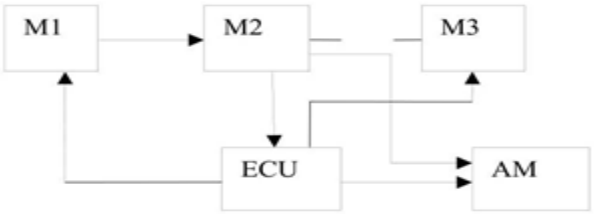

Fig. 2 layout with third machine (M3) breakdown

AM stands for additional machine, any failure in machine or tool breakdown is sensed by appropriate placed sensor units and is transferred to electronic control unit, which then bye pass the signal to the additional machine placed instead of breakdown one. This flexible manufacturing system is best suitable for automated batch production and the interruption in production unit is identified easily without human intervention.

IV. CONCLUSION AND FUTURE WORK

The flexible manufacturing system thus developed is best suited for automated batch production process. This will help in reducing production time and human error and intervention can be minimized to the maximum extent. The production operations performed by each specific machine cannot be stopped under any circumstance.

The concept of flexible manufacturing system has to be developed for other production processes to achieve uninterrupted machining operation.

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