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Rescheduling of Production Process by Flexible Manufacturing System Considering Tool Failure and Machine Break down 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 batchproduction. In general flexible manufacturing system is incorporated in the production process to achieve the desired rate ofproduction without anydistortions during the production process. Rescheduling of production process takes place due to the following factors; poor tool life, wear in machinecomponent, poor tool grinding, tool breakdown and machine repair. In the above stated factors, tool breakdown is the most common problem faced duringmost of the machining operation/production process. This paper deals in developing a algorithm to reschedule the production process during cutting toolbreakdown.

Keywords:Flexiblemanufacturingsystem,productionprocess,rescheduling,cuttingtoolbreakdown.

1. Introduction

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

2. Literaturereview

The ability to handle changes and quickly manage manufacturing and the production system to compensate for external demands is be coming an important competitive factor.The performance of the production system is largely dependent on the ability to be flexible as well as being able to reconfigure operations for new demands. The flexible manufacturing system and reconfigurable manufacturing system techniques plays a vital role inmanufacturing 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, production flexibility. FMSoffers lower carryover effects when stations interrupt, and also lowers the cost of maintaining

spare part inventories due to the fact that similar equipmentcan share components. FMS is actually an automated set of numerically controlled machine tools and material handling systems, capable of performing awide range manufacturing operations with quick tooling and instruction changeovers (RohitPandey et al). FMS differs from the conventional systems interms of flexibility in the flow of materials from one tool to another and performing the operations as per the required sequence. Flexible manufacturingsystem, the word is simple to understand but indeed difficult to achieve. Many firms failed to achieve flexible manufacturing system, become history andfirms who effectively achieved it, have pioneered themselves in manufacturing industry. The ultimate need to flexible manufacturing system arises fromvery basic rule of environment, nothing is permanent. The changing needs, choices, priorities and preferences of business or its stakeholder dynamicbehaviour forces firms to be flexible enough to deliver what is required (Vivekanand S. Gogi et al). Based on the methodology followed, FMS operationsliterature could be classified in the following ways: mathematical programming approach, multi-criteria decision making approach, heuristics orientedapproach, control theoretic approach, simulation based approach and artificial intelligence (AI) based approach (ChudaBasnet). The main advantage of anFMS is its high flexibility in managing manufacturing resources like time and effort in order to manufacture a new product. The best application of anFMS is found in the production of small sets of products like those from amass production (Mehrabi,M.,2005; Wilhelm,W.,1986). To put it in nutshell,the main advantages of FMS are: Reduced manufacturing times, lower cost per unit produced, greater labor productivity, greater machine efficiency,improved quality, increased system reliability, reduced parts inventories, adaptability to CAD/CAM operations, shorter lead times (Ahmad Afsari). AnFMS is a group of processing stations (predominantly CNC machine tools), which are interconnected by means of an automated material handling andstoragesystem,and controlled byanintegratedcomputersystem.

3. IdentificationofProblem

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 ofmachine 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 materialloading and unloading is automated and the entire handling system and CNC machines are controlled by electronic control unit (ECU). The sensors fixedin the fixture ensure the material loading and the appropriate information's are transferred to the electronic control unit. In this investigation each machineperforms specific operation using the tool available in the magazine. In all the machines the material handling is accomplished automatically and themachines are placed nearer. In addition, in this case a separate machine is placed in addition than the requirement comprising the tools of three machinesand 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. Theelectronic control unit then transfers the machining operation to be done by the breakdown machine to the additionally placed one. The additional placedmachine thus completes the specific machining operation that has to be accomplished by the machine which is under breakdown with the help of signaland stored program of electronic control unit. The flexible manufacturing system developed in this case also helps in sensing delay in production time anddimensional errors in the finished product, which might help in prior identification of problem in the specific machine and its rectification. The schematiclayoutofflexiblemanufacturing systemusedinthiscaseisshownin thefigure1.

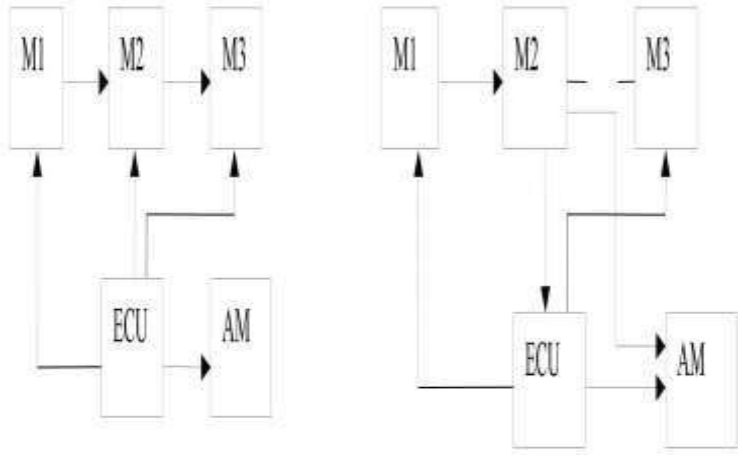

Figure1.layoutofFMSandlayoutwiththirdmachine(M3)breakdown

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AM stands for additional machine, any failure in machine or tool breakdown is sensed by appropriate placed sensor units and is transferred to electroniccontrol unit, which then bye pass the signal to the additional machine placed instead of breakdown one. This flexible manufacturing system is bestsuitableforautomatedbatch productionandtheinterruptioninproduction unitisidentified easilywithouthuman intervention.

4. Conclusion

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

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