Enhancing the Performance of Flexible Manufacturing Systems

B. Satish Kumar[1], N. Gopikrishna[2]
[1, 2] Department of Mechanical Engineering, S.R Engineering College, Warangal Telangana, India-506371

Abstract - A flexible manufacturing system is a system used to produce a wide variety of components and with suitable products with high accuracy, is also a computer controlled machine tool, which are interconnected by central unit control systems, material handling system, and automated inspection system ease into a single unit to overcome demerits of manufacturing systems. Due to increase in global competition, manufacturing companies are intended to make systems flexible for mass production. Present paper focusing upon the flexible manufacturing systems performance enhancement and even it reveals to overwhelm the influence of uncertainties like machine failures and stand-off.

***Keywords*:** flexible manufacturing systems, computer controlled machine, material handling system, and automated inspection system

Introduction:

A flexible manufacturing system is a system used to produce components and products, is also a computer controlled machine, material handling system, and automated inspection systems were subjected to run with possible operations and manufacturing processes by holding finite tooling and with switch conversions [7]. The main objective of the manufacturing systems making flexible is to reduce manufacturing costs, higher labor productivity & machine efficiency, to lower cost for unit produced, to enhance the quality of the parts, components with fine accuracy, to increase system reliability, and to reduce parts inventories to serve the purpose of manufacturing systems. basic components of fms are: workstations, used to load/unload stations like processing stations and machine stations, material handling systems, basically there are two incorporated systems, the one is: primary (establishes the basic layout of fms and is responsible for moving work parts between stations in the systems) and second one is secondary (consists of transfer devices automatic pallet changing and similar mechanisms located at the workstations) storage systems, computer control systems, uses a distributed computer system that is interfaced with all workstations in the system & with the material handling system, and human resources, required to manage [11]and operate the system.

Research exploration:

Algorithm developed by Mehta and Uzsoy (1998) [1] gives a difference between job completion times in the system and one that minimizes, maximum lateness. Under stochastic disturbances Leon, Wu, and Storer (1994) [2], worked in an area of finding the good initial schedule that maintains its planned performance and for processing of jobs on a single machine subjected to random breakdowns. Zhou et al. (2005) [3] studied dynamic optimal policies and issues of software development using a concept of an activity theory, particle swarm optimization and selection of personality traits of Myer Brigg Personality Traits (MBTI) [4] along with MPSO provides set of knowledge base creation for various type of projects like Mathematical algorithms are created and applied for scheduling problems given by Udhayakumar and Kumanan 2010. C. N. Potts and J. D. whitehead applied a three phase method to a case study for obtaining two objectives, [5] to maximize throughput and to minimize movement of work between machines. They derived a three phase integer programming model, the first phase balances the machine workload, the second

phase minimizes inter machine travel and the third phase assigns the position to the machines in the loop layout to minimize the total number of circuits. Tempelemeier & Kuhn (1993) [6] define FMS as a production system consisting of a set of identical and/or complementary numerically controlled machines, which are connected through an automated transportation system. Each process is controlled by a computer. Mr. Imran Ali Siddiqui, Manuj Darbari and Sunita Bansal. [8] Micro Ficko, et al., composed a system of subsystem which use evolutionary optimization techniques [9] Tang (1993) et al. identified 6 decision rules for scheduling of fms involving operations among machine parts, and AGVs.

Manufacturing systems flexibilities:

Flexible manufacturing system has come up as a mean to achieve these prerequisites term flexible manufacturing system, or FMS, refers to a highly automated GT machine cell, consisting of a group of computer numerical control (CNC) machine tools and supporting workstations, interconnected by an automated material handling and storage system, and all controlled by a distributed computer system. The reason, the FMS is called as flexible. Due to the benefits of manufacturing systems, it is intended to make it flexible, durable, simplicity, and reliable. To be a flexible, the manufacturing system must possess the following capabilities such capabilities are often difficult to engineer through manual operations. So it is necessary to assist an automated system with sensor system which is required to accomplish wants of business environment. It has been taken several years together to make manufacturing systems flexible in all various classes which were explained in brief as follows:

1. **Mechanism flexibility** - A machine can perform disparate type of operations.
2. **Material handling pliability** - The ability to move products within a manufacturing unit.
3. **Operation flexibility** - Produce a product in multiple approaches to minimize a control.
4. **Expansion flexibility** - The ability to build out the capacity of a system.
5. **Program flexibility** – Automatically, to run the system.
6. **Production flexibility** – A system can produce number of products.
7. **Market flexibility** – A system to adapt the market demands.
8. **Process plasticity** - The set of products that the system can produce.
9. **Product flexibility** - The ability to add new products in the system.
10. **Routing flexibility** - The different routes (through machines and workshops) that can be used to produce a product in the system.
11. **Volume flexibility** - It is used to operate at different output levels. The ease of profitably decrease or increase output of existing system.

Machine loading:

It encloses different types of flexibilities with reference to select a part and assign an operation along with constraints ranging from simple constraints to complex constraints are as follows:

1. Capacity of tool magazine

2. Capacity of machine
3. Tool requirement with different operations
4. Over utilization and under utilization cost of machines

Deals with allocation of jobs to different number of machines under mechanical and industrial constraints to meet the requirements of manufacturing systems

Testing of flexibility:

Assessment of these flexibilities is studied by simple additive weighting and Weighted Product Method. The weights were calculated by using the Analytical procedure. The primary objectives of this paper are as follows:

1. To identify flexibility and factors affecting the flexibility in FMS
2. To evaluate the flexibility by using simple additive weighting and Weighted Product Method
3. To discuss managerial implication of this research

Sequencing and scheduling:

The sequencing and scheduling, a set of jobs or set of tasks, have to be performed on the machines given or set of facilities, in its simplest term, problem deals with performing a certain the given jobs on set of the given machines. Jobs, which have to be carried out on machines, such that certain objectives are met, certain constraints, are satisfied. Now, the scheduling and sequencing is to try and meet certain objectives, Sequencing essentially refers to the order, in which the sequence represents order, in which the jobs are sent. The schedule gives about the time table of a particular job is getting processed on a particular machine. While sequence represents an order, in which things have to be done, schedule represents the time table of the activities.

Scope of Flexible manufacturing systems:

To seize the opportunities in manufacturing systems it is necessary provided by durability, reliability and flexibility. It promises lower costs, improved production quality [10], pliability and efficiency. Shorter response time to customer requests, market demands and it also opens up new and innovative business areas. Regardless of sector or company size, for these reasons it is essential to invest for all decision makers and.

Case 1: flexible manufacturing systems in belt manufacturing:

Towards possession of benefits in manufacturing belts, company has taken few steps which are as follows:

i. By introducing an assembly line
ii. Enhancing an improvement towards achieve requirements

iii. To improve quality (reduction of restriction has been declined from 24%-1.9%)

iv. Quick response on such fine belts from users

v. For the same level of daily output there is a short fall of labor cost

vi. Skilled workers has been working as a team

vii. Productivity of belts to required level has been achieved

viii. Overall efficiency has been improved

ix. Inspection has been reduced

Fiscal analysis:

Due to introduction of flexibility in manufacturing of belts, company has been gained Rs. 610 lakhs per half yearly.

Case 2: flexible manufacturing systems in manufacturing ramps up parts at Precise tool & Die

Towards possession of benefits in manufacturing ramps up parts at Precise tool & Die, company has taken few steps which are as follows:

i. Construction of an assembly line

ii. Enhancement towards improvement of fine production of parts and components

iii. Reduction of restriction has been declined

iv. Rapid and quick response on such fine tools

v. For the same level of daily output there is a short fall of labor cost

vi. Skilled workers has been working as a team

vii. Productivity found to be good.

viii. Overall efficiency has been improved

ix. Inspection has been reduced

Fiscal analysis:

With reference to flexibility in manufacturing of ramps up parts at Precise tool & Die, turnover of an industry has been crossed it annual gross with Rs. 7.8 Crores.

Conclusion:

Research presents the Enhancing the Performance of Flexible Manufacturing Systems in the manufacturing systems. Now a day's customer demands of any product changing/ changes in days so, it is to implement manufacturing systems such changes and wants rapidly to fulfill customer desires. So, it is intended to make industries flexible because it is a good combination of variety and productivity.

References:

1. *Mehta and Uzsoy (1998) "minimizing total tardiness on a batch processing machine with incompatable families" IIE Transactions, 30, pp. 165-178*
2. *Leon, Wu, and Storer (1994) "Robustness measures and robust scheduling for job shops" IIE transactions 26 (5), 32-43*
3. *Zhou et al. (2003) also studied "the stochastic scheduling for minimizing the expected weighted flow time using preemptive repeat machine breakdowns model".*
4. *P Udhayakumar, S Kumanan, "Task scheduling of AGV in FMS using non-traditional optimization techniques" International Journal of Simulation Modelling 9 (1), 28-39*
5. *C. N. Potts and J. D. whitehead "Single machine scheduling models with deterioration and learning: handling precedence constraints via priority generation" Volume 11 Issue 5, October 2008 Pages 357 - 370*
6. *Tempelemeier & Kuhn (1993) International Journal of Operations & Production Management, Volume 21, Issue 5/6*
7. *International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-018, pp 36-37, Vol. 4 Issue 01,January-2015*
8. *Mr. Imran Ali Siddiqui, Manuj Darbari and Sunita Bansal, "Optimization in Flexible Manufacturing System" Aug 7, 2014 - Vol.8, No.7 (2014), pp.55-64*
9. *Mehrjerdi, Y. (2009) A decision-making model for flexible manufacturing system, Assembly Automation, 29(1), pp 32-40.*
10. *Journal for research, Vol 4, issue 11, Jan 2016,issue: 2395-7549, pp 1-4.*
11. *IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 09, 2015 | ISSN (online): 2321-0613pp.471-475*