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Need and Scope of Flexible Manufacturing Systems

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Abstract: ***The flexible manufacturing system (FMS) is a type of system which consists of several integrated parts, a computer control system and an automated numerical control system to increase the flexibility of industrial processes. Automation and Industry 4.0 are key parameters for the future and FMS is a step in the right direction to achieve due to its capabilities, capacity and advantages. To stay competitive, there is a constant demand for greater output and manufacturing quality, as well as an urgent need to improve overall manufacturing system efficiency. This research shows the need and scope of FMS.***
Keywords: Flexible Manufacturing Systems, Flexibility, Industry 4.0, Productivity, Advanced Manufacturing technologies.

I. INTRODUCTION

Quality and productivity in manufacturing operations are increasingly important in today's world, as rivalry heats up in every industry and business. Advanced technical advances in production and manufacturing are the goal of the next age industries, in which there is a thriving market and room for growth. Robots, NC machines, automation, CNC machines, and other new dynamic concepts, such as FMS, are pushing companies to develop these technical capabilities [1]. Flexible Manufacturing Systems (FMS) is described as an interconnected complicated system controlled by the computer software for automation of material handling network and numerically controlled machinery that can handle small volumes of a variety of part types simultaneously [1]. The manufacturing technologies that comprise flexible manufacturing systems include computer or numerically controlled machines, conveyor systems (including roller, motorised roller), robotic systems, computers, automated guided vehicles and programmable electronic microcontrollers, among other things, are examples of numerical control or direct numerical control centres [2]. Flexible manufacturing can be understood as non-repeated mass production of multi-purposes due to changing client and market demand, production of different functions within the same period of the means of production made.

Ongoing process of globalization is a reality worldwide, and this is rather an irreversible process. So, adoption of modern AMTs, particularly FMSs, has become an imperative rather than a choice, particularly for an emerging economy like India.[2]

II. LITERATURE REVIEW

The advanced flexible manufacturing technology is discussed by Hammel [4] in his work and he talks about the capability of flexible manufacturing systems to increase system efficiencies, process flexibility and viability, and an end to end integration.

Pandey et al. [5] analysed the performing capabilities of FMS in the manufacturing sector and they found that benefits included enhanced output and reduced lead times. Fernandez et al. [6] presented the future of flexibility in manufacturing technologies in combination well with the industry's next-generation ready manufacturing areas. It was agreed that for supporting the next-gen manufacturing in an Industry 4.0 setup, the internet of things, cloud, and cyber systems are foundational blocks for advanced manufacturing activities to occur worldwide. These enhanced capabilities will be swift in scaling operations of production and will be attained with the help of emerging technology in material handling equipment, sensing, and integrating abilities.

It is evident that the application of flexible manufacturing systems in the Indian scenario has a long way to go and is limited by a variety of influencing factors such as lacking advanced aspects considered essential for the success of these systems and also necessarily required in flexible cells and systems as mentioned by Rao et al. [7].

III. CHALLENGES FACED BY FLEXIBLE TECHNOLOGY IN THE INDIAN INDUSTRY

Most of the challenges faced by FMS technology is at the stage of design. Not all the components that enter production can be suitably manufactured with flexible systems as the process might not be optimal. Therefore, it becomes essential to carefully select the components to be manufactured based on the potential of the system in terms of capacity, operational requisites, equipment, integration etcetera. A conjunctional challenge is the amount of flexibility that is provided to each flexible system. Such a challenge arises because of the presence of a diverse set of requirements from each flexible unit due to variable operations purposes. An automated arm’s flexibility and freedom in fabricating a mechanical component is an example of the challenge posed. Thus, design considerations have to be prioritized to eliminate the issue [8].

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At the early stage of design, blueprints of the factory floor highlighting the placement of each cell or unit aids the ultimate purpose of increasing the flexibility of the system through enhanced efficiency and effectiveness. The elements of such an objective would typically include and address queuing, vacant spaces, lead time optimization, congestion and traffic management etcetera.

An aspect closely related to computer-aided and integrated manufacturing is placing the control of the systems structurally considering the needs of multi-system and multi-element interaction. The decision pertaining to these elements such as control layout, equipment management, and production planning are needed to be taken at this point.

What follows the preliminary stages of design is the planning. Certain issues have been observed as a component of planning and essentially require resolution before the process of production starts.

It is an operational challenge to ascertain the components to be selected for the initiation of manufacturing of components. The decision of selection is based on a diverse range of factors that are determined.

The planning stage also includes the classification of the operations that need to be performed on the job on the numerical control machines using tools and equipment. Furthermore, the challenge is also to classify the machines to reduce lead times and the effectiveness of the flexible manufacturing systems. As we now advance to the stage of scheduling, the challenges associated with sequencing and scheduling occur and are dealt with in real-time or instantaneously in flexible manufacturing systems. It demands ascertaining the right chain or set of events to be executed in the perfect order through advanced smart techniques of employing procedures or algorithms. The performance of the entire flexible manufacturing system is also a function of the correct material handling systems put in place, hence the heedful selection of jigs, fixtures, conveyors, tuggers, trucks, lifts and pallets as per the requirements and capability of the systems is necessary. [9, 10]

IV. CONCLUSION

Flexible manufacturing systems are an integration of parts and processes. An essential component that finds its important mention is the computer or the process control unit which commands the operations involved. These flexible systems have changed the nature of manufacturing with limited human involvement and interference and huge production potential in today's world servicing and catering to swiftly evolving needs. This instils much-required confidence in the system. Such systems have thus claimed a special position in the global manufacturing industry. The work presented also highlights the scenario of limited contribution and adoption of flexible technological systems in Asia in contrast with the global scenario. It also stands by the fact that the utilization of this technology in the Indian subcontinent is also limited. However, owing to the fact that the adoption of smart and flexible technologies record performance enhancement in manufacturing, steps need to be taken towards its acceptance.

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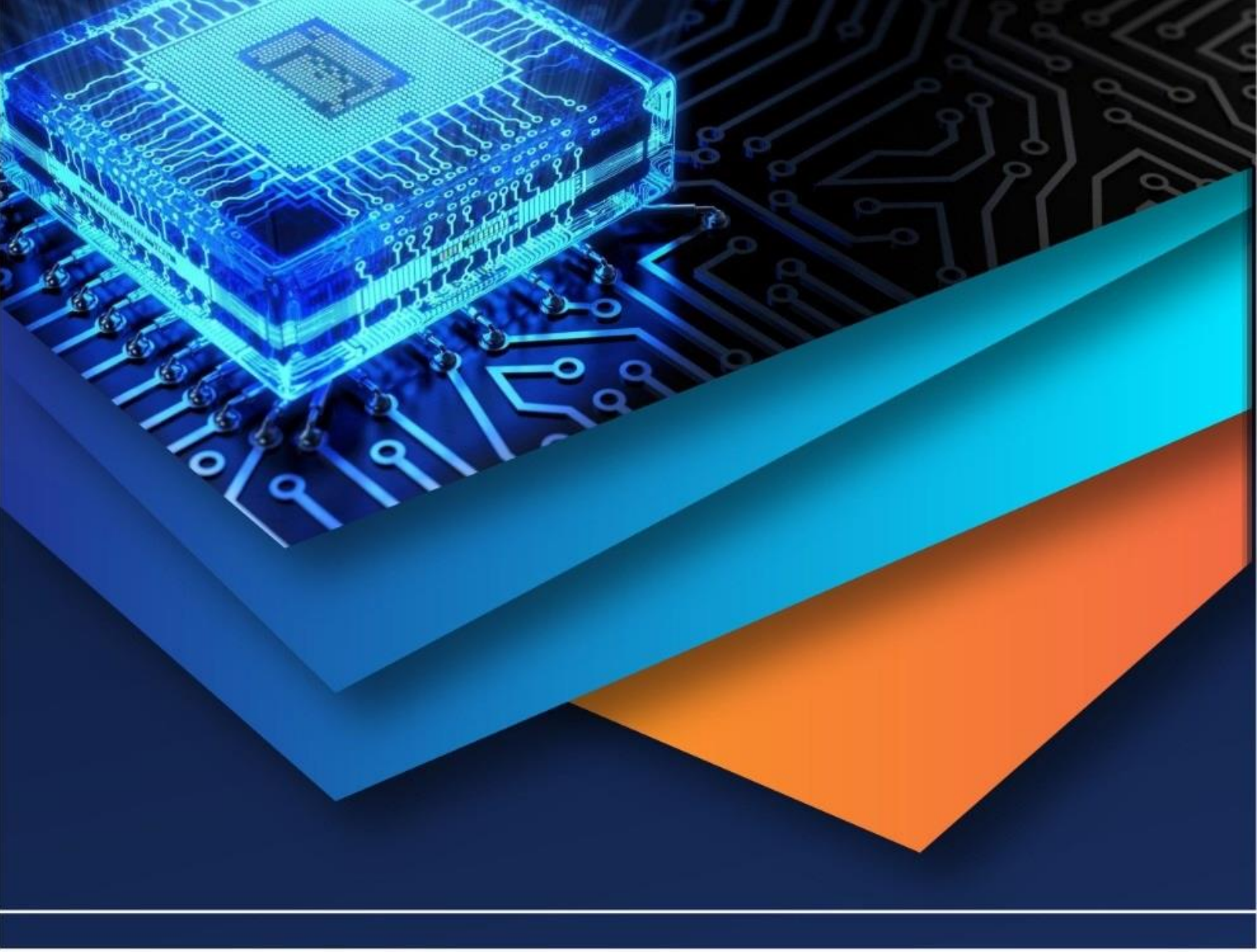
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