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Role of CAD/CAM in Designing, Challenges Facing in Manufacturing Industry and Developing Manufacturing in Modern Manufacturing Technology

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Abstract: ***This paper highlights the mutual relationship between CAD and CAM technologies, which serve as crucial computer-based applications in modern industry. These technologies not only simplify product design and modeling but also lower overall production costs under contemporary manufacturing practices. CAD/CAM supports collaborative design and production activities across multiple engineering fields and ensures smooth integration with subsequent processes. Continuous exploration of current advancements, innovative trends, and novel approaches is essential to address industrial challenges within the CAD/CAM domain. Future research and development must remain closely aligned with market requirements to sustain industrial growth. In today's competitive environment, CAD/CAM plays a decisive role in maintaining efficient production flow and enhancing manufacturing capabilities.***

In this paper CAD/CAM technology are interdependent industrial computer application that have used in design and finalizing of the product. CAD/CAM technology are superior technology for product modelling and design of the product. Reduced the cost of product in modern manufacturing policies. Many design and manufacturing techniques to help interdisciplinary design and manufacturing action in different engineering domains in addition to consequent processes are to be developed. A necessary job to achieve this main aim is to permanently scientifically investigate the present art and emerging trend, new approach in development of industrial problems in CAD/CAM area. The main aim of future research and development of the activities as close as possible to the requirements of the market demand. Facing many challenges in manufacturing industries today. CAD/CAM technology are used to be achieved smooth production rate.

Keywords: CAD/CAM, Facing Challenges in manufacturing Industries, CAPP, design and Manufactures.

I. INTRODUCTION

Computer-Aided Design (CAD) is the use of computers to create product models with defined shapes and measurements. These models are shown on a computer screen in 2D or 3D, and designers can change them easily by adjusting the input parameters. CAD also allows testing of products under real-life conditions through simulations. Computer-Aided Manufacturing (CAM) takes the CAD data and uses it to operate machines automatically. It works with CNC (Computer Numerical Control) and DNC (Direct Numerical Control) machines. Unlike older NC systems, which used mechanical data input, CAM works with computer-based data, making manufacturing faster and more accurate.

Computer-aided design (CAD) involves creating the computer models defined by geometrical parameters. These models are typically appeared on a computer monitor as showing a design on the three-dimensional representation of a part of a system of products, which can be readily altered by changing relevant parameters. If the CAD/CAM system enable to a designer to view objects under a wide variety of representations and products to test these objects by simulating real worlds conditions. The term computer aided manufacturing (CAM) are uses geometrical design data to control automated machinery. The CAM systems are associated with computer numerical control (CNC) or direct numerical control (DNC) systems. These systems are differed from older forms of numerical control (NC) machine in that geometrical data are encoded mechanically with computer. Since both the CAD/CAM system are use the computer-based methods with the help of encoding the geometrical data, it is possible for the processes of design and manufacturing of the products to be highly integrated. CAD/CAM system are commonly used in Computer aided design and use of computer to creation, modification and analysis or optimization of a design.

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The CAD/CAM software are used to increase the productivity of the product and designer improve the quality of the design, improve communication through documentation and to create a database for manufacturing. CAD/CAM outputs is often in the form of fields for print machinery or other computer aided design and drafting is also used in mechanical design it is known as mechanical design automation or computer aided design which included the process of creating a technical drawing with the help of computer software. The Computer aided manufacturing (CAM) is machine and application-based technology that uses computer software and machinery to facilitate and automate manufacturing process. CAM is the based-on computer aided engineering (CAE) and that is used with computer manufacturing. CAD/CAM is reduced wastage of raw material and energy for enhanced manufacturing and production efficiency is increased the production speed, raw material consistency and more tooling accuracy. CAM uses computer aided manufacturing process for addition automation of management, material tracking, planning and transportation. CAM also implemented advanced productivity tools like simulation and optimization to the skill. Manufacturing and Product life cycle as well as machining processes.

II. FACING CHALLENGES IN MANUFACTURING

The facing five challenges in manufacturing in CAD/CAM.

1) Skilled labor shortage
2) The Internet of things
3) Maintaining the right level inventory levels
4) Rising employ cost
5) Robotics and Automation changes

A. Skilled Labor Shortage

One of the highest manufacturing challenges faced by the industry today is the lacked of skilled workers. The 22 % of the skilled manufacturing works (2.7 million) will be retiring within the next 10 years in addition another 700,000 works will be need due to industry growth. The combination of workload and growing population has led to this difficulty. To overcome this challenge. These are a few option manufacturing could consider.

Communication and planning idea aimed at keeping some of older highly skilled employee around past the date they might otherwise chose to the tensive.

B. The Internet of Things

Manufactures need to utilizes the latest technology in other to stay relevant innovation and competitive in 2018. The biggest challenges in how best to implemented to be achieve operational goals such as reducing the cost improving the quality and efficiency increasing the safety supporting compliance or perching product innovation. There as a pressure for manufacturing to use the lot to its full potential.

It is not enough for then to supply implemented the technology into there products and service there need to be a strategy. Systems need to be in place to collect and analyze and translate this data if no clear strategy is set. Manufacturing will not be able to improve these decisions making in a way that is beneficial. The manufacturing industry is leading to this concept so companies need to stay smart to the change if manufacturing stay aware of the challenges they face today. They will be able to find the best solution and continue to be successful.

The internet is most impotent concept in the CAD/CAM field. The internet is creating the new design and easily manufacturing of product.

C. Maintaing the Right Level Inventory Levels

CAD/CAM Facing inventory challenges are common in the manufacturing industry. It is difficult for manufacturing to stay organized and Colum in the right time. To help the CAD/CAM maintain the right inventory levels. Manufactures can use real time tracking throughout the whole production process. Through the serialized barcode. It is possible to see the location and quality of goods. The tracking software in CAD/CAM can be provide precise updates of raw materials work in process and finished products. Its possible form this to keep inventory accuracy at an all-time high level. So, the CAD/ CAM to overcome the challenge of inventory. Companies need to look into system that can support more efficient operation and more efficient to save cost and increases sense level.

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D. Rising Employee Cost

CAD/CAM another big challenge in manufacturing at least for companies like ours the externally high cost of the works compensation insurance and local property taxes. An employer could make the CAD/CAM all the right internal cost decision only to have then neutralized or concealed out to works compensation and taxes. Essentially these rising costs mean manufactures are constantly taking to steps forwarded only to be the steps both what's especially sad is that those things that we employers have little or no control over.

E. Robotics and Automation Changes

One of the most important area of the automation technology in manufacturing. The automation is defined as the automated system in used manufacturing automation are three types one is flexible automation second is programable automation and third is fixed automation. If the fixed automation is hard automation. Which is the sequence of processing operation is fixed by equipment. If the programable automation is a form of automation for producing the products in batches. The products are made for quantities ranging from the several thousand units at a time.

If the flexible automation is the extension of programmable automation. The robotics and automation are used in manufacturing operation if the CAD/CAM are also used the robotics and automation concept in manufacturing industry are used today in large scale. If the robotics and automation concept are used in CAM. The main purpose of robotics is used three types process one is material handling second is processing operation and third is assembly and inspection. The material handling and transfer are used with the robot to move one location to another. It is time saving process. In the robot proceeding operation the robot is manipulation a tool to perform a process on the work part.

III. DESIGN PROCESS IN CAD/CAM

The design process is most important role in CAD/CAM to understand the computer aided design effectively. The design process is an iterative process which checks the suitability of the design.

1) Recognition of Need: Recognition of need involves of the realization by someone that a problem exists for which some feasible solution is to be obtain. This might be the identification of some defect in a current machine design activity by an engineer of new product making opportunity.

2) Definition of a Problem: Definition of a problem involves through specification of the item to be designed. Generally, include physical characteristic cost performance and quality.

3) Synthesis: During the synthesis phase of the design and manufacturing process various preliminary ideas are developed by product of design.

4) Analysis and Optimization: The resulting idea of a design is subjected to appropriate analysis to determine their suitability for the specified design. If this type design fails to satisfy the constraints they redesign are modified on basis of the feedback from the analysis.

5) Evaluation: The assessment or evaluation of the design and production against the specification established during the problem definition phase is then carried out this often regards the fabrication and testing of the prototype models to evaluate operating performance quality, reliability.

6) Presentation: The final phase of a design is the presentation of the design. This is including the documentation of the design through drawing material specification, assembly of the product.

Figure: 1 Design process

IV. ADVANCED MANUFACTURING CAD/CAM

One of the most broad used of advanced manufacturing process involves the use of technology to improve product or process, with relevant technology.

The CAD/CAM Advanced manufacturing technology upon improving the performance and production rate of industry through the innovative the application of technology, process and methods to product design and production. Finally, the advanced manufacturing offered by some is makes thing that makes life easier. If the manufacturing process is act of converting raw materials in the form of a finished products by using manual or mechanized transformational techniques. The main aimed of such activities is to add value to achieve targeted objectives. Figure: 2 Advanced Manufacturing

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A. Product Technologies

Any organization predicting of the CAD/CAM advanced manufacturing shall produce products characterized as.

Products with high levels of design

- Technologically complex products
- Innovative products
- Reliable, affordable and available products 4.2 Process Technologies

The manufacturing process in CAD/CAM the technologies are advanced manufacturing.

- High level of performance computing for modeling, simulation and analysis
- High rate of manufacturing

B. Dynamic Constantly Changing

Finally, several sources are pointed out of CAD/CAM is an advanced manufacturing technology will need to change all parameter with the changing times and that the definition will vary for different companies and different industry.

C. Process Manufacturing

The CAD/CAM is the Process manufacturing is a branch of manufacturing that is associated with formulas and manufacturing. Process of manufacturing in CAD/CAM in the relevant factors. Just like the products that they produce, discrete and process of CAD/CAM software and that is solve all type problems.

V. DEVELOPMENT OF MANUFACTURING SYSTEM

CAD/CAM is most important role in the field of manufacturing system. Manufacturing concept is the use of the production or sale using labor and machines, tools chemical. But it is most commonly applied to industrial design in which raw materials are transferred into finished goods on a large scale. The CAD/CAM and Manufacturing engineering and designing process are the steps through which raw materials are transferred into a final product. Modern manufacturing includes all intermediate processes required in the production and integration of products and component. The CIM is computer integrated manufacturing is a manufacturing and production approach of using computers to control the entire production process. This integration allows individual processes to exchange the information with each other and initiative actions. All manufacturing steps can be faster and less error by the integration of computers. The main advantage of is the ability to create automated manufacturing process. Typically, CIM relies on closed loop control processes. It is based on real time process. Integration of component from different suppliers when different machine such as CNC, CONVEYORS and robots. Process control is used of computer and human operator of the manufacturing facility. Data integrity is the higher degree of automation, the more critical is the integrity of the data is used to control the machine

Figure: 3 Development stage

VI. MANUFACTURING ENGINEERING

Manufacturing engineering is a branch of professional engineering in CAD/CAM. Design and production engineering required the ability to plan the practices of manufacturing system to develop tools process machine and equipment of the CAD/CAM systems for producing good quality of product with low cost. The CAD/CAM engineers develop and create physical, production processes, and technology. It is very broad area of CAD/CAM. This field of CAD/CAM and manufacturing engineering emerged form tool and die in the early 20^{th} century. Advanced methods of quality these factors are used in manufacturing industries. The factory concept and this manufacturing engineering in the early 20^{th} century with innovation of mass production highly skilled workers. This concept is used in manufactured product at low cost.

Figure: 4 Manufacturing Tool

VII. MODERN MANUFACTURING TECHNOLOGY

CAD/CAM is a Modern manufacturing technology include all intermediate process required for the production of a products and components. Some industries such as steel manufactures use them fabrication for these processes. Emerging technology have provided some new growth in advanced manufacturing system and employment opportunities in the manufacturing sector. Manufacturing provides important material support for national infrastructure. On the other hand, most of manufacturing may involve significance social and environmental cost.

Figure: 5 Rapid Prototype Model

The Automation is used in different processes of manufacturing such as machining and welding. Automation manufacturing refers to the application of automation to produce goods in factory. The CAD/CAM main advantages of automated manufacturing for the manufacturing process are realized with effective implementation of automation. CAD/CAM Higher quality and reduction of lead times simplification of production reduced handling and improved work flows well as improved worker moral. The CAD/CAM are used robotics concept is the application of automation in CAD/CAM. To create robots, which are often used in manufacturing to perform the task. These concepts are economical process in manufacturing of the product.

VIII. CONCULUSIONS

The study highlights the significance of CAD/CAM in addressing the challenges of modern manufacturing. With continuous advancements, CAD/CAM technologies are widely implemented to enhance productivity while reducing costs. Their integration enables industries to design products with improved quality, accuracy, and efficiency. The primary goal remains to achieve economical production with higher output rates. Thus, CAD/CAM has become an essential tool in modern manufacturing, supporting innovation and competitiveness in product development.

This paper concluded the results of a study the role of CAD/CAM designing and facing the challenges in the manufacture industry the modern manufacturing industry are used to developing a new and advanced CAM/CAM concept and manufacturing technology the main aim of CAD/CAM is used in the manufacturing system is low cost and high rate of production are to be achieved. The CAD/CAM are most widely used in manufacturing sector. If the new product is to be design on the basis of good quality and low cost as well as the good specification the recent development of the technology is used in modern manufacturing company today. The advance manufacturing CAD/CAM and design process of the product are to be used in CAD/CAD technology are widely used at a time of manufacturing of the product. The CAD/CAM are improving technology are mostly used for main purpose of greater accuracy and greater efficiency of the product that is used in the field of CAD/CAM. The CAD/CAM concept are also used in the manufacturing engineering is a branch of professional engineering CAD/CAM technology. This concept is used in manufacture of the product at a low cost and high quality. The development of manufacturing system which are also used robotics and automation concept are used. The robotics and automation concept are used for material handling from one place to another place and these processes are time saving process as well as cost saving process. The row materials are transferred into a final product and component at a large scale. The greater growth and development in CAD/CAM and CIM. Mostly those principle are adopted in manufacturing industries today.

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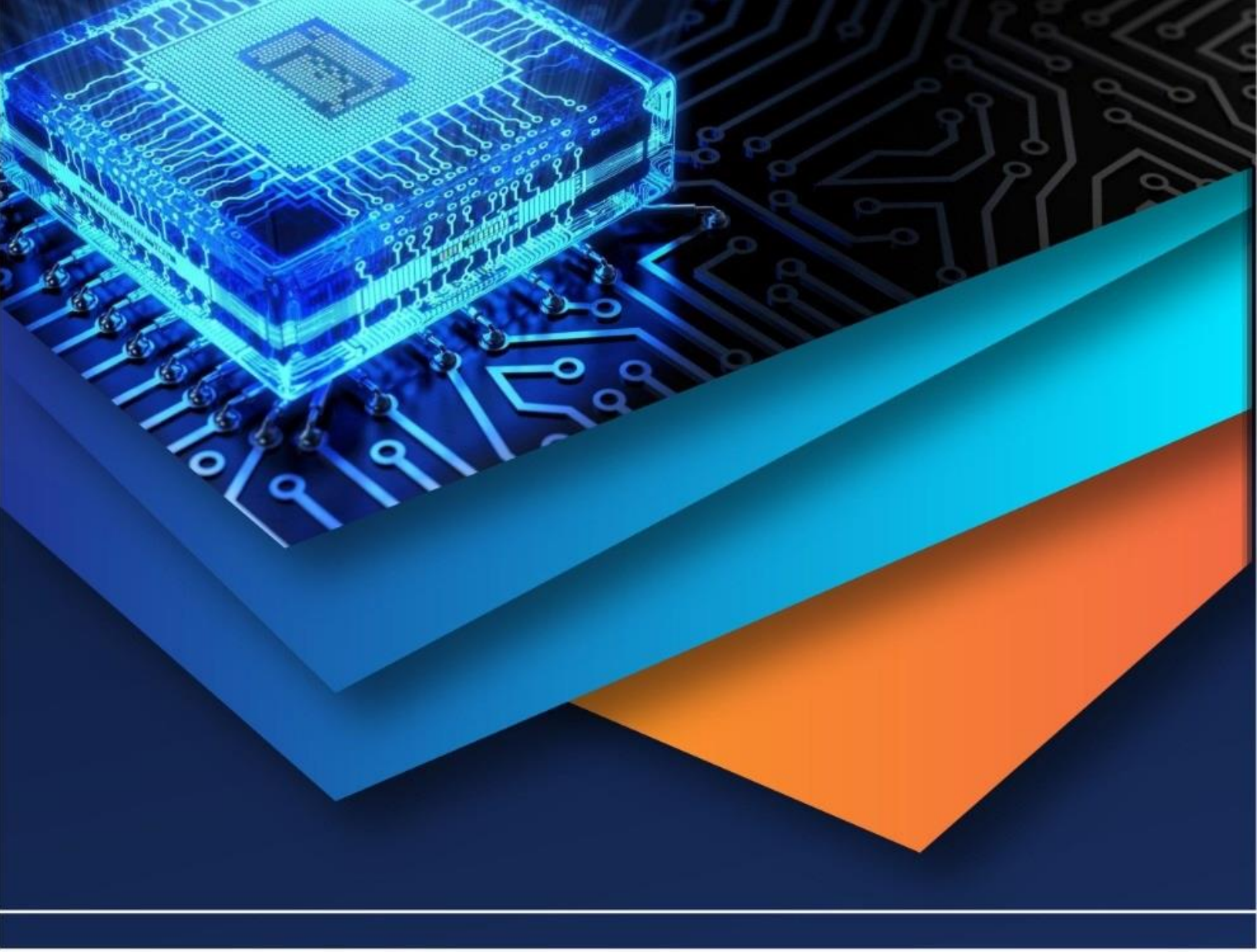

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