International Review of Applied Engineering Research.
ISSN 2248-9967 Volume 4, Number 2 (2014), pp. 171-176

http://www.ripublication.com/iraer.htm

Integration of CAD/CAPP/CAM/CNC to Augment the Efficiency of CIM

Viswa Mohan Pedagopu[1] and Manish Kumar[2]

[1]Department of Mechanical Engineering, Shoolini University, Solan, HP, India.
[2]Associate Professor, Department of Production and Industrial Engg, J N V U-Jodhpur, Rajasthan, India.

Abstract

Computer Integrated Manufacturing [CIM] is the modern manufacturing approach with the help of computers to control the entire manufacturing process from design to end user. The enlargement of total integration amid Computer Integrated Manufacturing Technology [CIMT] has appreciably amplifies efficiency in each individual sub system. The independent expansion, between one sub systems to consecutive subsystems in a row wholly restrains the improvement of overall efficiency of a product in each and every state of manufacturing scheme. Therefore, it has been observed that the optimum integration between the subsystems is inevitable in Advanced Manufacturing Industries [AMI] in order to manufacture a product at nominal cost and precise quality. The sub-systems of CIM includes Computer-aided design [CAD], Computer aided process planning [CAPP], Computer Aided Manufacturing [CAM], Computer Numerical control [CNC], and the other CIM subsystems like Computer aided quality assurance [CAQA], computer aided robot control [CARC], Computer aided inspection and planning [CAIP], computer Aided transport and stores [CATS], Computer Aided Assembly [CAA], and computer aided maintenance [CAM]. Today, to integrate one subsystem with other, so many commercialized software solutions and industrial systems are available. In this paper various integration issues, technologies, and solutions or systems of necessity connected optimum integration particularly in CAD/CAPP/CAM/CNC are discussed.

Keywords: CIM sub systems, CAPP, CAM, CAD, CNC, CAIP, CAQA and CAE.

1. Introduction

CIM system is deals with the functional areas linking with computers from initial design, analysis, planning, purchasing, cost accounting, inventory control, and distribution are linked through the computer with factory floor functions such as materials handling and management, providing direct control and monitoring of all the operations. CIM allows individual processes to exchange information with each other and initiate actions. Through the integration of computers, manufacturing can be faster and less error-prone, and the main advantage is the ability to create automated manufacturing processes. The implementation of information and communication technologies in manufacturing is the instant of CIM Technology, the controller of an arm robot and a micro-controller of a CNC machine. In CIM system, the higher the degree of automation makes more critical the integration of the related data that used to control the machines. CAD (Computer Aided Design) is a modern technique used to design products with the help of computer's both hardware and software systems.

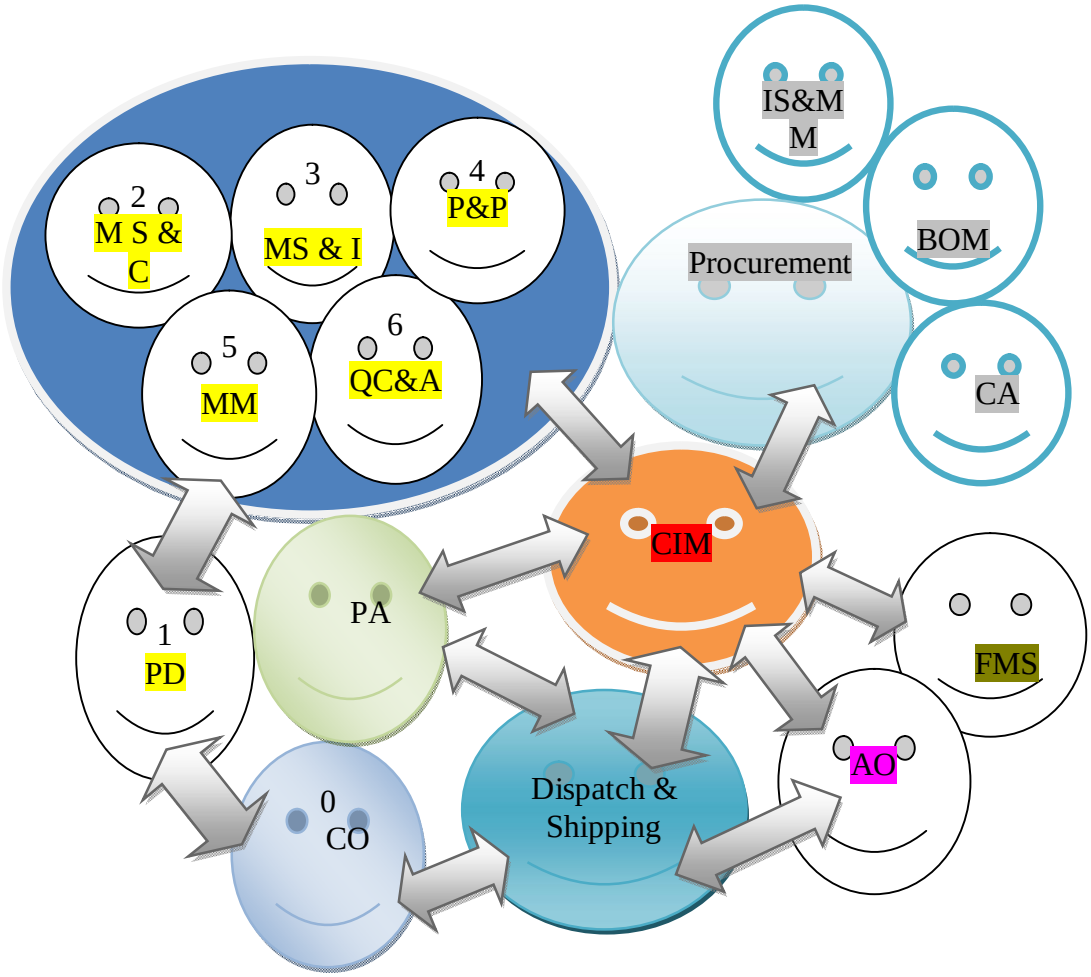

Fig. 1: Various systems linking as CIM family.

The CAD involves in various designing activities like technical files execution, plot, design, plan, and project analysis. CAPP (Computer Aided Process Planning) is the manufacturing and processing course that uses computer to assist design the parts. In a narrow sense, it mainly refers to the completion of processing design and outputting process regulations.

[CO: Customer Order, PD: Product Design, MS&C: Manufacturing Scheduling and Control, MS&I: Machining Specifications and Instructions, P&P: Process and Planning, MM: Machine Maintenance, BOM: Bill of Material, PA: Personal Assignment, CA: Cost Account, AO: Assembly operations, FMS Flexible Manufacturing Systems]

The initial concepts of Computer integrated Manufacturing published byJoseph Harrington in 1973 but after 1984 only so many industrial researchers realized that the prospective profits of CIM. Now,The CIM is being used to solve various issues in order to optimize the process and techniques. The main components of CIM system are one is hardware and other is software. The software may be the kind of operating system,communication, ,DBMS,production planning and controling softwares,cad softwares,decision support system sofwares,Office and other information softwares. Similarly, hardware components like computers and computer hardwares ,networks,devices, and other peripherals. Both the CIMS integrate with each other to perform the specified task.

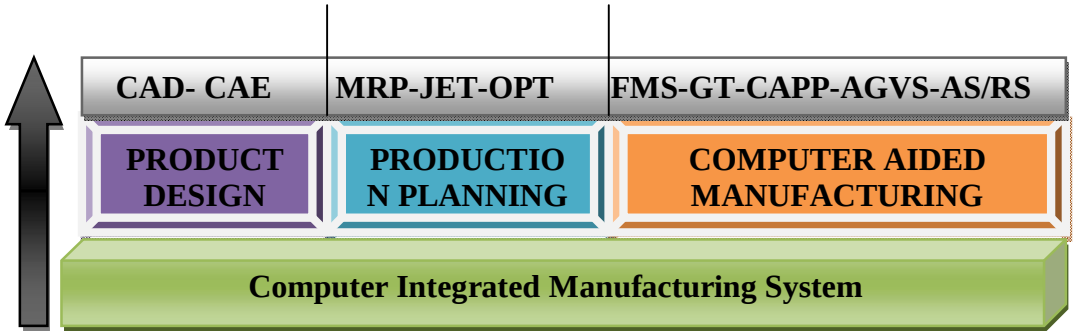

Fig. 2: CIM subsystems.

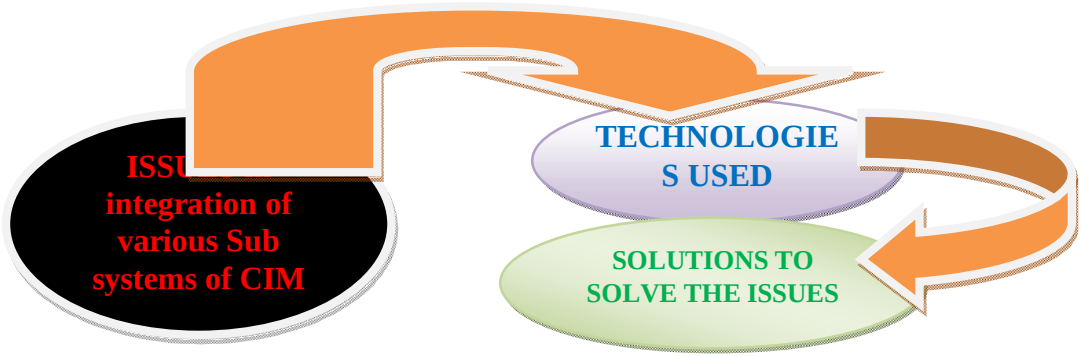

Fig. 3: Issues, technologies and solution.

2. Integration of CAD and CAM

Process planning is a manufacturing architecture activity to reflect the step by step sequence of production process of a product being produced. The planned improvement of proper process planning architecture in advanced manufacturing industries leads the effective utilization of manufacturing resources. Computer aided Process planning covers the product from engineering drawings, specifications, parts or material lists, prediction of issues and ideal project plan. There are various steps in process planning includes 1) operations routing2) operation sequences, 3) identification of right work centers, standard specifications, machine tools, tool equipment's, various software's, hardware's, jigs and fixtures, 4) planning sequences step-by-step work instructions, 5) total project plan, 6) issues in operational information, machining parameters and standards 7) definite set-up instructions, 8) quality control, quality assurance checking 9) fabrication and assembly with the help of given drawings.**[1].**The process planning may not useful if it fails in detailed interaction with the issues. The study of engineering drawings and identification of the complexities of a problem and concentrate on the real issues and using various technologies to get complete solutions. But, on the other hand some issues may be hiding some important understanding of the problem as well therefore the planning of a concerned product manufacturing is double edged knife task. A number of Computer Aided Process Planning (CAPP) systems offer good geometric capability and intensified**.** Process planning is chiefly an open ended issue which receives multiple issues with the help of experience, artificial intelligence and knowledge based solutions.

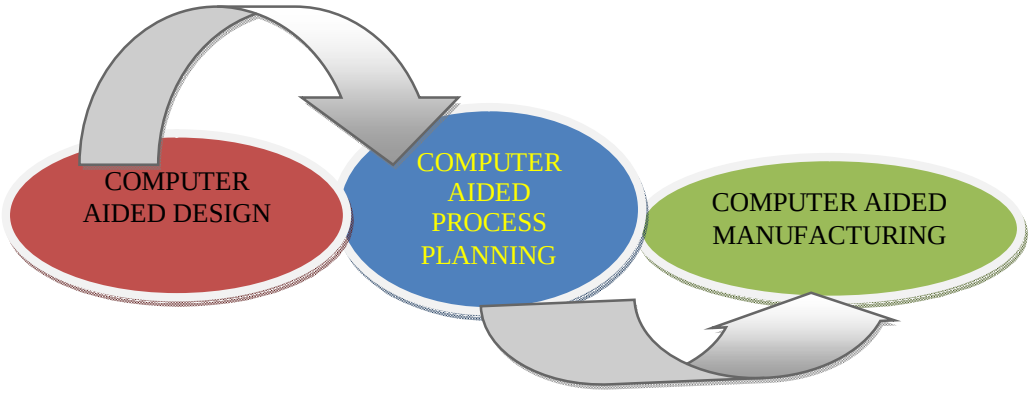

Fig. 4: Interaction between CAD/CAPP/CAM.

Computer-aided process planning (CAPP) is a link or bridge among product design and manufacturing design. The CAPP system used to optimize variables such as cost, lead times, equipment availability, production volumes, and potential material substitution, routings and testing requirement etc., CAPP is a key tool for engineers in the modern manufacturing industry. Distributed decision-making in planning comes out as a rigid hierarchical structure of tasks from the lowest levels to top level tasks. Determination of machine their specification standards and cutting parameters are

considered as low levels and the top levels control, coordinates and manages the entire system. The CAPP system starts work piece's surface, and identifies all possible machining processes for all facets, one at a time, and later specific production facilities were taken to the pool. Optimal machining plans are identified based on local production conditions, e.g., machine capabilities, delivery schedules, personnel, etc. It is found that the CAPP system is particularly useful in concurrent engineering environment, where a large number of design changes are made on routine basis. An integrated planning framework by utilizing Artificial Intelligence [AI] as a logical extension of current CAPP activities is of recent interest. **[1]**

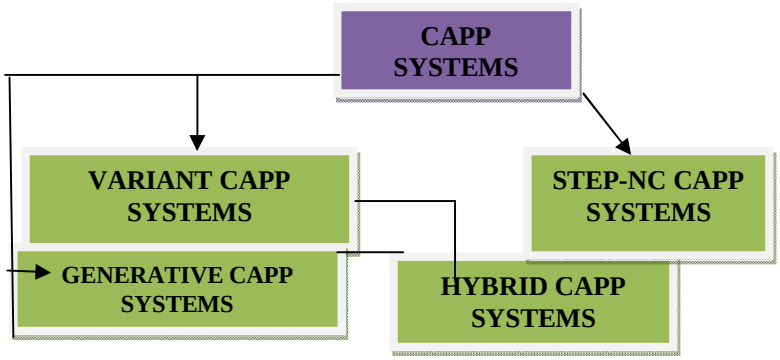

Fig. 5: Classification of CAPP system.

Computer aided process planning (CAPP) systems plays a tremendous role in integration product manufacturing and business functions to withstand market demands and global competition. The CAPP also plays a major role in reconfigurable and reconcile manufacturing fundamentals. In CAPP better mechanized management and cost control to industrial needs. Obviously, the traditional process planning scheme with additional functions at aggregate level which are designed to operate using limited product and process data. The future work will develop additional modeling methods and dynamicity to improve manufacturing performance and planning. CAPP is suitable to optimize processes selection, equipment choice, production routes, quality of parts, manufacturing cost and time. This capability builds confidence in industrial and manufacturing engineering team in day-to-day operations**. [1]**

3. Integration of CAM and CNC

Obviously, the failure of conventional machine tools led the development of CNC machines. The CNC machines works on various software programmes. The popular earliest ISO 6983 standard had made remarkable impact on modern manufacturing industries in arrow to achieve more resourceful and accurate production. A part programme which contains a small subset of the information for CAD/ CAM environment. The linear, circular movement and more flexible, critical and complex machine functionalities, advanced graphical figment of the imagination and alteration of a complex Numerical Control programme are at the factory-floor level. The various

standards like ISO-14649 describes a new interface for more effective, bi-directional information exchange between CAD/CAM systems and NC controllers. The highly compatible, feature-based, and object oriented structure of ISO-14649 is used as more informative. The STEP -ISO-10303 includes STEPNC, various CAD, CAM and NC data can be stored in a single database. The Numerical Controllers used to access information retrieval, alteration and appending more effectively. The development and implementation of STEPNC somewhat re-shaped of CNC machine manufacturing. The emerging technologies in CNC machine tools have led manufacturability and further fulfillment of total CAD/CAM integration. **[2]**

In the early 1950s Numerical Control Machines [NCM] were first introduced and ignite the start to Computer Aided Manufacturing (CAM). In industry, CAD techniques are extensively used to design products, and CAM techniques are used to manufacture the products. To translate the geometric shape into the machine understandable form by considering the specification of the same geometry. From given computer aided design drawing into computer-controlled machine tools understandable form like "G-code" and M-codes. The cutter motion is mainly specified in terms of position and the federate of axes [x, y, and z] in various CNC machine tools. **[2]**

4. Conclusion

The brief explanation about Computer Integrated Manufacturing [CIM] and its application in the modern manufacturing approach is discussed. In CIM, computers are used to control the entire manufacturing process from design to finished product. The total integration amid Computer Integrated Manufacturing Technology [CIMT] has increases efficiency in each individual sub system. The sub-systems of CIM includes Computer-aided design [CAD], Computer aided process planning [CAPP], Computer Aided Manufacturing [CAM], Computer Numerical control [CNC], and the other CIM subsystems like Computer aided quality assurance [CAQA], computer aided robot control [CARC], Computer aided inspection and planning [CAIP], computer Aided transport and stores [CATS], Computer Aided Assembly [CAA], and computer aided maintenance [CAM]. The most important integration among the CAD/CAPP/CAM/CNC is discussed.

Reference

[1] Saad nawaz1, zeeshan nawaz2, Chen wuyi1[2012]"computer aided process planning: an integrated approach toward manufacturing sustainability" sci.int.(Lahore),24(1), ISSN 1013-5316; coden: sinte 8

[2] X.W. Xu*, Q. He [2004] " Striving for a total integration of CAD, CAPP, CAM and CNC Robotics and Computer-Integrated Manufacturing 20 101–109 Elsevier.com