Research Insight: Highlights on CAM Applications in Production

D. Siddharth
Sharda University, Greater Noida, India
E-mail: sidd.robotech@gmail.com

INTRODUCTION

Most of the machines needed control systems for operating the machine. There are various control systems available, such as automatic control, computer control, manual control, and remote control. For the convenience of mass production, machines needed to repeat speed, automatic actions, and precise continuously. These machines may use mechanical, pneumatic and electrical systems to control. However, some changing procedures, fixed procedures, or tools may need a lot of time to restore the whole system of the machine. Testing and productions can be start as soon. This simplifies that the procedures from the designing to manufacturing of the product.

BASIC TERMINOLOGIES

Computer Aided Manufacturing (CAM)

CAM is an application based on computer technology, regarding software tools, which assist machinists and engineers in prototyping product components and tooling or manufacturing , in purpose to make more fast production process and tooling with more material consistency and precise dimensions.

Computer-aided machining can programming the tools in a way that the possibility of creating tools to physical manufacture models, which is able to perform computer-aided design (CAD) programs with computer aided manufacturing (CAM), and creates the reality of life versions of components that is designed within a software package. In the study of Elanchezhian et al. (2007), they expressed more simple and useful definition of CAM, which is not only used as computer system in nondesign activities but also in manufacturing process. CAM is closely related to the computer-aided design (CAD), as the output information based on the products from the CAD can be assisted the composing of production program.

Numerical Control (NC)

As technology advances, computer technologies, and electronic have been applied to a lot of production machines to reduce the production time and increase both the efficiency and quality. Therefore, usually modern factories used numerical control machines, simply called NC machines. Moreover, CAM has been considered as a numerical control (NC) programming tool wherein three-dimensional (3D) models of component generated in CAD software that can be used to generate G-code to perform numerically controlled machine CNC.

Computer Numerical Control (CNC)

An NC machine that comes along with a computer is called a computer control numerical machine, simply CNC machine. It uses digital information to control the movements of tools and parts, that is, the spinning speed, the

moving direction of tools, the cutting speed, etc. Therefore, it can change the production procedures quickly, simply by changing the program or information in the production method, which needs a computer to control the machines is called a computer-aided manufacturing, simply called CAM. Since years the software has been developed different experiences in dealing with, and the requirements of small, medium and large manufacturing businesses. The design has assisted by human, user handy, and easy to learn, and given the flexibility in managing the operations from quotations through to invoicing, cost, efficiency, enabling the manufacturer to hit the target of quality, and delivery.

Advantages of a CNC Machine

(i) The computer can be designed as the best tool path, cutting speeds of tools, and spinning according to the information of the product. This can help to decrease the cost and time. CAM control systems are preplanned and predictable.

(ii) Usually CNC machines have the function of automatic changing tools.

(iii) CNC machines can be controlled the tools movement precisely in any axis; so, it can cut efficiently some complicated workpiece.

(iv) A CNC machine can download and modify program efficiently with the use of various input devices and the memories of computer; so, the production procedures can be made quickly.

(v) In operating the CNC machine, manual adjustment is not needed. Therefore, the CNC machine can run at a high speed, and it requires less skillful workers to reduce the labor cost.

(vi) CNC machine are used in various designs to produce feedback; and

so, it can keep its high reliability and quality, and this can help to decrease the number of the cost of inspection and disqualified product.

Limitations of CNC Machine

(i) The cost of the machine is so high that some small factories may not be able to afford.

(ii) Operators are needed to be trained to compose the computer controlled program.

(iii) The control system is sophisticated and complicated; thus, the maintenance cost is high.

The difference between NC and CNC lies in controller technology, even though both the systems refer to coding of same standards. While NC functions need to be designed and implemented in hardware circuits, CNC functions can be easily implemented in CAM software.

STRETEGIC ROLE OF CAM

Flexible nature of CAM technology in production applications offers advantages to the organization to develop capabilities by combining conventional economies of scale with economies of scope, which further results in the desired flexibility and efficiency. For manufacturing a large number of items with faith and perfect precision to the CAD design, the code can instruct the machine tool, while the stage at the conceptual designs for new products can be made entirely within the framework of CAD software. The computer-aided manufacturing taked a further step by bridging the gap between the manufacturing of the finished product and the conceptual design.

Major roles of CAM system that impress manufacturing industry to a large extent are as follows:

- Fast response to changes in market demand
- Distributed processing capability
- Greater supervision of the production
- Small-lot sizes
- Reduced wastes
- Product variety

APPLICATIONS OF CAM IN PRODUCTION TECHNOLOGY

Ever since the revolution in computer technology took place, CAM software systems have served great deal of applications to numerous sectors of engineering and technology.

Some of the CAM applications used in production sector are mentioned in the following:

- The rise of virtual manufacturing has led to the creation of work-cell simulation tools which are capable of developing, simulating and validating manufacturing processes.
- Commercial CAM provides complete solutions to Product Lifecycle Management (PLM) in multiple stages of the production, such as manufacturing (CAM), engineering (CAE), and conceptualization, design (CAD).
- CAM is used as an essential utility in order to enable the automation and the computer support of all the production activities on the shop floor, in order to manufacture parts designed with CAD and analyzed with CAE.
- Besides, the CAM technology has brought a revolution in manufacturing systems by enabling greater flexibility and mass production, CAM has enhanced a direct link between 3D CAD model and its production.
- It enables the interaction between CAD, CAM and CAPP is a dynamic procedure and takes place through various production stages.
- Since, NC programmer usually require to specify auxiliary geometry during the programming course and since the CAM program do not offer model editing abilities the need is presented for the CAM system to be combined with CAD system.
- Equipment on the shop floor like robots, controllers machine tools and machine centers are controlled and operated using CAM systems
- The mechanical drawing/drafting files in CAD software are needed from CAM system for the purpose of manufacturing any of the parts. Thus, CAM programs represent a designed part as a wireframe of two or three dimensions.
- Not only this, off-line programming of multi-device robotic and automated processes (virtual commissioning) offer optimization functionalities, from the concept to the implementation phase.

FUTURE PROSPECTS

Because of the dynamic and multi-disciplinary engineering applications, CAM technology seems to have great stand in manufacturing sector, no doubt manufacturing environment is characterized by ever changing dynamics and evolution.

Moreover, the need is presented for effective coordination, collaboration and communication amongst all the aspects of the production. The production procedure is based largely on virtual simulations and networking features, i.e. from factory level to global level. Improvement in CAM systems can be revealed through focus on collaborative technics, effective

communication and efficient data exchange.

Artificial intelligence is one such future prospect in enhancing CAM technology to a level where CAM systems can offer automatic optimization of NC tool paths and benefit from knowledge-based systems. Moreover, self-evolving robots are fairly novel concept and will have positive impact on CAM system functioning and on economical approach to robotics to a greater extend. In the process, it can help in reducing the cost of designing and building robot systems.

The implementation of digital manufacturing relies on state-of-the-art CAD/CAM and CAPP systems by integrating them and obtaining more user-friendly approaches.

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