

CAD/CAM with New Trends and Advancements, using Machine Learning: A Review

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Abstract

The total sum up and the best review which is conclude is that the CAD/CAM systems are the modern-day requirement. CAD/CAM systems work best in the integrated form and they are not only confined to the engineering world but to each and every corner of the process background. Integration of the system has given birth to the CAPP, ERP, DNC and Production and development. Designing has been well advanced and meets the requirements of the task, not only big but the system of CAD/CAM is sophisticated for the small industries. CAD/CAM is the requirement of the every managerial as well as engineering and processing industries weather it is the process or operation handling or the manpower and resource handling or meeting the dead lines of the deliveries. Simulation is also carried out by this system and the challenges in the modern-day world for the survival in the fast changing and growing world can be backed by the integrated CAD/CAM systems. Prototyping, Reverse Engineering, Additive Manufacturing, Intelligent Management all are the features of the CAD/CAM system. Machine learning can help us to develop the designs which would have minimum errors and after the rescans and checks the AI part of the software will totally eliminate the error. Designing on CAD and Manufacturing techniques will be much more benefitted by sharing data between different systems in a firm will let machines learn the trends and patterns and will optimise the process and advance it further.

Key Words: CAD/CAM, Program language, ERP, CAP and Machine learning

1. INTRODUCTION

Computer Aided Design/Computer Aided Manufacturing are the two terms which are often used together and they are abbreviated as CAD/CAM. Computers have revolutionised the human world in every aspect weather it is designing or manufacturing it has given its part to minimise the human efforts and errors and are seen often while carrying out the huge computations. CAM is an acronym of Computer Aided Manufacturing which means manufacturing using the computer. Manufacturing is a very tough job to carry out in which we have to track the inventories, have to keep records of orders, need to make generalised lists for the manufacturing processes all these tasks can be done just by the single click on a computer having CAM software [1]. The huge data is feed in the computer and is processed. Then gives the input as in the form of workable tasks. While as CAD is associated with the Computer Aided Design, in the previous times even today at some places we see that designs of parts of engines, bridges, buildings, spare-parts, aircrafts etc [2]. are made both fail proof and fail safe which means they are safe for the period of their commission weather it is flight hours or years of stand for aeroplanes and buildings respectively, all this is possible only by the CAD applications which emits human errors and provide the suitable suggestions based upon the data feed [3]. With the advancement in the engineering field new trends and benefiting advancements are being introduced into the field the software are being made much more advanced with user friendly features which enables us to make designs more sophisticatedly earlier tough now easy, the introduction of AI(artificial Intelligence) has revolutionised this field software like SOLIDWORKS, AUTOCAD can now point out the mistakes at first hand and suggest the best ways to the designer and manufacturing firms, AI uses the computer memory and stores the most corrected things to suggest to the user and gives the suggestions according to the learned or we can say stored in memory[4]. In the field of artificial intelligence machine learning techniques are developed to fight Complex relationships based upon the mechanism that generate a set of outputs from a set of empirical inputs which are considered as input data for the complex algorithm, at the first instance when relationship or any rule of the law that predicts the performance on the new data, this stars the machine learning. when we talked about the numerical simulations we take into consideration the adaptation idealization processes which are totally based upon the CAD models for preparing simulation model which can be seen as a well completion of complex nature which involves high-level expertise and operations for addressing such problem, machine learning techniques show good mean to drive the CAD model preparation and process and they can be helpful in the knowledge embedded in a set of adaption scenario [5]. CAD/CAM (computer-aided design and computer-aided manufacturing) some times both the terms are used together. Some software provides interface and functionality for both, we can use them for the design and manufacturing purposes. In the global market where the competition is so high that every step towards design weather a new product or new technique has to be taken keeping the competition in mind. Different product has varying time of finishing an aeroplane takes years from the design up to finishing, while some of the products have very short

development time but technology becomes obsolete and halts the product development. The computer involvement has brought down the development time and the time up to which the product was designed, is now finished by using both the technologies i.e. CAD/CAM. The idea of manufacturing involving computers includes the activities in planning and production control at different places.

2.LITERATURE REVIEW:

Pandey et al. [6] has done research in order to briefly explain the role of the CAD/CAM Design, Development and Manufacturing in Modern Manufacturing Technologies, as the advancement of the processes are complexing day by day and need the best in the class to withstand the advancements and the intelligence needs to be put into the field of all the discussed parameters. The research gives an open and wide idea to incorporate the interdisciplinary design actions which would connect their common goals. To do this we need to study and investigate the present-day state of art, latest trends in engineering design, new approaches, with the addition of industrial problems, and which of the requirements are demanding the inclusion of CAD/CAM. The research has been conducted with the aim of direct future research, and the development activities by the inclusion of studies done by the Germans leading CAD/CAM magazine. Which made the authors possible to reach the possibilities of the future role and possibilities of the emergence and reachability of the CAD/CAM. Authors have well defined the role, and has well explained the future role and also defined the steps to be followed in the application of Rapid Prototyping. It is the new face of manufacturing and it is incomplete without designing so again the need for CAD/CAM come into existence. Author has explained the top-up and top-down manner of creating electrical mock up. Author has defined the agile manufacturing conception and the enabling technologies, where customer needs are studied and satisfied and keeping the cost and sales quality.

Ko et al. [7] have effectively defined the user-friendly CAM software and presented the functionality of automatically generated three-dimensional tool path and imparting the CAD drawing. The authors have defined the complexities which came into play when we need to draw a trajectory of few micron dimension and multidirectional moves. The reported CAM software offers constant velocity for all short trajectory elements and provides an efficient shift of tool path direction in sharp corners of a tool trajectory, which is vital for any laser, based precision machining. Authors have also made the functionality well defined and a detailed research has been conducted over the CAD/CAM software and the file and format systems (STL, DXF, DWG format files).

Haifa and Israel [8] has explained the challenges that pertain in the modern-day markets of rising demand in efficiency for a better design and manufacturing of industrial products, collaboration and the data exchange between designers and process planners. The research has been carried out on the industrial survey and the author has said that the industries lack collaboration and cooperation between designers and process planners. And has emphasised his declination towards the use and evolving of CAD, CAM, CAPP, PLM tools which has now become the back bone of the industries for the cooperation and collaboration but additional tool are still required which could be customised according to the usage of that particular industry. Author has suggested that CAD/CAM is the building block and fills the knowledge gap between the said gaps and has made the working environment a healthy one for efficiency. Number of evaluation processes can be developed for a process which would help in developing the best ergonomic path way by the implementation of the technology i.e. CAD/CAM.

Reich et al. [9] conducted research to check the CAD/CAM efficiency for the clinical use, authors have made a great leap from the engineering automation to the medical application for using the engineering automation to carry out the research the researchers have taken three systems which are DIGI, LAVA and INLA on which they provided the samples which were twenty four in number and were all -ceramic FPDs. After dividing the samples randomly and they fabricated the samples by the above said systems. Then the researchers examined the replicas which were made for the denture for clinical use, and found that the results are suggesting that the replicas from the CAD/CAM are very satisfactory for the clinical use.

Lee et al. [10] CAD/CAM/CAE are basically base on the computer applications which authors described as the open or closed shells of faces or we can call them surfaces. As we know the surfaces are either 2-D parameter spaces which may be not rectangular. In many applications we are bound to adhere the individual parameter spaces into a single global parameter space that would look alike the model shape in the 3-D physical Space. Authors has well described and presented the method of creating such shape preserving global parameterization of a shell of faces which are eligible to the CAD/CAM/CAE Applications.

Soliman et al. [11] authors have done a dedicated work in the field to find out the critical success factor for integration of CAD/CAM system with ERP systems. The current scenario of the world design and using of computers has revolutionised the modern engineering sciences, usage of computer aided manufacturing and design has given an impressive detailed knowledge, which opened the doors for us to implement computers for the work of ERP (enterprise resource planning) which is using computers not only for designing and manufacturing products but now to develop the idea to the delivery of service by that product is now being developed by the computers. This has led the companies, firms, to invest the time and money at the zero-risk factor. Authors have described the system as an progressive one

which has no chance of failure and also the errors are at a very faint to the affirmation of failure. Authors have research in the sub set of the CAD/CAM field which highlights the importance in the automating complex design and the modern and new era manufacturing processes. Author suggests the implementation is going to grow at a very fast. Researchers have studied under this frame the exploitation of the problems of integration of CAD/CAM system behaviour and efficiency with ERP systems, also they have studied the severities of the problems which will come related to the said system configuration, and have successfully proposed the critical success factor (CSF) for the integrity of CAD/CAM with ERP Systems. The researchers have suggested that the hypothesis in studying the relevance of these CSF for successful integrating of CAD/CAM with ERP systems. According to the researchers they have added to the paper work that demonstrate pattern of successful integrating the CAD/CAM with ERP and getting the desired system that will give out the beneficial work that was not possible before the introduction of the CAD/CAM system with the integration of ERP and other applications while the generation of next manufacturing will come. This finding that integration of CAD/CAM system with ERP system is complex, although they were not explored in the earlier times they are now well explored and they are giving out the fruitful factors that will help humans to get all the required work from the computers in the desired fields.

Adler [12] has done research in the field of CAD/CAM: Managerial challenges and Research Issues and has given the well-defined investigation into the managerial challenges that we face in the modern day industries and manufacturing units, it has given the set of computer aided design which has a broad sub sets which include engineering aspects design aspects and manufacturing aspects and also the manufacturing computing used in the computer aided manufacturing which has sub-sets including machine control, material handling manufacturing scheduling, planning and administration testing and quality assurance which are the sub sets of the CAD/CAM Applications. The author has focused on the printed circuit boards in electronic industry, and hydraulic tubing in the aircraft industry. Author has collected the information on the synthesizing the elements of best practice. The author has identified many issues and key points which he has pointed are managerial challenges and research issues on the five key points “levels of organisational learning”: skills, procedures, structure, strategy, and culture. Author has given well set of explanation about the points and has given the measure of optimisation within the application field of CAD/CAM.

Sung-Kee and Jong Choi [13] have done their research in the field and sub set of the CAD/CAM Technology where they have fielded their centre on the topic of A PC-based retrofitting toward CAD/CAM/CNC integration. Retrofitting is addition of new technology which was based on the addition of use of PC i.e. computers and the programming was done to made the applications which would use the algorithms to solve the problems related with the designing and processing. The authors have defined the use of design in the CAD software and then converting the design made into a CNC program.

Twigg et al. [14] are of the opinion that the CAD/CAM is the technology that is a managerial and an engineering integration which combines the both sectors which are interdependent. CAD/CAM has played the role of the time saving and money storing concept and elimination of the errors that cause failure and time delay. The concept of the research is to make an integration between Engineering and Manufacturing. Fast and effective product development has become the key and biggest strategic importance to many companies, the cross functionality and co-operation has been well defined and strengthening of linkages between all functions. Some of the key points made are; integration through the minimisation the differentiation by integrating functions; by coupling men and machine; by making the user familiar with the user interface of the machine. CAD/CAM has been away a keen and interested subject it has not only made the user interface and machine handling easier but has also made the management so easy for operation.

Shukla et al. [15] the authors have been incorporated the role of CAD/CAM in the designing for skill development and has give the deep reviews related to the skill development and the interdependency of computer-aided design (CAD) and computer -aided Manufacturing (CAM).The technology has greatly influenced the continuity of the processes which have an interdependency and they share the computer based applications which have a sharing for the design and development. And sometimes the amalgam is called the third technology called Computer-Aided Engineering (CAE). Authors have defined the literature from different others authors for review and explaining the further advancement of the use of the software has nullified the ambiguities in designing work and the skill development. Authors have emphasised the saving of time and money by use of CAD/CAM technologies.

Gal-Tzur et al. [16] have analysed the design and manufacturing processes which form the core of the integrated CAD/CAM system. The authors have conducted the research based on lift schedule specified either by analytical functions or by discrete data points which are transformed to an analytical form by cubic spline interpolation. The required cam contour and its curvature at each point on the cam periphery are then derived. Machining of the Cam shaft is fully analysed for the NC Jig grinding, NC Grinding and rocker Grinding. For the first process only, geometrical aspects are analysed and the lateral two all the geometrical as well as physical parameters are analysed for a complete control of cam geometry and the damages caused by heat. Integration of design and manufacturing tasks in this way allows for manufacturing characteristics and limitations to be taken into account in the design stage.

3.CONCLUSIONS

In the modern era where the management and the manufacturing are the building blocks of the industries and the race towards the progress and betterment has complexed the situations and we need an errorless system which would help industries to emerge from the distress. The computers have been the friend of humans, right from the time they were developed and brought into work. Scenario has been much more changed now we find computer application everywhere from the manufacturing units to the aerospace industries to the medical field, we need an integration which would synchronise the data and help us to get the better results. CAD/CAM (Computer-Aided Designing and computer -aided Manufacturing) is now developed and integrated. Both the applications have provided a tremendous efficiency to the industries. CAD is used to build the designs using modern day computing and those designs are simulated and then brought into particle field and development starts. CAD applications can be linked with Artificial Intelligence Which we use in many fields where the computer provide the suggestions about the designs and their optimisation, machine learning has can also be added to the CAD systems which make them much more advanced and designing can now be taken to the next level of advancement. CAM (Computer Aided Manufacturing) is an application type which governs all the manufacturing tasks same as CAD does but the difference here is, we need to synchronise the system with the available resources, materials and available manpower with other manufacturing requirements. It provides us with the optimum solution. Adding AI (artificial Intelligence) to the CAM systems we can better their performance. Machine learning can improve the performance of the system and it doesn't have to repeat the loop tasks. CAD/CAM integration is a revolution which only needs the single system application and all the Design and Manufacturing work can now be done easily and the flow of the data can be made to any channel where it is needed. The CAD/CAM integration has interestingly developed the computer graphic system for better understanding. We can now design engineering analysis (stress-strain etc.) by the help of software, Automated Drafting can now be easily done. The integration of the system has now made us equipped with the Computer Assisted Process planning, shop floor controls, computer Numeric controls, direct numeric controls and also has covered the world of automation. we can now design the process and let it proceed on its own, unless interpreted saving time and money, robots are now also controlled by the system, The CAD/CAM has impact all over all the trades .Computer aided design the automation section of the CAD/CAM has computational effect for the computation which led to the drastic change. For the modern world people need to understand the use of CAD/CAM for the betterment of production, scheduling, manufacturing .it is the need of coming future and understanding the computerised designing and emitting human errors to a very small level.

4. FUTURE WORK AND SCOPE

The future work which can be done over the CAD/CAM is that the AI (Artificial Intelligence) can be added to the software which could help to develop Convolution Neural Network just like human neurons which would build smart designing and Manufacturing.

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