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Chapter 1 : The Disadvantages of Computer Aided Manufacturing | calendrierdelascience.com

Computer-aided process planning (CAPP) is the use of computer technology to aid in the process planning of a part or product, in calendrierdelascience.com is the link between CAD and CAM in that it provides for the planning of the process to be used in producing a designed part.

The use of the computers for quality control of the product is called as the computer aided quality control or CAQC. The two major parts of quality control are inspection and testing, which are traditionally performed manually with the help of gages, measuring devices and the testing apparatus. The two major parts of computer aided quality control are computer aided inspection CAI and computer aided testing CAT. The main objectives of the CAQC are to improve the quality of the product, increase the productivity in the inspection process and reduce the lead times in manufacturing. The implementation of CAQC in the company results in the major change in the way the process of quality control is carried out in the company. In the traditional manual process the testing and inspection is done by the sampling process out of the hundreds and thousands of products or parts manufactured by the company since it is not feasible to check each and every product. With computer controlled inspection, it is not necessary for the quality control department to settle for less than perfection. In the traditional process there is separate quality control department where the manufactured product is taken for the inspection and testing. In CAQC the inspection process is integrated with the manufacturing process and it is located along the production line. Thus as soon as the product is manufactured it is tested immediately by the computerized process without moving it to some other location. This helps in reducing the overall time required for manufacturing the product. In the traditional process the product or the part to be inspected is handled manually since it has to be positioned properly for inspection on the desk or suitable location. In CAQC non-contact sensors are used for the inspection purpose and they inspect the product without coming in contact with the product. The non-contact sensors operated by the computer are kept along the production line and they can check the product very quickly in the fraction of seconds. In future with further advancements in the technology, the robots would be used to carry-out the inspection process thus further automating and speeding the process. The data collected by the non-contact sensors is sent as the feedback to the computerized control systems. These systems would carry out the analysis of the data including statistical trend analysis. This helps in identifying the problem going on in the manufacturing line and find appropriate solution to it. For instance, the results from non-contact sensors may indicate that the parts manufactured are not within the acceptable tolerance limits. This would help the production or quality control personnel to find out the precise location of the problem and its exact cause. The corrective action taken quickly saves lots of time and money due to reduced wastages and also improves the quality of the product. Apart from inspection and testing, computers are used in a number of other areas of the quality control. Groover and Emory W.

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Chapter 2 : Computer Aided Quality Control (CAQC): Use of Computer in Quality Control

Computer-aided production engineering (CAPE) is a relatively new and significant branch of engineering. Global manufacturing has changed the environment in which goods are produced.

This environment would be used by engineers to design and implement future manufacturing systems and subsystems. The NIST project is aimed at advancing the development of software environments and tools for the design and engineering of manufacturing systems. The current process in engineering manufacturing systems is often ad hoc , with computerized tools being used on a limited basis. Given the costs and resources involved in the construction and operation of manufacturing systems, the engineering process must be made more efficient. New computing environments for engineering manufacturing systems could help achieve that objective. Why is CAPE important? In much the same way that product designers need computer-aided design systems, manufacturing and industrial engineers need sophisticated computing capabilities to solve complex problems and manage the vast data associated with the design of a manufacturing system. In order to solve these complex problems and manage design data , computerized tools must be used in the application of scientific and engineering methods to the problem of the design and implementation of manufacturing systems. Engineers must address the entire factory as a system and the interactions of that system with its surrounding environment. Components of a factory system include: CAPE must not only be concerned with the initial design and engineering of the factory, it must also address enhancements over time. CAPE should support standard engineering methods and problem-solving techniques, automate mundane tasks, and provide reference data to support the decision-making process. The environment should be designed to help engineers become more productive and effective in their work. This would be implemented on personal computers or engineering workstations which have been configured with appropriate peripheral devices. Engineering tool developers will have to integrate the functions and data used by a number of different disciplines, for example: Although some computerized tools are available, they are often very specialized, difficult to use, and do not share information or work together. Engineering tools built by different vendors must be made compatible through open systems architectures and interface standards. They will maintain information about manufacturing resources, enhance production capabilities, and develop new facilities and systems. Engineers working on different workstations will share information through a common database. Using CAPE, an engineering team will prepare detailed plans and working models for an entire factory in a matter of days. Alternative solutions to production problems could be quickly developed and evaluated. This would be a significant improvement over current manual methods which may require weeks or months of intensive activity. To achieve this goal, a new set of engineering tools are needed. Examples of functions which should be supported include: The tools implementing these functions must be highly automated and integrated; and will need to provide quick access to a wide range of data. This data must be maintained in a format that is accessible and usable by the engineering tools. Some examples of the information that might be contained in these electronic libraries include: These on-line libraries would allow engineers to quickly develop solutions based upon the work of others. Another critical aspect of this engineering environment is affordability, which can best be achieved by designing an environment that can be constructed from low cost "off-the-shelf" commercial products, rather than custombuilt computer hardware and software. The basic engineering environment must be affordable. For both cost and technical reasons, it must be designed to be able to support incremental upgrades. Incremental upgrades would allow companies to add capabilities as they are needed. Commercial software products must be easy to install and integrate with other software already in use. These capabilities exist to a limited extent in some general purpose commercial software today, e. There are three critical elements to be addressed: Resolution of these elements will help ensure that independently developed systems will be able to work together. The common information model should identify the elements of the manufacturing system and their relationships to each other; the functions or processes performed by each element; the tools, materials, and information required to perform those functions; and measures of effectiveness for the model and its component elements. There have been many efforts over the years to develop information models for different aspects of manufacturing, but no known existing model fully meets the needs of a CAPE ernviroment. Some of the major phases which may be included in a system life cycle approach are, requirements identification; system design specification; vendor selection; system development and upgrades; installation, testing, and training; and benchmarking of production operations. Management, coordination, and administration functions need to be performed during each phase of the life cycle. Phases may be repeated over time as a system is upgraded or re-engineered to meet changing needs or incorporate new technologies. A software tool integration framework should specify how the tools could be independently designed and developed. The framework would define how CAPE tools would deal with common services, interact with each other and coordinate problem solving activities. Although some existing software products and standards currently address the common services issue, the problem of tool interaction remains largely unsolved. The problem of tool interaction is not limited to the domain of computer-aided manufacturing systems engineeringâ€”it is pervasive across the software industry. This new environment is being used to demonstrate commercially available tools to perform CAPE functions, to develop a better understanding and define functional requirements for individual engineering tools and the overall environment, and to identify the integration issues which must be addressed to implement compatible environments in the future. Several engineering demonstrations using COTS tools are under development. These demonstrations are designed to illustrate the various types of functions that must be performed in engineering a manufacturing system. Functions supported by the current COTS environment include:

Chapter 3 : Computer-aided process planning - Wikipedia

5) Computer aided quality control and CAD/CAM integration: Apart from inspection and testing, computers are used in a number of other areas of the quality control. All the applications of CAQC can be integrated with CAD/CAM to make the whole process of designing and manufacturing controlled by the computers converted into fully automated process.

Chapter 4 : Computer Aided Conception and Production in Mechanical Engineering

This book is a result of the professional work done in the International Federation of Information Processing Technical Committee IFIP TC5 "ComÂ- puter Applications in Technology" and especially in the Working Group WG5. 7 "Computer-Aided Production Management".

These models typically appear on a computer monitor as a three-dimensional representation of a part or a system of parts, which can be readily altered by changing relevant parameters. CAD systems enable designers to view objects under a wide variety of representations and to test these objects by simulating real-world conditions. Computer-aided manufacturing CAM uses geometrical design data to control automated machinery. These systems differ from older forms of numerical control NC in that geometrical data are encoded mechanically. Since both CAD and CAM use computer-based methods for encoding geometrical data, it is possible for the processes of design and manufacture to be highly integrated. The first source of CAD resulted from attempts to automate the drafting process. These developments were pioneered by the General Motors Research Laboratories in the early s. The second source of CAD was in the testing of designs by simulation. The use of computer modeling to test products was pioneered by high-tech industries like aerospace and semiconductors. The third source of CAD development resulted from efforts to facilitate the flow from the design process to the manufacturing process using numerical control NC technologies, which enjoyed widespread use in many applications by the mids. The development of CAD and CAM and particularly the linkage between the two overcame traditional NC shortcomings in expense, ease of use, and speed by enabling the design and manufacture of a part to be undertaken using the same system of encoding geometrical data. This innovation greatly shortened the period between design and manufacture and greatly expanded the scope of production processes for which automated machinery could be economically used. Computers are also used to control a number of manufacturing processes such as chemical processing that are not strictly defined as CAM because the control data are not based on geometrical parameters. Using CAD, it is possible to simulate in three dimensions the movement of a part through a production process. This process can simulate feed rates, angles and speeds of machine tools, the position of part-holding clamps, as well as range and other constraints limiting the operations of a machine. The continuing development of the simulation of various manufacturing processes is one of the key means by which CAD and CAM systems are becoming increasingly integrated. This is of particular importance when one firm contracts another to either design or produce a component. For example, designs can be altered without erasing and redrawing. CAD systems also offer "zoom" features analogous to a camera lens, whereby a designer can magnify certain elements of a model to facilitate inspection. CAD systems also lend themselves to modeling cutaway drawings, in which the internal shape of a part is revealed, and to illustrating the spatial relationships among a system of parts. CAD systems have no means of comprehending real-world concepts, such as the nature of the object being designed or the function that object will serve. CAD systems function by their capacity to codify geometrical concepts. Efforts to develop computer-based "artificial intelligence" AI have not yet succeeded in penetrating beyond the mechanicalâ€"represented by geometrical rule-based modeling. Other limitations to CAD are being addressed by research and development in the field of expert systems. This field is derived from research done in AI. One example of an expert system involves incorporating information about the nature of materialsâ€"their weight, tensile strength, flexibility, and so onâ€"into CAD software. By including this and other information, the CAD system could then "know" what an expert engineer knows when that engineer creates a design. Expert systems might involve the implementation of more abstract principles, such as the nature of gravity and friction, or the function and relation of commonly used parts, such as levers or nuts and bolts. Such futuristic concepts, however, are all highly dependent on our abilities to analyze human decision processes and to translate these into mechanical equivalents if possible. One of the key areas of development in CAD technologies is the simulation of performance. Among the most common types of simulation are testing for response to stress and modeling the process by which a part might be manufactured or the dynamic relationships among a system of parts. In stress tests, model surfaces are shown by a grid or mesh, that distort as the part comes under simulated physical or thermal stress. Dynamics tests function as a complement or substitute for building working prototypes. Simulation is also used in electronic design automation, in which simulated flow of current through a circuit enables the rapid testing of various component configurations. The processes of design and manufacture are, in some sense, conceptually separable. Yet the design process must be undertaken with an understanding of the nature of the production process. It is necessary, for example, for a designer to know the properties of the materials with which the part might be built, the various techniques by which the part might be shaped, and the scale of production that is economically viable. The conceptual overlap between design and manufacture is suggestive of the potential benefits of CAD and CAM and the reason they are generally considered together as a system. Another important trend is toward the establishment of a single CAD-CAM standard, so that different data packages can be exchanged without manufacturing and delivery delays, unnecessary design revisions, and other problems that continue to bedevil some CAD-CAM initiatives. Finally, CAD-CAM software continues to evolve in such realms as visual representation and integration of modeling and testing applications. As defined by SearchSMB. Retrieved on 27 January

Chapter 5 : Understanding Computer-aided Manufacturing and its Benefits

Computer Aided Quality Control Automated Inspection â€¢ Automated inspection can be defined as the automation of one or more of the steps involved in the inspection procedure.

It provides for the planning of the process to be used in producing a designed part. Process planning is concerned with determining the sequence of individual manufacturing operations needed to produce a given part or product. Process planning in manufacturing also refers to the planning of use of blanks, spare parts, packaging material, user instructions manuals etc. The term "computer-aided production planning " is used in different contexts on different parts of the production process; to some extent CAPP overlaps with the term "PIC" production and inventory control. Process planning translates design information into the process steps and instructions to efficiently and effectively manufacture products. As the design process is supported by many computer-aided tools, computer-aided process planning CAPP has evolved to simplify and improve process planning and achieve more effective use of manufacturing resources. Process planning encompasses the activities and functions to prepare a detailed set of plans and instructions to produce a part. The planning begins with engineering drawings, specifications, parts or material lists and a forecast of demand. The results of the planning are: Routings which specify operations, operation sequences, work centers, standards, tooling and fixtures. This routing becomes a major input to the manufacturing resource planning system to define operations for production activity control purposes and define required resources for capacity requirements planning purposes. Process plans which typically provide more detailed, step-by-step work instructions including dimensions related to individual operations, machining parameters, set-up instructions, and quality assurance checkpoints. Fabrication and assembly drawings to support manufacture as opposed to engineering drawings to define the part. Process planning is very time-consuming and the results vary based on the person doing the planning". According to Engelke, [4] the need for CAPP is greater with an increased number of different types of parts being manufactured, and with a more complex manufacturing process. Computer-aided process planning initially evolved as a means to electronically store a process plan once it was created, retrieve it, modify it for a new part and print the plan. Other capabilities were table-driven cost and standard estimating systems, for sales representatives to create customer quotations and estimate delivery time. Future development[edit] Generative or dynamic CAPP is the main focus of development, the ability to automatically generate production plans for new products, or dynamically update production plans on the basis of resource availability. In addition, a Manufacturing Execution System MES was built to handle the scheduling of tools, personnel, supply, and logistics, as well as maintain shop floor production capabilities. In Discrete Manufacturing, Art-to-Part validations have been performed often, but when considering highly volatile engineering designs, and multiple manufacturing operations with multiple tooling options, the decisions tables become longer and the vector matrices more complex. Unlike a Variant Process Planning system that modifies existing plans, each process plan could be defined automatically, independent of past routings. As improvements are made to production efficiencies, the improvements are automatically incorporated into the current production mix. Shop floor manufacturing abilities of BYJC were defined. It was determined that there are 46 major operations and 84 dependent operations the shop floor could execute to produce the product mix. These operations are manufacturing primitive operations. These factory operations are then used to define the features for the Feature Based Design extensions that are incorporated into the CAD system. The combination of these feature extensions and the parametric data associated with them became part of the data that is passed from the CAD system to the modified PDM system as the data set content for the specific product, assembly, or part. The ERP system was modified to handle the manufacturing abilities for each tool on the shop floor. This is an extension to the normal feeds and speeds that the ERP system has the capability of maintaining about each tool. In addition, personnel records are also enhanced to note special characteristics, talents, and education of each employee should it become relevant in the manufacturing process. Once physical components are identified, the items are scheduled. The scheduling is continuously updated based on the real time conditions of the enterprise. Ultimately, the parameters for this system were based on: Availability The parameters are used to produce multidimensional differential equations. Solving the partial differential equations will produce the optimum process and production planning at the time when the solution was generated. Solutions had the flexibility to change over time based on the ability to satisfy agile manufacturing criteria. Execution planning can be dynamic and accommodate changing conditions. The system allows new products to be brought on line quickly based on their manufacturability. The task of building and implementing the MES system still requires identifying the capabilities that exist within a given establishment, and exploiting them to the fullest potential. The system created is highly specific, the concepts can be extrapolated to other enterprises. Traditional CAPP methods that optimize plans in a linear manner have not been able to satisfy the need for flexible planning, so new dynamic systems will explore all possible combinations of production processes, and then generate plans according to available machining resources.

Chapter 6 : Computer-aided production engineering - Wikipedia

About this course. This course aims primarily at a clear understanding of the topics and basic notions related to problems and solutions coming from computer aided planning and control of production processes.

A Diploma supplement will be issued No Integrated study abroad unit s Integrated study abroad unit s The programme takes place in Aachen Germany. Integrated internships A mandatory industrial internship of nine weeks has to be completed within the study programme. Course-specific, integrated German language courses No Course-specific, integrated English language courses No The course of study can be taken entirely online No Digital learning and teaching modules Virtual classrooms Description of e-learning elements Lecturers upload learning materials onto an online platform so that students can use them before or after the lectures. Some professors also record their own lectures to share with students. Participation in the e-learning course elements is compulsory No Can ECTS points be acquired by taking the online programmes? No Can the e-learning elements be taken without signing up for the course of study? No Tuition fees per semester in EUR 4, It includes, among other benefits, a semester ticket covering public transport in the federal state of North Rhine-Westphalia. Costs of living The average cost of living and studying, including food, accommodation, personal and social expenses, and study-related costs, is estimated to be a minimum of EUR per month. Funding opportunities within the university Yes Description of the above-mentioned funding opportunities within the university A limited number of scholarships from various organisations are available to help students finance their studies. Please see the following website for a list of exchange programmes, scholarships, and grants as well as specific application requirements and conditions. Alternatively, students can contact the International Office directly for advice and assistance. They must have fundamental knowledge in the following subjects: The minimum requirements are as following: One of the following certificates must be submitted: Admitted students will attend an obligatory German language course at the beginning of September around one month prior to the beginning of the programme. Application deadline 1 March for the following winter semester German and EU citizens may apply until 15 July. Submit application to Please use the online application portal at: This also allows students to become more familiar with the university institutes and to take part in projects related to their field of study. The maximum working limit for off-campus work is days per year for non-EU students. Accommodation The staff of RWTH International Academy offers support in finding accommodation either in a student residence, in a private apartment, or in a shared flat. However, there are usually waiting lists for these rooms, and students will probably need to find private accommodation first. There are a number of options for finding private accommodation in and around Aachen, and RWTH International Academy can provide students with information beforehand and upon arrival. For short-term accommodation, there are many hotels and two youth hostels. Further guidance on student accommodation in Aachen can be found at: Among other things, students can make use of CV checks, LinkedIn profile upgrades, assessment centre training, and interview preparation. Furthermore, we organise excursions to companies and factories regularly so that our students gain first-hand insight into the industry. Our graduates have overwhelmingly positive prospects, as on average they: Specific specialist or non-specialist support for international students and doctoral candidates Welcome event.

Chapter 7 : Computer-Aided Manufacturing (CAM)

Computer-aided Manufacturing (CAM) is the term used to describe the use of computerized systems to control the operations at a manufacturing plant. These computerized systems assist manufacturers in various operations such as planning, transportation, management, and storage.

Chapter 8 : An Introduction to Computer Aided Production Management - Ebook pdf and epub

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