

„NX MANUFACTURING” – DIGITAL MANUFACTURING INTEGRATED SOLUTION FOR PLM

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ABSTRACT

This paper presents a description of the integrated manufacturing solution produced by Siemens NX MANUFACTURING INDUSTRY SOFTWARE - that respects the principles of the concept of Product Lifecycle Management (PLM). It's also made a succinct explanation of the origin and the way of defining the concept of PLM. All these notions are presented making reference to digital production system.

KEYWORDS: PLM, CAD, NX 7.5.

1. NEED CONCEPT AND COMPONENTS OF PRODUCT LIFECYCLE MANAGEMENT (PLM)

The emphasis nowadays on revenue growth and international competitiveness has forced manufacturing enterprises to seek new ways to accelerate product development through innovation, global alliances and sometimes through strategic partnerships. Relocating and market dynamics require a high degree of skill that no one would have thought of even ten years ago. But besides the new opportunities created, globalization has brought significant new challenges.

After some studies, it was found that most of the value chains of producers lack the skills to enable them to generate new products efficiently and to support them throughout the life cycle.

The main reasons are mainly the complexity of increasingly accelerated global markets and value chains.

To reduce costs and to penetrate global markets, enterprises are forced to disperse technology concepts and production and marketing activities, sales and service worldwide. Consequently it has become very difficult, so the value chain coordination and efficient management of products throughout their life cycle. In a rapidly changing

environment and distributed globally, all team members need immediate access to all product information. They must have security at every stage of the product life cycle that the information they access is accurate and current. Necessity of accessing current and accurate information is supported by the need of every team member of the company extended the concept to observe changes and their impact in a concrete situation, and sometimes you can even observed the impact they have on the general context products and programs.

Each location of a global enterprise may wish to optimize their own local database of products, which limits the relevance of extended enterprise database. Often this lack of relevance arises because the database can only be accessed locally. If the information is properly organized and distributed to all who need access, then they will form the basis for good decision making and will help the organization to achieve the next level of competitive advantage.

Teams geographically dispersed need easy access to information about processes and the ability to use information from the previous delivery programs, as this allows businesses remotely, reduce costs and resource consumption. Besides facilitating the reuse of components, manufacturers need access to design processes to take account of evolving product configurations in addition to other options

and choices. The purpose of a PLM system is that everyone should use it the same way. If we design a family of products, the engineer should number the components in a standard way so that another engineer from another location should recognize the components one needs to use for a particular product.

Establishing a managed product development structures provide global manufacturers to make decisions based on factual, accurate and current information. The companies, work teams and individuals will need less time to activities that add value, and identify the latest versions of the product or the appropriate design context.

Product Lifecycle Management (PLM) enables companies to efficiently manage, in terms of cost, the full life cycle of a product, from design and production ideas, service and recycling by using the following components: Computer Aided Design (CAD), Engineering Data Management (EDM), Product Data Management (PDM), Computer Integrated Manufacturing (CIM), Computer Aided Engineering (CAE) whose significance is presented below [3], [4]:

Computer Aided Design (CAD) refers to design and virtual graphical representation of physical objects using the computer in a virtual environment.

Software (Solid Edge, NX) refers to the first stage in the life cycle of a product, namely, the conception and design. The advantage of this design applications is that the information is in a virtual 3D environment (virtual prototype), the product can be optimized in terms of design, is achieved before the physical information can be transmitted easily, within the company and outside it.

- **Engineering Data Management (EDM).** While CAD applications have long been considered the core of PLM, there are other key points and product information at least as important. CAD applications describe a product based on geometric information, but do not fully describe. Graphical representation must be accompanied by other information called feature (metadata). Features are the information describing the product, namely tolerances, weight restrictions, material etc. These characteristics must be associated to geometric representation.
- **Product Data Management (PDM).** PDM applications have developed a new method to organize information in different formats, CAD and EDM in a single database. PDM has proposed a new way to organize different types of CAD formats that company can produce and manage them in a short time. PDM processes incorporate some form of information flows. The development of PDM systems was a necessary ability to configure these systems to allow implementation in companies that have different fields, but also to allow the implementation processes and practices within the company.

- **Computer Integrated Manufacturing (CIM)** was born based on the premise that information can and should be shared between departments of an enterprise. Specifically, the product information from the design department (CAD) can be transferred to and used by the manufacturing department electronically. This extends the period of CAM (computer aided manufacturing), which is the way to perform numerical control program, based on a CAD model. While the term CAM refers to a single product, CIM is meant to organize the entire production, and the use of company resources. CAM applications must be scalable to allow the transfer of product information, CAD department, and can be managed using a PDM application. In recent years, with the development of technology, there was the concept of Digital Manufacturing Digital Manufacturing (DM). To understand this concept, we start from the premise that implementing PLM in a company brings the greatest benefits for the manufacturing department because this department has a well-defined objective, to manufacture a product with well defined with size and precise tolerances and which uses the best plant resources. Digital Manufacturing is an approach that involves people, processes / practices and technology, which uses PLM information to plan, design and produce the first product, and optimizes manufacturing processes for other products to be manufactured using a minimum of resources.

- **Computer Aided Engineering (CAE).** With the advent of systems to create virtual prototypes (3D modeling CAD) that faithfully corresponding real objects appeared and need virtual prototype testing and analysis obtained. In other words, after the design phase of a product, there is a stage of life cycle, prior to factory testing, done in a virtual environment using a specialized CAE application. Digital simulation of the behavior of the product takes place in a controlled environment and using finite element analysis method, which involves dividing the product of a finite number of elements that can be analyzed in context.

2. SIEMENS PLM PORTFOLIO SOFTWARE INDUSTRY

The solutions offered by Siemens PLM Software Industry are:

- **Teamcenter** (Fig. 1) is the most widely used PLM software. Teamcenter empowering innovation and improves productivity by connecting people involved in the development and manufacture of products with product knowledge and about the processes they need to succeed.
- **NX** offers the broadest suite of CAD / CAM / CAE integrated (Fig. 2) and fully associative

industry. NX is found in the full range of development processes related to the design of product, manufacturing and simulation solutions that enable companies to encourage the use of best practices, knowledge capture and the reuse of products and processes.

- **Velocity Series** is a comprehensive family of modular and integrated solutions that bring the PLM SME and contains:
 - ✓ Solid Edge [1], [2] with synchronous technology
 - ✓ Femap
 - ✓ CAM Express
 - ✓ Teamcenter Express.

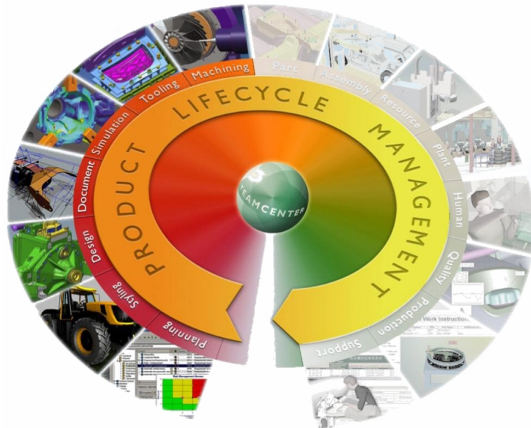


Fig. 1 TeamCenter – software PLM [5]

- **Technomatix** is a comprehensive portfolio of digital manufacturing solutions (Fig. 3) that deliver innovation by linking all manufacturing disciplines together with product engineering - from the sitting and design of enterprise process simulation and validation to the execution manufacturing.



Fig. 2 NX unified solution [5]

Technomatix PLM is built on the principle called Teamcenter manufacturing platform and offers the most versatile set of manufacturing solutions in the market today.



Fig. 3 Portfolio Technomatix [5]

PLM market is growing faster than any other software markets that are dedicated to business management. Siemens PLM Software is committed to creating solutions that customers need to remain leaders in a future dominated by PLM.

3. CONCLUSIONS ON PRODUCT PERFORMANCE “NX MANUFACTURING”

Manufacturing of NX[®]CAM application, called NX Manufacturing (Fig. 4), has a set of tools used to establish and modify machining operations on CNC machines. It is possible to create programs for milling machining, turning, wire EDM. Manufacturing Software NX applied technology and advanced processing methods to maximize efficiency of manufacturing engineers and NC programmers.

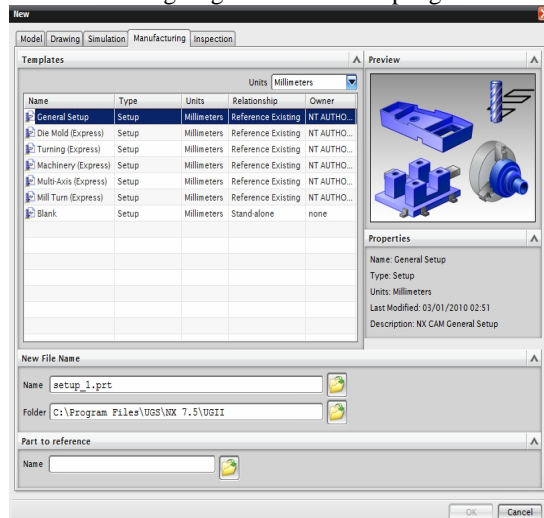


Fig. 4 Window opening “NX Manufacturing”

Manufacturing NX [5] is completely integrated into the product development NX solution, which leads to the same high level of compatibility with other formats and associative CAD file. Integrated

software package Teamcenter, NX Machining helps the user to follow the patterns and results and also allow for team communication. NC programmers can directly access comprehensive tools for design, installation and drawing within a single unified system. Design created by manufacturing associatively implies that design changes are automatically propagated to the processing operations.

Working techniques possible with NX manufacturing are:

- Routing by 2, 3, 5-axis, drilling, processing based on features, engraving;
- Turning and combinations of milling and turning;
- Processing of electrical erosion;
- Coordinate Measurement;
- Geometry translators
- Library data tools;
- Check tool paths (ISV).

NX® CAM - Integrated Simulation and Verification (ISV) is a new generation, which allows NC programmer to validate instruments and movement trajectories machine by digital simulation of the programming session.

The software is created distinct modules and ensures that material removal simulation tools path, by simulating movements of the machine tool. The common use of advanced simulation technology with three-dimensional representations of parts and verification methods that collision and frictions, ISV eliminate the need for costly equipment as a possible step verification error-free manufacturing. ISV is completely embedded in NX CAM, allowing for simultaneous simulation and validation process with effective scheduling, in the context of immediate feedback in real time.

Simulation and verification of a manufacturing process in the digital world can significantly improve the likelihood that the task to be executed as planned, without error in the real environment

In the NC processing, there is a number of issues that the developer and manufacturing engineer would like to validate frequently before running a machine tool operation.

This ranges from checking of instruments proposed trajectory in terms of complete and accurate material removal without collision or friction, checking car wider global movement, to ensure that the travel limits are not exceeded and that there is no collision with any part of the machine or fixtures.

The discovery of these problems in an early stage in the planning cycle minimizes planned periods exceeding the time required for reprogramming and the danger of scrap parts.

Because ISV product runs in NX CAM programming environment, it allows the programmer to run checking sequences as part of the programming task. It avoids both the need to export data from the program and the obligation to create and maintain duplicate models of tools and machines for use in external separated verification packages.

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