Digital development of products with NX9 for academical areas

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Abstract. International competitiveness forced the manufacturing enterprises to look for new ways to accelerate the development of digital products through innovation, global alliances and strategic partnerships. In an environment of global research and development of distributed geographically, all members of the joint teams made up of companies and universities need to access updated and accurate information about products created by any of the type employed, student, teacher. Current design processes involve more complex products consisting of elements of design created by multiple teams, disciplines and suppliers using independent CAD systems. Even when using a 3D CAD mature technology, many companies fail to significantly reduce losses in the process, improve product quality or product type to ensure successful innovations to market arouse interest. These challenges require a radical rethinking of the business model, which belongs to the field of design, which must be based on digital development of products based on integrated files. Through this work, the author has proposed to provide both synthesis and transformations brought news of the integrated NX [1, 2, 3] from Siemens PLM Software 9, following a news results detailed documentary study, and personal results obtained by applying the same version, the digital and integrated development of a product type device test beams. Based on educational license received for NX 9 was made a detailed study of the innovations made by this release, and the application of some of them went to graphical modelling and getting all the documentation of a test device bearing beams. Also, were synthesized in terms of methodology, the steps to take to obtain graphical documentation. The results consist of: 3D models of all parts and assembly 3D model of the three-dimensional constraints of all component parts and not least respectively all drawings and assembly drawing. The most important consequence of the paper is the obtaining of integrated files that can be subjected to further analysis type CAE / CAM / PDM software components by the same company. Additional advantages related files by the synthesis of integrated CAD / CAE / CAM / PDM.

1. Digital Integration and PLM Aspects – "Product Lifecycle Management"

Digital integration is the stage a community tends to in order to enter the global network [4]. When talking about digital integration and development we refer to many aspects of the daily life starting with electronic commerce until getting digital products needed in any field including health and education. Electronic commerce and applications in information and communication technology (ICT) as components of the digital development of a society as a whole have become the engines of the economic development, significantly influencing the world we live in. It should be noted that from this

impact on the daily life generated by technological breakthroughs the developed countries are the first to benefit. The increasing discrepancy between developed and poor countries, especially visible economically and socially, is worrying also from the perspective of information and communications technology. The rapid expanding the Internet and "digitization" of society among developed countries creates in the less developed countries real problems of integration according to the technological changes. For the majority of less developed countries or there has been or there is an optimum moment to join global networks of information able to propel them towards welfare However, it is not important only to be ready on time; without sustained and consistent effort, developing countries will find it much more difficult to bridge the already existing gap between them and the rest of the rich world and the use of new technologies will remain a phenomenon characteristic only to economically prosperous countries. Digital integration creates new market opportunities for companies and individuals, removes barriers that traditionally suppresses the flow of information and allows movement of goods to and from developing countries, promoting efficiency as the ultimate goal. Students can learn more about the world and about themselves using the global network. Business men can learn about new opportunities available on the market and management techniques likely to improve the company performance. Central and local government offices can provide better public services. Individuals can communicate with their friends and family and can inform virtually about any area of interest. Digital integration can offer developing countries new ways to improve their social, economic and political life. Ideas and opportunities for a better life are becoming easier to access as information and communication technologies are becoming cheaper and cheaper. All multinational companies wishing to expand business area and optimize profit have increasingly sought to focus more on less developed countries too.

Responding to the general industry trends dictated by environmental compliance, management complexity caused by globalization, shortening the time for launching a product on the market, the increasing levels of personalization and innovation of the designed products, Siemens Industry Software [5] provides an integrated portfolio of software solutions for product development, fundamentally oriented towards ensuring a high level of efficiency in production, increasing profitability and meeting the expectations of the product delivery. The main challenges industry faces today are related to:

- managing the growing complexity of design and production;
- improving both processes and outcomes in relation to changes in terms of complexity and diversity of product performance, quality and innovativeness;
- reducing costs and optimizing resources without compromising quality;
- reducing product delivery times.

Among the most important results obtained by companies using SIEMENS design products, we mention:

- Issues identified and resolved more quickly;
- Greater production flexibility;
- Less waste, more products;
- Investment decisions validated;
- 80% fewer problems after production of machinery or equipment designed;
- design modification reduced from 90% to 60%;
- Simplified production processes;
- Reduced product development time;
- Improved collaboration between departments and external suppliers.

One of the key phases of product development is to produce prototypes [6]. This phase follows the design and construction phase after the technological processing of the production process, as final stage in product development and as testing for mass production preparation. For this reason, the information appearing during production of the prototype is one of the key factors in the decision making with large series of products or giving it up. The pace of developing new products today and the global market demands require companies to adapt quickly to new conditions and constant

adoption of new technologies. In recent years, the rapid prototyping technology, supported by computer-aided design (CAD) has become an inevitable engineering tool. Reduction of product development because of innovation and constant fight on the market and the increasing complexity of products and the need of real models for a qualitative assessment such as shape, size and control functions are all factors that influenced the rapid development of this technology and its implementation in many areas of engineering. Studies on industry made by analysts suggest [7] that the vast majority of products which actually represents 70% of company revenue today will be withdrawn within a period of 5 years. Most concepts do not reach the market, and among those available on the market between 50 and 70% fail. Thus, new product development has become essential for the existence and success of any company. To face market pressures every company should create a platform for continuous innovation. This platform is an integrated business approach based on information and consists of people, processes / practices and technology known in industry as Product Lifecycle Management (PLM) [8]. For example, Teamcenter produced by SIEMENS manages complete information about this product from marketing, production concept, design (CAD), analysis (CAE), processing (CAM), digital manufacturing (DM), sale, maintenance, service, to withdrawal and recycling. Figure 1 illustrates the influence of PLM concept influence on the incubated stages of business, development, maturity, decline and end of life of the product. It is clearly seen that the time to launch the product on the market is much smaller when applying PLM concept, which leads to lower launch costs in manufacturing. Also, the periods of development, maturity and decline, profit is maximized and the lifetime of the product is growing significantly.

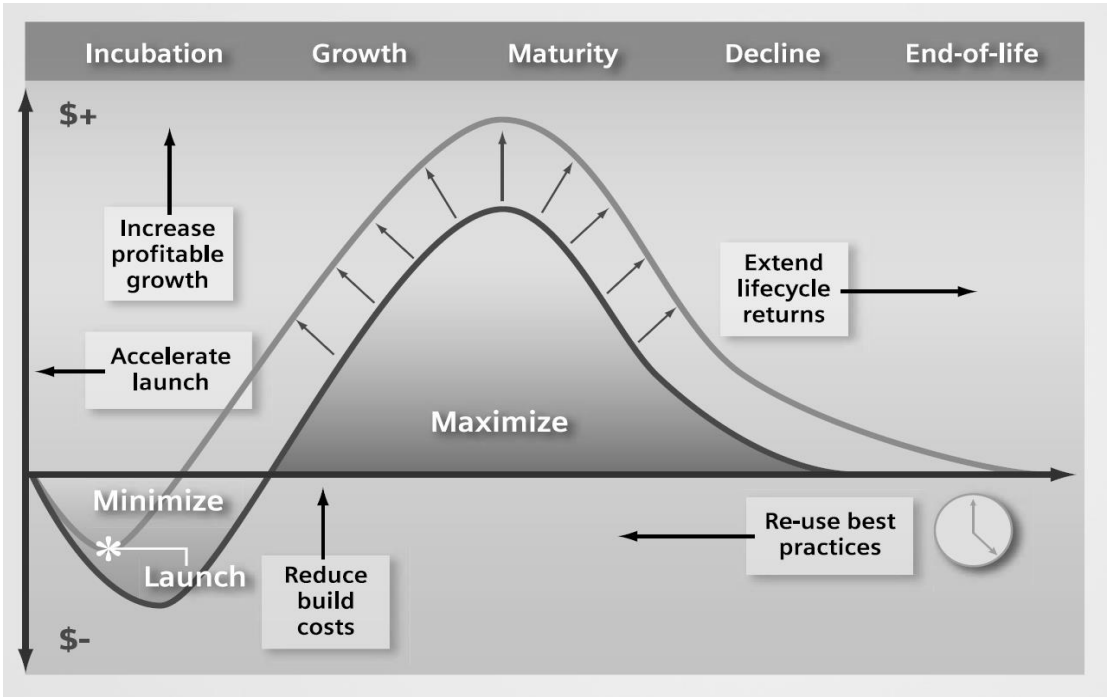

Figure 1. Long-term business benefit of PLM concept.

2. Present day evolution and performance of NX SIEMENS product

The software package NX currently under SIEMENS property, appeared in 1969 and was originally known as Unigraphics, then much later, in 2002 acquired the name of NX. Since 2007, the NX has introduced the Synchronous technology that comes to revolutionize the 3D modelling work because allows designer to act directly using the mouse over certain parts of the generated body and easily modify a shape, which has not been seen up to that moment. In the NX 9 version 9, the synchronous technology was extended to the 2D changes in that it allows operations of „shooting" the edges, under

the name of „Synchronous Sketch". The supremacy of all these tools is because they can be used in the same file in a single interface. The key benefits of this integrated software are: immediately propagate changes into all components of the project, there are no transfer files because all the information is found in a single file, it is possible to purchase and subsequently use complementary modules, with the development of the company without affecting interpretation unit of the designed project. We should not forget that the Parasolid modelling is based on the Parasolid nucleus which is very powerful and flexible, being used even by competitors. In the process of reverse engineering, NX takes the points cloud resulted from a 3D scan, it evaluates it, possibly fixes it and turns it on a surface or solid, which subsequently transform with editing commands in order to obtain new complex geometries. NX 9 allows the opening [9] of both IGES Step transfer files and other files created by other CAD systems. Basically Siemens NX became a fully integrated solution for the conception and design of complex systems with specialized components such as those below, for the following industry sectors:

- Automotive industry - reverse engineering, concurrent engineering, multidisciplinary design (mechanical and electrical), CAE analysis (fluid flow, mechanical strength and impact analysis) complex assemblies, realistic visualization, etc.
- Aero and marine industry - parts and complex assemblies, CAE analysis (fluid flow) and multi-axis machining.
- Consumer goods industry - areas with unique design, complex molds, visualization and rendering.
- Machinery and equipment manufacture industry- complex assemblies and multidisciplinary engineering

This integrated design solution with history and experience of over 40 years offered the highest level tools for modelling and analyzing multidisciplinary specialized industrial fields as mentioned above.

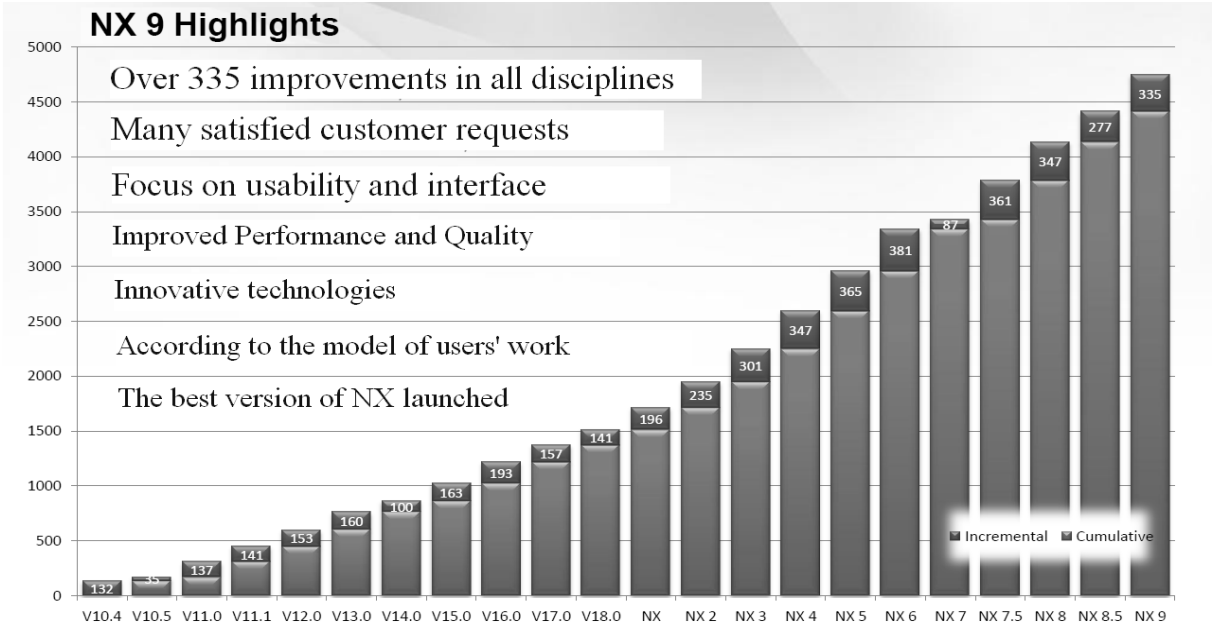

Figure 2. NX evolution.

NX 9 version has an improved module of "Distributed Memory Parallel" (DMP) and a new method of response at processor core level, significantly reducing computation times of the operation type input / output within the photorealistic visualization and analysis with finite elements.

3. 3D and 2D results

To obtain overall three-dimensional results, each item was achieved three-dimensionally starting from parameterized sketches which were applied commands for generating 3D features. Steps to be taken for modelling the items are [10]:

- Choosing the drawing plan by command "Sketch" and setting the position and orientation of the coordinate system
- Drawing a sketch by controls like „Profile", Line", „Arc", „Circle", „Rectangle".
- Editing the sketch by controls like „Fillet", „Chamfer", „Offset Curve", „Pattern Curve", „Mirror Curve", „Project Curve", „Quick Trim", „Quick Extend", „Make Corner".
- Setting 2D constrains 2D which keeps the form of the sketch as a geometric family.
- Insert all required sizes to complete the definition of the sketch.
- Based on drawings it will be generated 3D features to which Boolean operations of "Unite", "Subtract", "Intersect" type are applied
- Attaching materials of well defines physical – mechanical properties.
- Opening an assembly file type and insertion, based on 3D constraints, of each item in order to generate a file that contains the 3D model of the entire assembly.

As a case study it was considered the generation of a test device for load-bearing beams for which all parts were modelled geometrically and all the execution drawings were obtained, the overall drawing. Figure 3 and figure 4 illustrate the hook subassembly and whole device less the anchoring cable and fastening hook.

Regarding the results of 2D it should be noted that the following steps must be run, namely:

- Switching to mode "Drafting".
- Defining the paper size and representation scale.
- Establishment of European or American type of projection
- Imposing the baseline projection and getting other screenings.
- Technical sizing of the drawing obtained and adding tolerances of form and position, and size tolerances respectively.

Figure 3. Hook subassembly.

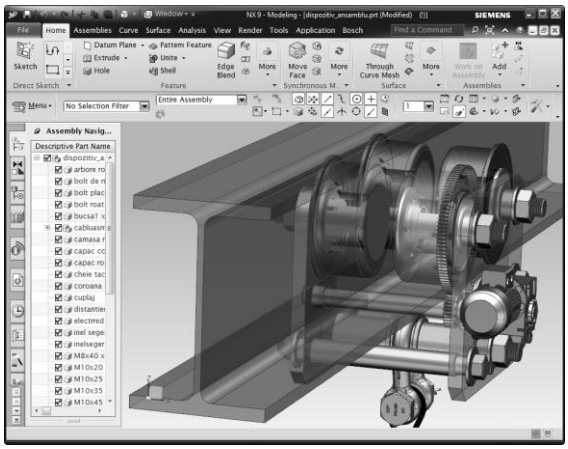

Figure 4. Device assembly.

Figure 5 and figure 6 shows the dialog box where it is set the paper size and type and the projection systems, i.e. the 2D result obtained.

4. Conclusions

Mechanical design capabilities of NX 9 are unmatched in terms of computing power, versatility, flexibility and productivity digital product development environment usually provide. The latest version of NX 9 includes new features and technological innovations that provide increased flexibility and product development up to 5 times more productivity, removing old paradigms related to flexibility and productivity when working with 2D data and large assemblies.

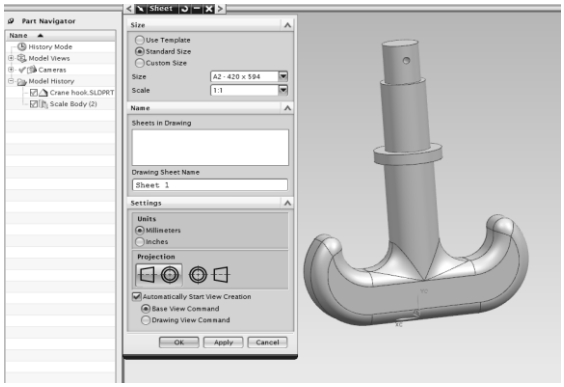

Figure 5. Setting box for the 2D drawing.

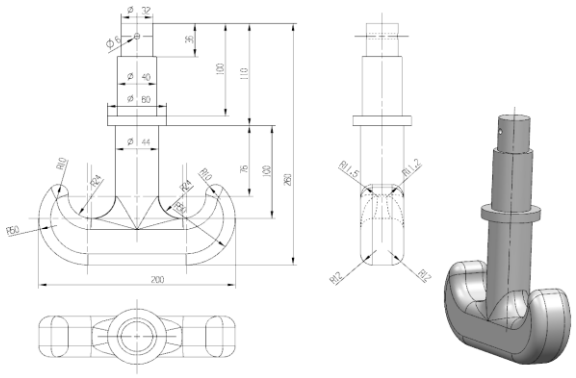

Figure 6. Execution drawing for the hook.

NX 9 offers the widest range of CAD / CAM / CAE integrated applications (figure 2) and fully associative in industry. NX is found in the full range of development processes related to product design, manufacturing and simulation that enable companies to encourage the use of best practices, by capturing and reusing the knowledge on product and process.

The case study demonstrates the device beams tried all these additional capabilities of NX 9 software. Ribbon interface of version NX9 helps users find, understand and use directly and efficiently controls through a small number of clicks without having to resort systematically to the Help page. The ribbon previews very well most common commands and in addition, unlike other similar interface, allows complete customization. Also to be mentioned as a novelty is the functionality "Multi-Touch" which allows the use of tablets and touch type Display sites and gestures interpretation of mouse or stylus type. The benefits of integrated files are as follows:

- using a single database and a common software infrastructure to provide information in real time, allowing managers to take better decisions;
- eliminating transfer files that can lead to errors;
- increase the quality and speed of data access is provided by single database covering all functional areas of the company;
- integrated data provides better efficiency in terms of decision support and assistance to users.

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