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NX SIEMENS - INTEGRATED SOLUTION OF PLM MECHANICAL DESIGN

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ABSTRACT

This paper presents a description of the integrated solution for the SIEMENS NX design – meeting the principles of the concept Product Lifecycle Management (PLM). There is also a succinct explanation of the origin and the way of defining the concept of PLM. All these notions are presented making reference to the prototype design of an equipment of digging potholes *for planting trees.*

KEYWORDS: PLM, CAD, NX 7.5.

1. GENERAL CONSIDERATIONS ON PLM CONCEPT

PLM term did not exist until 1999. [5] Before this year, the notions related to the product technical data management was called the *Product Data Management* (DPM) or sometimes engineering data management (EDM). Many PDM software suppliers had their origins in CAD, CAM and / or CAE and the main purpose of PDM systems was the management and control of large and complex data structures of CAD/CAM /CAE/Cax systems. In 1999, the main PDM systems included features for document management, configuration management / BOM, management and control of basic workflow. Currently, there is a standard universally accepted descriptive definition of the product lifecycle management. However, there are some accepted formulations such as that of *Anselmi Immonen* and *Antti Saaksvuori* [2] who consider that "the product life cycle management is a systematically controlled concept for managing and developing products and information about products". PLM provides management and control of the product process: product development, production and marketing of the product, manufacturing and delivery to customer, control of product information throughout its lifecycle. ***Product lifecycle management*** **(PLM)** is the process of managing the entire product life cycle, from conception, through design and manufacture, to service and marketing. PLM integrates people, data, processes and business systems and is the digital data backbone of a product for companies and extended enterprise partners with all employees. PLM is a comprehensive vision for the management of all data related to product design, production, support (service) and the final withdrawal of manufactured products from the market. PLM is associated with product manufacturing, but management structure can be used for software development and service delivery as well. The PLM concept was originally introduced where safety and control were extremely important, namely aerospace, medical devices, military and even nuclear industry [3]. In recent years, manufacturers of precision tools, industrial machinery, consumer electronics, packaged goods and other industrial complex products have discovered the benefits of PLM and therefore have adopted specialized software in PLM field. In other words, the PLM software involves the integration of information about market requirements with CAD, CAM, CAE activities, production planning and digital manufacturing and product data management (DPM). The PLM Software can be used to automate product data management and data integration with other business processes, such as enterprise resource planning (ERP) and *Manufacturing Execution Systems*.A Manufacturing Execution System is a control system for managing and monitoring the progress of the product being manufactured in the factory workshops. The PLM software enables companies to coordinate the entire product life cycle effectively, from generating ideas, design and manufacturing, including service until abandon. Manz

PLM software was developed and they included include:

- *Teamcenter, Siemens PLM Software* product;
- *ENOVIA MatrixOne and ENOVIA SmarTeam - Dassault Systemes* products;
- *Windchill, PTC* product;
- *SAP* PLM;
- *Oracl*e PLM.

2. CONCEPTIONS AND DESIGN OF MECHANICAL PRODUCTS

application allows for a complete design [4] and integrated [1] (Fig. 1) solution in the mechanical field, including top tools and methodologies for:

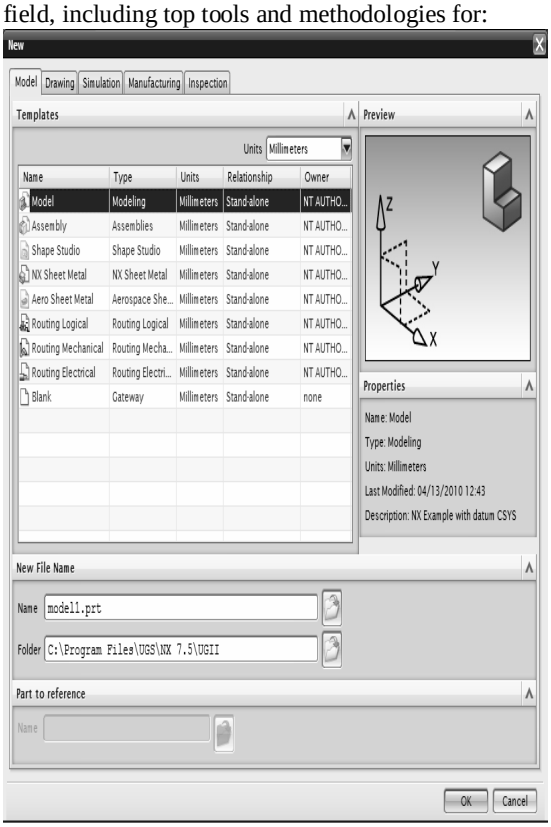

Fig. 1 One integrated window to open NX.

- **Comprehensive performance modelling**, which allows for continuous use of the most productive modelling approaches - from explicit modelling of surface and solid to parametric direct modelling specific to the modelling process and modelling not based on historic features using models from any CAD system.
- **Creating active layout and overall design**, which allows for interactive work with large assemblies, involving the application at the same time of both the main assembly management and the technical modelling tools at singular reference level.
- **3D annotation and drawing acc. to standards**, which simplifies the creation of product documentation by directly using the 3D model.

2.1 Exhaustive Performance Modelling

NX provides the most powerful and flexible modelling solutions available - solutions that allow for the free use of modelling techniques that best meet the design requirements. All NX modelling tools are built on the core geometry modelling of *Parasolid® Siemens*, the most powerful, robust, and used modelling base in the world. It should be mentioned that NX is supporting *Design Freedom* based on *Synchronous Technology* from Siemens.

This unique approach enables unification of modelling which is based on characteristics of history parametric and feature-based modelling in the same design environment.

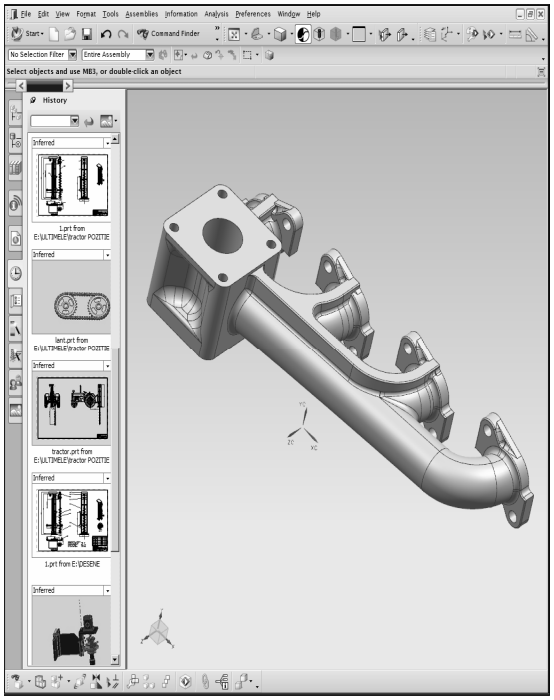

Fig. 2 Important piece of the other CAD systems.

The *Design Freedom* has the advantage that designers can use NX synchronous modelling tools for modification of the 3D geometry originally created in other CAD systems or other modelling techniques (Fig. 2). Whether the data in question were imported from another CAD system or, if native type parametric or non-parametric.

NX Synchronous tools allow designers to work directly with any geometry, without the need to rebuild the data. These synchronous tools allow designers to use parametric features without limitations of features - history. Reusing existing projects is becoming increasingly important as manufacturers today are trying to expand their market share by establishing product platforms

The NX solution allows the use of any part or any assembly as a pattern for new designs, introducing best practices and knowledge of the product in the

development processes. Powerful capabilities to create the layout and assembly of solution design environment NX provides a diverse range of interactive capabilities that accelerate overall design and engineering processes.

2.2 Creating Active Layout and Overall Design

Powerful capabilities to create the layout and assembly of solution design environment NX provides a diverse range of interactive capabilities that accelerate overall design and engineering processes.

NX Active Mockup enables designers to easily navigate through large ensembles and establish a detailed work environment for subassemblies and components. *NX Active Mockup* uses *JT technology* as an industry standard to allow designers to upload thousands of components from multiple CAD systems in just a few seconds. *JT Technology* is a highly flexible CAD neutral format that allows designers to represent fully all relevant information about the model.

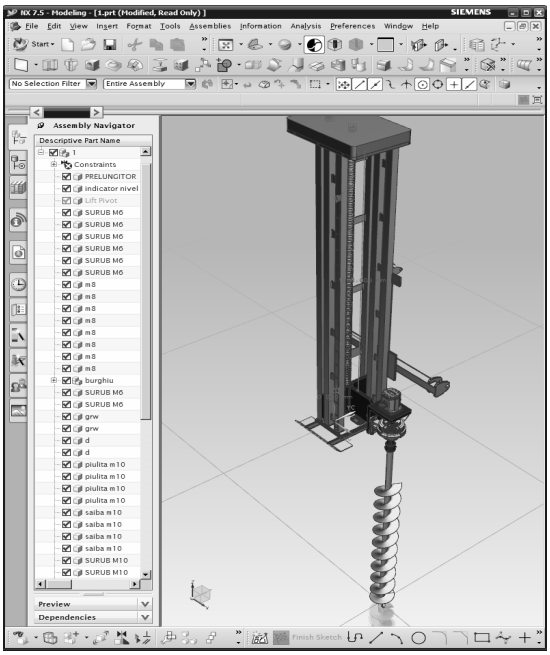

Fig. 3 Prototype equipment for digging potholes for planting trees

JT format and technology allow loading assemblies with up to a million pieces with an exceptional interactive performance. Therefore, *NX Active Mockup* provides designers with real interactive design capability that enables the display, cutting and rapid rotation of very large assemblies.

NX provides design tools and validation of assemblies that allow designers to identify and resolve process problems since the early stages of the project development - without resorting to physical realization of the prototype. NX allows designers to interactively test distance and interference in order to detect and eliminate compatibility issues. Designers can interactively simulate the assembly motion for the verification and optimization of the components of motion as presented in Fig. 3 and Fig. 4 respectively which illustrate the equipment separately and respectively plugged to the power plug of the tractor. By using automatic planning of the assembly path and movement profiles, designers can optimize products for assembly, disassembly, maintenance and service.

Designers can record and later play back sequences of movement and assembling because videos can be shared with the workshop as assembly instructions. These easy to use tools can be applied to quickly validate design changes as the product evolves.

NX also provides tools that allow designers to create and validate routed subsystems for electrical and mechanical designs. Libraries and tools for mechanical system layout are available to install pipes, steel pipes and components.

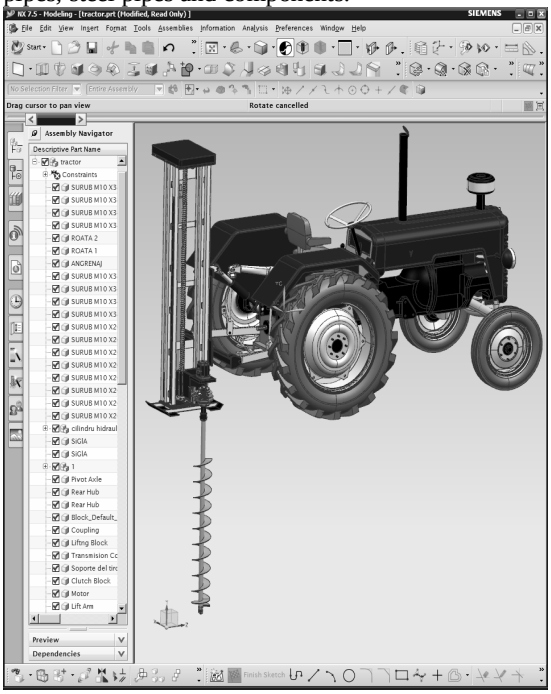

Fig. 4 Prototype equipment attached to the tractor.

Tools for electrical components layout allow designers to place electrical cables, cable channels while libraries of standard components are available for electrical systems. *NX Electrical Routing* includes support in the design and manufacture of electric beams, eliminating the need for physical prototypes, and reduces the time required for product development, allowing designers to carry out the interface, to validate the design rules, to view the route in a 3D diagram and identify the location of certain cables and electrical connections.

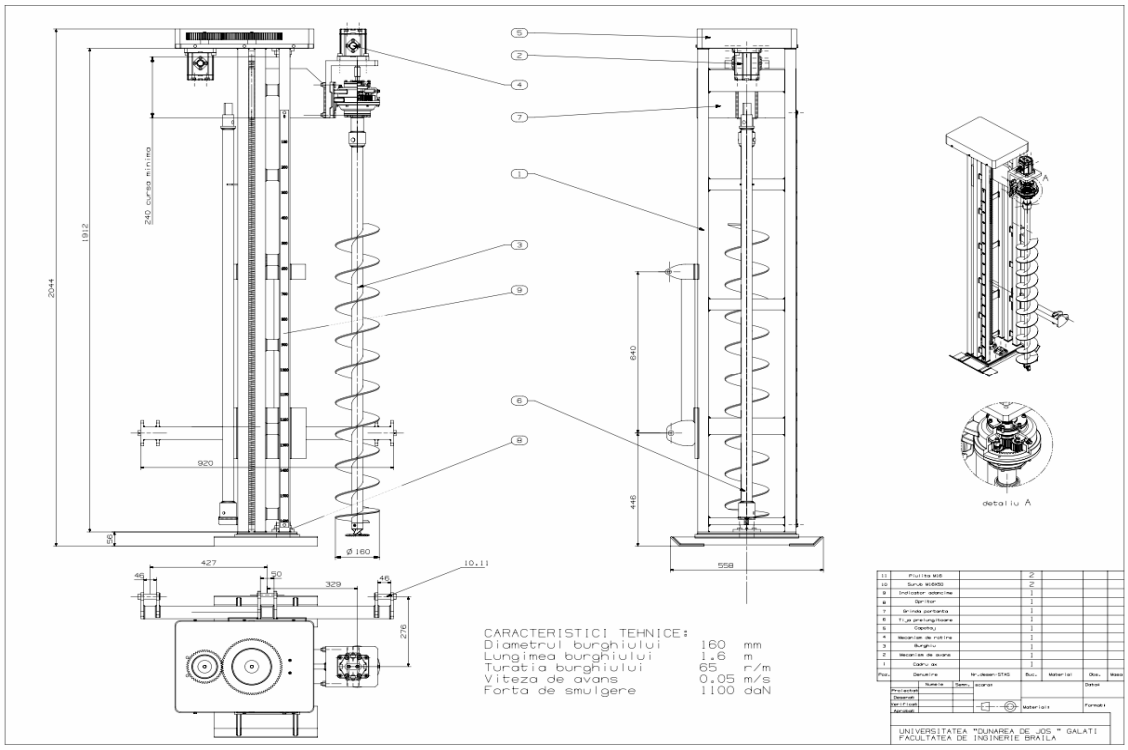

Fig. 5 Overall drawing of the potholes digging equipment.

2.3 Annotation and Drawing According to Standards

NX provides production-based tools to document designs as 3D or 2D products (Fig. 5) acc. to standard and annotations related to manufacturing information (PMI).

It is possible to use these capabilities to ensure appropriate communication of the design intent within the development organization. This improves product quality by removing potential sources of error in the interpretation of the design environment and accelerates the process used for sending designs to manufacturing.

The drawing capabilities offered by NX enables designers to rapidly develop and create view drawings, detailing and dimensioning that geometric dimensioning and tolerances drawings (GD & T) as NX complies with industry standards for annotating 3D model

3. CONCLUSIONS

NX mechanical design capabilities are extremely valuable in terms of power, versatility, flexibility and productivity that they provide to digital product development environment.

The NX solution brings about extensive improvements at design level, simulation and manufacturing, provides improved productivity, smarter decisions and thus it deliveries higher quality products.

The NX 9 latest version includes new features and technological innovations that provide increased flexibility, product development and up to 5 times more productivity, removing old paradigms related to flexibility and productivity as when working with 2D data and large assemblies. All NX modules related to functions of the type CAE and CAM are integrated into the same interface and observe the principles of concurrent engineering. NX allows opening both transfer files type *IGES Step* and other files created by other CAD systems.

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