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SIEMENS PLM SOLUTION APPLIED TO THE DESIGN OF AGRICULTURE FACILITIES AND EQUIPMENT

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ABSTRACT

This paper presents a brief description of the SIEMENS PLM solution and its application to the design of machinery and equipment for agriculture. Also it is shown in detail the concept of Product Lifecycle Management - PLM. Specifically, the author reviews the stages of modelling the type of equipment used for compaction rollers, levelling and grinding clods. The results refer to the 3D models of each marker, the 3D model of the assembly and the related 2D drawings.

KEYWORDS: PLM, CAD, *NX 7.*

1. GENERAL ON PLM CONCEPT

Product Lifecycle Management (PLM) is an integrated business approach, based on information, made up of people, processes / practices and technology that cover all the aspects of life of a product, from design to production, use and maintenance, culminating in the removal from operation and recycling in order to increase efficiency and productivity. PLM solutions produce a cohesive platform for [4]:

- ✓ Optimizing relationships over the life cycle and within the organization;
- ✓ Maximizing the lifetime value of the product portfolio of the business;
- ✓ Creating a unique registration system to support the various needs of data.

The benefits of a company after the successful implementation of PLM concept and the impact caused by this change within the organization are:

- ✓ **Reducing the duration of creating a new product (Time to Market) -** This is the major benefit of implementing a PLM system.
- ✓ **Improved Productivity of the Statistical design;** it was shown that an engineer spends 25-30% of his working time seeking information. PLM reduces this time almost completely; the engineer no longer has to memorize a lot of locations where each project is stored because the PLM system will provide all the information he needs instantly.
- ✓ **Improved precision in design and manufacturing processes**. An important benefit brought by PLM is that any member of a team involved in the development of a Project (CAD, CAM, and CAE) operates with the same sets of data that are always updated and always working with the latest versions. If an engineer is working on a „master file" , it is known that it is only one; if someone else opens it, they know that that is a copy, so that the superposition of inconsistent information is eliminated, even if those people are working at the same time.
- ✓ **Data security -** protection of intellectual capital is essential in a company that is on the market with strong competition such as the machine manufacturing market. By the PDM component within a PLM system, information is protected giving different access rights to each user.

Better control over changes - A PLM system must allow a user to create and maintain multiple revisions and versions of any document in the database, regardless of department or product development stage.

Introducing the PLM concept brings many changes in the organization, from how data is stored to how people interact with each other.

Although PLM is more than the sum of these concepts we consider that the following systems compose the PLM system: Computer Aided Design (CAD), Engineering Data Management (EDM), Product Data Management (PDM), Computer Integrated Manufacturing (CIM), Computer Aided Manufacturing (CAM) and Computer Aided Engineering (CAE).

2. GENERAL ON SOIL PREPARATION WORKS

The Seedbed is the soil layer at the surface of the field being processed and where the seed is to be placed. The works to achieve a seedbed are very important being the first steps in getting a culture that comes up evenly and which subsequently provides the premises to obtain a good harvest. The objectives of this work are to create a good loose seedbed and grounded over the depth of sowing likely to provide seeds equal germination and emergence conditions. A good quality seedbed must meet certain qualitative requirements: loosening the soil to be made only to the depth of sowing, the soil to be placed in depth, seed to be put in contact with the ground as closely as possible, for a good water absorption and growing young plants embryo crosse as fast as possible the loose soil above so that emergence be uniform.

In practice there are very different situations as regards preparation of the seedbed, depending on:

- soil humidity (surface and depth)
- type of soil (clay, sand, etc);
- soil working system (if a good plough work can be done or not);
- range of agriculture machinery available on the farm;
- amount of plant debris from the previous culture;
- seed depth and size (with small seed the seedbed should be very well grounded).

In case of the most common conventional soil work system the seedbed is prepared initially by ploughing tillage followed by various types of machinery works: harrows, rollers, levelling combined with cultivator.

Harrowing which is performed by shred disc harrow to chop the clods and loosen the ploughed land has high efficiency when the soil is ripe, damp. Ideally it occurs immediately after ploughing and gives the following advantages: loosen the surface soil layer preventing the loss of water from deeper layers of soil and facilitates the creation of a favourable seedbed. Rolling – Rolling is carried with smooth, ring or spiral rollers and provides compaction, levelling of soil and clods shredding.

The advantages of this work are: it presses the soil layer to the surface when the soil layer is very loose, it crushes clods and facilitates further work with harrow discs, thus facilitating the contact of the seeds with soil. Rolling is effective when the ploughing is done in conditions of drought resulting boulders and before sowing small seed plants.

Levelling is performed with the smoothing or levelling blades removes bumps on some flat land and gives the following advantages: it prevents water loss from the soil, seed emergence is uniform in levelled land, it prevents stagnation of rainwater.

3. STEPS TO GENERATE PARTS

The steps to be followed for each item in 3D part modelling are:

• Choice of work plan for drawings.
• Drawing a preliminary draft.
• Adding 2D constraints necessary to define a family sketch drawing. This means that, no matter what sizes are attached in the next step, the resulting form should be similar to the initial one.
• Adding all requires sizes for completing the sketch.
• Modelling space shapes starting from parameterized sketches by simple commands or by using surfaces as props.
• Attaching a material with well defined properties.

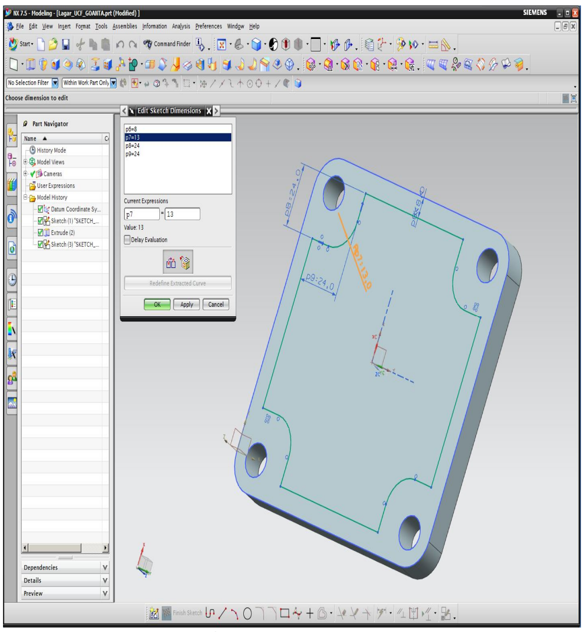

Fig. 1 Sketch performed to obtain a slot/cut

• Obtaining 2D projections views, sections, details or axonometric representation.

• Technical sizing of the drawings obtained, including notation of roughness, tolerances and dimensional and form deviations.

Thus, Figure 1 illustrates a constrained and sized sketch which was put to the command "Extrude" to obtain a slot through the "Subtract" option [3].

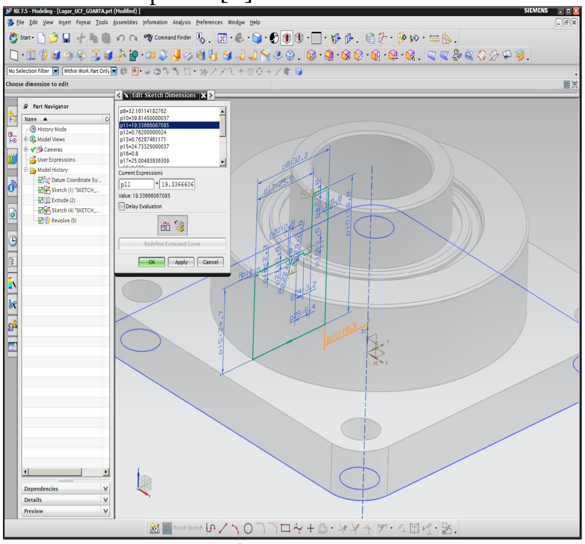

Fig. 2 Sketch used for command "Revolve"

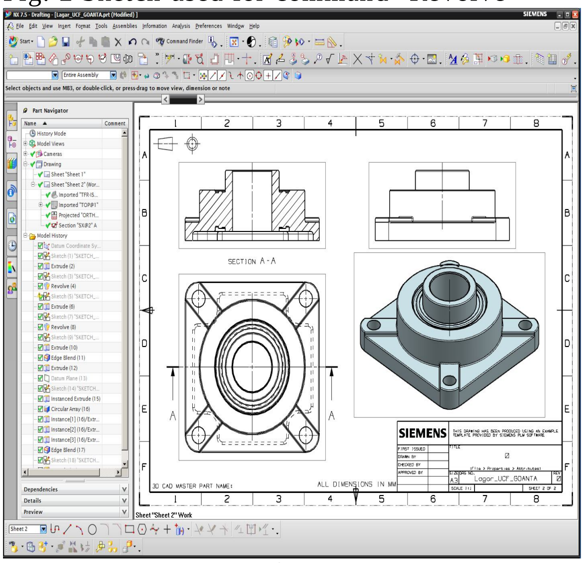

Fig. 3 Projections of the unlisted modelled piece

In Figure 2 it is represented another sketch that was used with "Revolve" for generating components of the bearing elements of the piece of type bearing [1].

In Figure 3 there are the projections of the unlisted 3D modelled piece.

4. MAKING SUBASSEMBLIES AND THE FINAL ASSEMBLY

The ultimate goal of getting an assembly can be achieved in two variants, namely [2]:

• Making a projection from top to bottom which involves modelling each item separately and subsequently achieving the desired assembly by adding components originally made.

• Making a projection from top to bottom which involves development of new components within an assembly already started, meaning that the related file is already open and allows for the creation of new components.

In Figure 4 it is represented the coupling flange subassembly to be found in the final assembly of the roller.

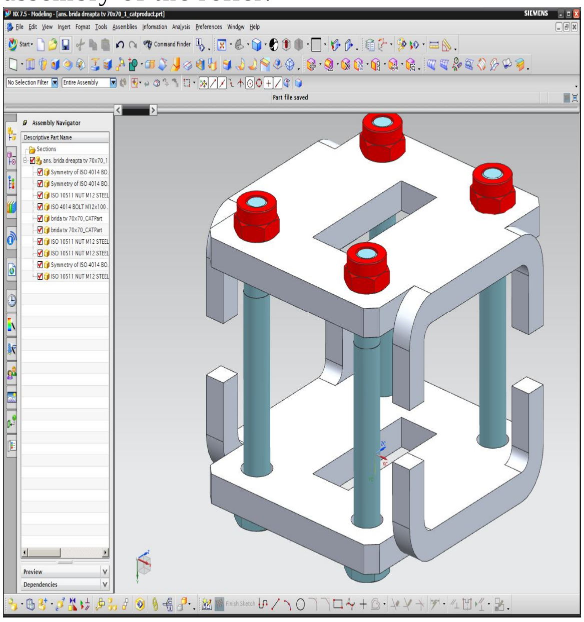

Fig. 4 The coupling flange subassembly.

It should be noted that in the first method of generating assemblies, placing parts piece by piece is followed by the imposition of 3D constraints relative to landmarks previously inserted. In figure 5 is the 3D roller assembly.

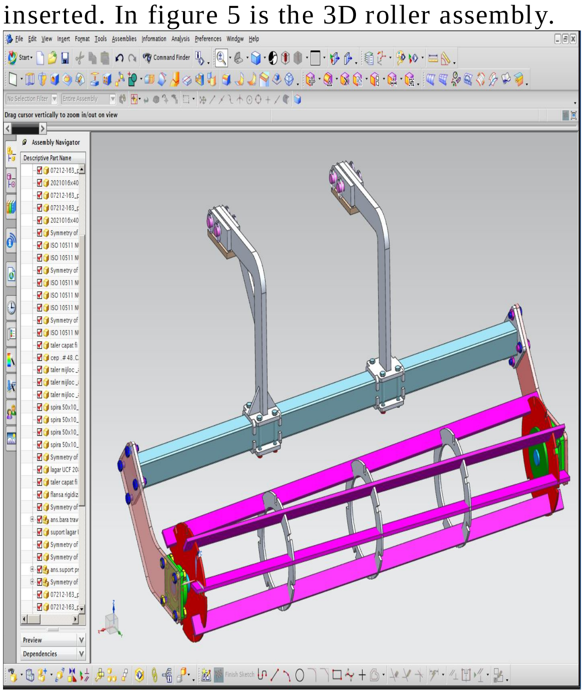

Fig. 5 3D roller assembly

5. REZULTS AND CONCLUSIONS

The main result of this paper is the practical realization of the whole three-dimensional model. Figure 6 presents the real roller version, ready for installation.

Fig. 6 Real roller ready for installation

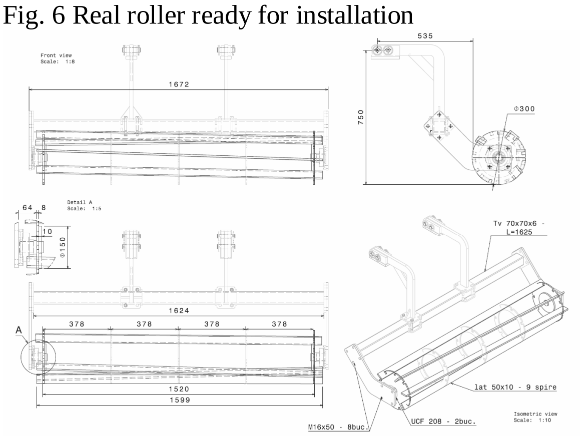

Fig. 7 Extract from assembly drawing

Under this overall drawing there were the execution drawings of each item and the assembly drawing of which is a part is shown in Figure 7.

Regarding the conclusions we can draw from using NX package for the design we can mention:

- • NX is a fully integrated CAD / CAE / CAM latest generation software.
- • NX has an easy to use interface and is applied in many areas of mechanical design, including the design of machinery and equipment for agriculture.
- • NX allows to open both the transfer file type IGES, STEP and other files created by other CAD systems.
- • NX observes the principles of concurrent engineering.
- • All NX modules related to CAE and CAM type functions are integrated in the same interface.

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