ASPECTS ON THE USE OF VERSION AUTODESK INVENTOR 2012 WITHIN AUTODESK INVENTOR SUITE

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ABSTRACT

This paper aims to present some new aspects in using Autodesk Inventor software within the Autodesk Suite for Industrial Design. A series of steps in making a vice-type assembly are also briefly presented.

KEYWORDS: CAD, parameterized modeling, Autodesk

1. INTRODUCTION

Created and developed by the American company Autodesk, AutoCAD is currently one of the most well known and used aided design systems and is considered the initiator and promoter of modern CAD applications. Launched in 1982, AutoCAD was the first program of its kind that run on computer systems at the time known as "microcomputers", Intel 8080, today's PCs. Version 1.2 adds to the unanimous demand of the users in April 1983, an important feature, the figure sizing. In fallowing versions version, 1.3 and 1.4, bring a large number of improvements, both in interface and especially to the controls Line, Array, Zoom, WBLOCK, Hatch or Fillet. In 1983 and 1984 locations of the program are developed for German and French markets. In October 1984, version 2.0 (Release 5) includes numerous additions to the existing controls and system variables, together with a capital optimization program, becoming the main development platform for the next three years. With version 2.1, Autodesk introduces the first 3D drawing commands and a programming language into a CAD software. Called AutoLISP, this opened new opportunities for small firms in creating different solutions with AutoCAD as the primary development platform. Also, in 1984, the first official Autodesk training center is founded in response to numerous requests for knowledge of the program that used to come from industry. In June 1986, with version 2.3 (Release 8), Autodesk announced the first sale of 50,000 licenses worldwide. Their success has finally established them as the most common commands in all CAD systems at that time on the market, Autodesk contributions being rewarded with numerous awards, one of the most important, "The Best CAD Product", being offered in a row for 10 years by the prestigious magazine PC World magazine. Since 1990, Release 11 includes network support, allowing installation of a license on a server program to be run by licensed users in front of workstations. The numerous enhancements to Autodesk developers, including the visualization of shaded three-dimensional bodies, make AutoCAD an important solution to the aided design, recording an impressive number of licenses sold (500,000). The success of the program creators even put them in difficulty, Autodesk employing the best programmers and engineers available at the time. Results are seen immediately in the next version, Release 12 (June 1992) and 13 (November 1994), which offers a great many improvements, while continuing to run on DOS operating systems. First version appears on the Windows platform (1993, Release 12), becoming one of the most popular CAD solutions with graphic support of this operating system. The turnover of Autodesk company has increased to 465 million dollars in 1994, allowing investment in Release 14, and also in other projects initiated in parallel with AutoCAD: 3D Studio 4, 2, etc. The year 1995 means the first Autodesk site developed continuously to become the ideal meeting and information place for the CAD specialists. By the end of the year, more than 3 million licenses are sold, of which 1.3 million are AutoCAD and AutoCAD LT 300.000. The 3D Studio development platform brings the first Windows version of its 3D Studio Max.

Mechanical Desktop, designed and created in support of mechanical engineering, is distributed as part of AutoCAD Release 13, AutoCAD Designer with technology 3, Assembly Modeler 1.0, 3.0 and Auto Surf Auto Vision. Year 1997 brings the highly anticipated Release 14, known as R14, with native support for Windows, and a new version of the well-known animation program 3D Studio Max 2.

Implementation of the latest technologies resulting from years of research and experience gained by the company made from AutoCAD R14 one of the most popular and stable design programs. The new version has brought many improvements in 2D and 3D, making the AutoCAD software an industry standard with manifold applications. Its benefits enjoyed first the mechanical engineers who have received a very good version of Mechanical Desktop 2, then the architects, structural engineers, cartographers. In late 1997, AutoCAD reaches a record of 1.5 million licenses sold. For the third millennium, Autodesk launched AutoCAD 2000 and a suite of new products: Mechanical Desktop 5 integrated into AutoCAD 2000, Inventor 4 and improvements in all versions of the existing programs. Also now Autodesk proposes Point A design portal as an on line meeting place for the CAD specialists. In 2002-2003, Autodesk makes full use of AutoCAD 2000 to develop new products AutoCAD 2002 and AutoCAD 2004, Revit but also acquires and develops solutions, applicable in construction. As a separate development direction, it is worth mentioning the company interest in Inventor product at version 6, 7 and 8. The first nine versions of Inventor have a greater claim, names of car FORD: Mustang - V1, Thunderbird - v2, Camaro - V3 Corevette - v4, Durango - v5, Prowler - V5.3, Viper - V6 Wrangler - V7, Cherokee - V8 Crossfire - v9. With Inventor, Autodesk is able to redefine parametric-based aided design, with new options for generating three-dimensional solid parts, management of assemblies, creating sheet metal parts and the welded parts. In Inventor, Autodesk includes modules for finite element analysis, kinematics analysis of assemblies, and many facilities for obtaining rapid route of piping and electric cables. The appearance of Inventor 11 includes AutoCAD and Mechanical Desktop at an excellent price, in an attempt to expand the capabilities of users. To increase sales it was launched Autodesk Inventor Suite which until year 2009 contained AutoCAD, AutoCAD Mechanical, Mechanical Desktop and Inventor. In 2010 Mechanical Desktop was dropped out, all attention focusing on two main directions: AutoCAD and Inventor, to which were added one by one various versions of AutoCAD specialized to professional sectors and new software packages such as Autodesk 3ds Max, Autodesk Alias Products, Buzzaw Autodesk, Autodesk Design Review, Autodesk Maya, Autodesk Moldflow Produscts, Autodesk Navisworks, etc.

What has AutoCAD brought about in these 25 years? A lot, the program has always been at hand, ready to draw the simplest or most complicated mechanical parts of a hydroelectric dam, it was conceived on the desks of millions of school students, many of whom the engineers today, using it continuously for 20-29 years. It has millions of licensed users on all continents, in large industrial and construction companies, universities and design firms, dedicated journals, the Autodesk University, special training schools, specialized congresses, an impressive community of fans on the Internet. Many of the ones I wrote above are well known, as is the AutoCAD software (which is new, but is sometimes taken as manufacturing company, Autodesk), which became part of our lives, a friend you can rely on , with whom you have developed a tool always provocative, willing to work tens or hundreds of hours on a project. Autodesk products have been developed over recent years, have matured and changed and become more competitive, but knew how to remain friendly, regardless of the industry which is addressed to, accessible to whom needs it, the user's imagination being the only limit to what it proposes to accomplish.

2. ELEMENTS OF NOVELTY SPECIFIC TO AUTODESK INVENTOR 2011

This chapter has dealt with some of the novelties introduced by Autodesk Inventor since its version 2011.

2.1 Dynamic introduction into the sketch environment

Inventor 2011 now offers dynamic introduction to outline the most common sketching commands. The dynamic introduction into the sketch environment provides a "head up" (Heads-Up Display - HUD) presentation to help you focus on the sketch area. When the sketch area is active, data entry fields next to the cursor display dynamically updated information associated with the cursor movement. The "head up" presentation (HUD) lets you create sketch – like geometry - eliminating an entire stage during sketching. Dynamic introduction in the sketching environment helps engineers design more freely and more directly without interruption of the creative process.

2.2 Inventor Fusion Technology Preview

Autodesk® Inventor® Fusion Technology Preview is a revolutionary technology of "Digital Prototyping" from Autodesk which changes the way 3D mechanical applications work.

Inventor Fusion anticipating technology is intended to give mechanics designers the opportunity to provide feedback to possible future capabilities.

Inventor Fusion Technology Preview is totally interoperable with Autodesk Inventor by Inventor 2011. Integration of Inventor Fusion technology with Inventor provides users with two base modelings. If Inventor Fusion is installed, the import of a basic body launches Fusion and the basic body can be edited in Fusion environment. Once the Fusion editing session is ended and the environment Inventor is brought again, the model is redisplayed in the graphics window and all the new or modified features are presented.

The Inventor Fusion Changes Manager allows users to identify and manage changes made to a part or assembly via Inventor Fusion technology.

Inventor Fusion technology facilitates the exchange of data with AutoCAD and other 3D CAD systems. One can open projects in AutoCAD Inventor Fusion technology to easily create designs or combinations of digital prototypes. The ability to use mixed data formats is one of the many friendly and intuitive advantages of the Autodesk Inventor Fusion technology.

2.3 Inventor iLogic Technology

The **Inventor iLogic** Technology is now fully integrated into Inventor 2011. Inventor iLogic amazingly simplifies the design based on rules for any Inventor user - even for those who have little or no experience. Inventor iLogic enables designers and engineers to capture and include engineering or production knowledge directly into virtual models. The Inventor iLogic Assistance Module allows easy creation of "smart" parts and assemblies defining multiple product configurations and update them automatically in real time based on logical relationships between the parameter designs. While the parameter design allows capturing the design intent, Inventor iLogic ensures the capturing of the design intelligence to define the overall behavior. ILogic allows users to add knowledge of existing projects with total support for iParts and iAssemblies. Rules can be added to any model or Inventor set, turning them into a treasure of reusable knowledge.

2.4 iCopy

The new feature iCopy in Inventor 2011 makes it easily to customize widely used assemblies by automating the process of copying and positioning of similar components in the assembly. ICopy automatically resizes multiple copies of standard elements to fit into a project by referring to a few key restrictions, such as points and connecting trails. ICopy combines structural modeling with adaptability to allow subassemblies to change shape so as to fit the model. Instead of performing painstakingly to resize each copied element iCopy can be used to resize correctly and insert each object into the whole. ICopy saves time and is particularly effective for structural engineering which needs to quickly go through multiple design iterations of the structure elements.

2.5 Interoperativitate Alias-Inventor

For projects that require "smooth" and neat forms , industrial designers and mechanical engineers take advantage of CAD interoperability between Autodesk ® Alias ® Design package and Inventor, achieving high quality data exchanges. With the new Autodesk ® Alias ® Design for Inventor ® 2011, Autodesk raises this interoperability to a new level.

Autodesk Alias Design Alias Design for 2011 package now includes *Alias Design for Inventor*, an additional application that directly works with Inventor, providing free-form 3D modeling. It can be installed directly in Inventor and is fully integrated.

Free-form 3D modeling with *Alias Design for Inventor* enables a new level of integration between design, engineering and manufacturing.

2.6 CATIA translators

Autodesk Inventor 2011 facilitates interdisciplinary collaboration among several industries and products. In addition to CATIA V5 files, one can now open, import, place, or "drag and drop" models CATIA V4 in Inventor files. Associativity is maintained but the imported models behave as if it were created with Inventor. One can choose from several options to import, the one that will create the desired features model.

The ability to read CATIA V4 and CRG formats, Inventor users will now be able to handle more models created with CATIA. In addition, developments applied to the existing built –in translators offer improved capabilities for import and export of many file formats out of those already available.

3. SYSTEM REQUIREMENTS, CAPABILITY AND INFRASTRUCTURE OF AUTODESK DESIGN SUITE 2012

Family suite for Autodesk creation and design offers greater access to powerful industry specific design tools through economic software packages easier to install, implement and manage than

individual products. Suites enable standardization of work in different design departments which offers greater flexibility in innovation and the ability to more easily meet demands of ever-changing business. In addition, the suite enables exploration of new products and technologies by users and gives them a consistent experience, which significantly facilitates learning and working with multiple Autodesk tools within the same project. Family Suite 2012 includes Autodesk: Autodesk Design Suite 2012 Autodesk Product Design Suite 2012 Autodesk Factory Design Suite 2012 Autodesk Building Design Suite 2012 Autodesk Design Suite 2012 and Autodesk Infrastructure Plant Design Suite 2012.

For average-size kits to 1,000 pieces, Autodesk Design Suite can be installed on Microsoft ® Windows 7 (32-bit or 64-bit) Home Premium, Professional, Ultimate or Enterprise Edition, or Microsoft ® Windows Vista ® (32-bit or 64-bit) Home Basic, Home Premium, Business, Enterprise, or Ultimate Edition (SP2) or Microsoft ® Windows XP Professional (SP3) or Professional x64 Edition (SP2) (1.2), while for large assemblies it is recommended only 64-bit versions. System requirements for working with average kits to 1,000 pieces are:

- Intel® Pentium® 4, 2 GHz or faster, Intel® Xeon®, Intel® Core™, AMD Athlon™ 64, or AMD Opteron™ processor, or later (3)
- 2 GB RAM or more (4)
- Microsoft® Direct3D 10® or Direct3D 9® capable graphics card (5)
- DVD-ROM drive (6)
- Microsoft® Mouse-compliant pointing device
- 1,280 x 1,024 or higher screen resolution
- Internet connection for web downloads and Subscription Aware access
- Adobe Flash Player 10 (7)
- Microsoft® Internet Explorer® 6.x through 8
- Microsoft® Excel 2003 through 2010 for iFeatures, iParts, iAssemblies, thread customization, and spreadsheet-driven designs
- Microsoft .Net Framework 4.0

While for much larger ensembles, supplementation is recommended:

- AMD64 or Intel® 64 processor
- 8 GB RAM or more
- CAD workstation-class graphics card
- Microsoft .Net Framework 4.0

By comparing these data with those for of previous versions we found that for small assemblies there are no additional restrictions, but for large assemblies 2012 version requires an additional 2GB of RAM. Capabilities for Autodesk Design Suite 2012 package are presented in Table 1.

Table 1

Capabilities	St	P	U
Foundational design and documentation tools, extensive customization options, and native DWG file support	√	√	√
Access, integrate, and analyze CAD and GIS data	√	√	√
Integrate 3D models from other sources for multidisciplinary coordination and project review	√	√	√
Explore design options, analyze project performance, and deliver more consistent and coordinated documentation		√	√
Perform stormwater and sanitary sewer analysis	√	√	√
Create near-photorealistic renderings and animations data		√	√
Building Information Modeling for Infrastructure	√	√	√
Integrate 3D models interference management, and clash detection			√

Legend for Tables 1 and 2:

St. – Standard variant
P – Premium variant
U – Ultra variant

The infrastructure of the three versions of Autodesk Design Suite 2012 is presented in Table 2.

Table 2

Included Software Products	St	P	U
AutoCAD® 2012 software provides powerful design and documentation tools, extensive customization options, and native DWG™ support to take infrastructure projects further.	√	√	√
AutoCAD® Map 3D 2012 software is a model-based infrastructure planning and management application that provides broad access to CAD and geographic information system (GIS) data, helping geospatial and planning professionals make more informed design and management decisions.	√	√	√
Autodesk® Storm and Sanitary Analysis 2012 software* is a comprehensive hydrology and hydraulic analysis application for planning and designing urban drainage systems, highway drainage systems, storm sewers, and sanitary sewers.	√	√	√

Autodesk® Navisworks® Simulate 2012 software provides advanced tools for review and coordination of project information. Comprehensive 4D simulation and animation capabilities enable better design insight and predictability. Real-time navigation combined with review toolsets supports collaboration among the project team.**	√	√
AutoCAD® Civil 3D® 2012 software brings the power of BIM to infrastructure projects to help civil engineering professionals stay coordinated, more easily and efficiently explore design options, analyze project performance, and deliver consistent, higher-quality documentation—all within a familiar AutoCAD environment.	√	√
Autodesk® 3ds Max® Design 2012 software helps you create near photorealistic renderings and animations to tell the story behind designs. Dynamically link to civil data, validate designs, and better communicate project intent.	√	√
Autodesk® Navisworks® Manage 2012 software** is a comprehensive review solution for analysis, simulation, and coordination of project information. Multidisciplinary design data can be combined into a single integrated project model for interference management and clash detection. Navisworks Manage helps design and construction professionals anticipate and avoid potential problems before construction.		√

4. EXAMPLE FOR AN ASSEMBLY TYPE VICES

It must be said from the very beginning that Autodesk Inventor is the continuer of Mechanical Desktop but at much higher levels. The operating principle is parameterized modeling which offers the possibility of generating underlying sketches and 3D models and can be permanently altered in shape and size with direct and immediate implications on the final piece. Next we present several stages of three-dimensional modeling of a vice – tool with Autodesk

Inventor 2012. As a way of approaching the design of such an assembly, the starting point is the 3D modeling of each part separately so that all parts can achieve the vice by assembling as proposed in the project. The work environment is very friendly but unfortunately the color used is not nice, warm, as is with the competitors. Figure 1 illustrates the Inventor modeling interface and we captured the sketching/ drawings phase of the process of modeling the mobile jaw.
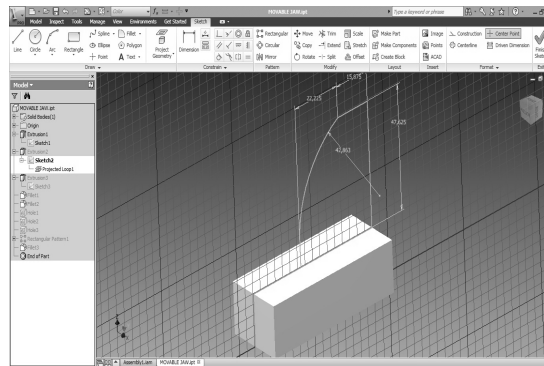

Fig. 1 Drawing stage

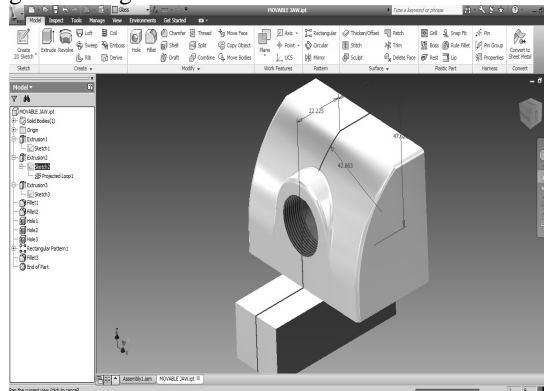The result of the mobile jaw drawing stage is given in Fig.3.

Fig. 2 3D model of the mobile jaw

Mention must be made that after achieving the three-dimensional models of all parts of the vice assembly, one can proceed to generate the assembly and finally obtain technical documentation for the proposed project. Figure 3 shows the designed assembly.
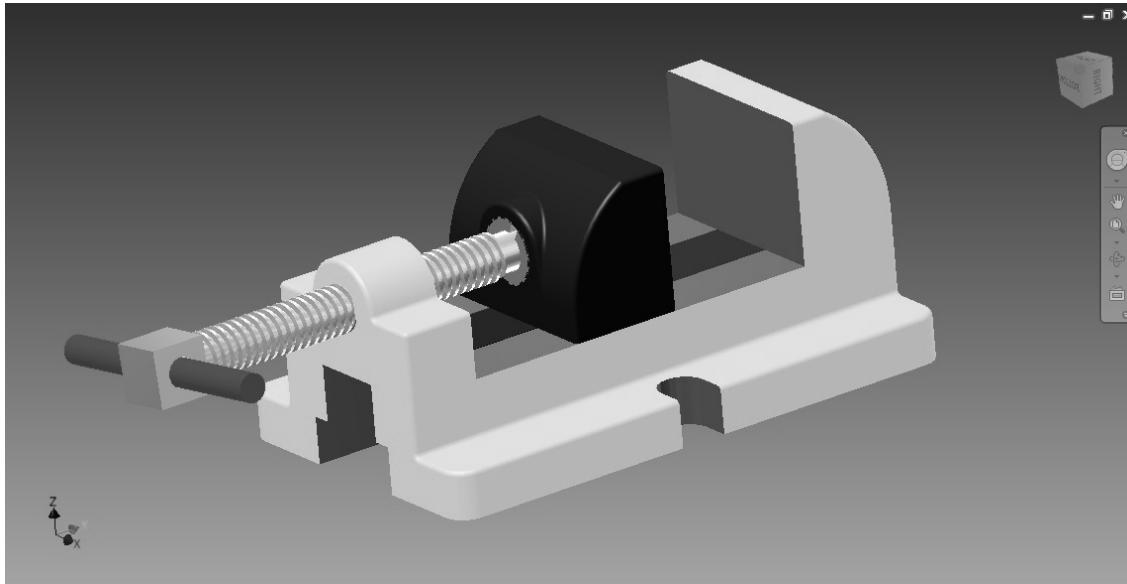
Fig. 3 3D model of the designed vice

2D documentation is very easy to get along with the necessary materials. An example of 2D design overview is presented in Figure 4.
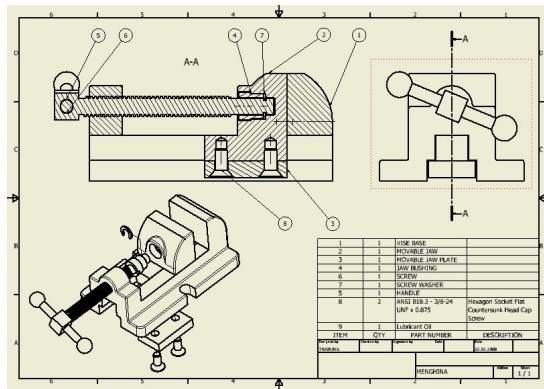

Fig. 4 Example of assembly drawing

5. CONCLUSIONS

The Autodesk ® Inventor ® 2012 Software product line redefines the term "Ease-of-Use" with a new revolutionary design challenge that provides these significant advantages to engineers who design, visualize, and simulate products:

*Inventor 2012 offers ultimate viewing capabilities to achieve impressive representations of projects to further help the transfer of information with partners in the design process.

*a powerful simulation tool in Autodesk Inventor 2012 has been developed to facilitate the creation and validation of multiple design iterations.

*the major areas this new version is focused on include: new methodology for design, rule-based design, next-generation visualization, interoperability and data transfer BIM (Building Information Modeling), drawing and productivity, simulation, design of injection tools and molds

In addition, Inventor 2012 includes a preview of the revolutionary new technology of "Digital Prototyping" (digital prototyping) from Autodesk that will change the way one is working with mechanical design software.

REFERENCES

[1] **http://www.catia.ro/articole/autocad/autocad.htm**
[2] **www.autodesk.com**
[3] http://www.manandmachine.ro/
[4] **Haraga Georgeta** *Various Decorative Shapes With Catia System,* Buletinul Institutului Politehnic din Iaşi, Universitatea Tehnică „Gheorghe Asachi" din Iaşi Tomul LVII (LXI), Fasc. 3, 2011.