Autodesk Inventor and Solid Edge Applications Addin for CAD Models Parameters Management

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Abstract

The article describes the Autodesk Inventor and Solid Edge applications Addin (software plug-in). The history of production information source in Engineering (2D drawing, 3 D model) is summarized in the introduction. The individual functions of the Addin are described in the next part. The Addin serves for simplification and acceleration of the work with creating 3D models and drawings. The Addin is designed for working environment of the parts, assemblies and drawings.

Keywords: CAD, Autodesk Inventor Addin, Solid Edge Addin, Models Parameters

1. History of Information Source

The necessary information for any machine production is based on design department data. The manufacturing information is transmitted between the various factory departments via an information source. During the years, the source was changed and developed.

Initially, a paper drawing was the basic bearer of the information for engineering manufacture. The geometrical information (shape and dimensions), material features and technological information was stated in part drawing. The list of used parts and the quantity (BOM - bill of materials) was stated in the assembly drawing. The information was filled into drawings manually. The information wasn't interdependent, moreover, there was big space for making mistakes.

The information stated in drawing was the input parameters for other dependent factory departments (see Fig. 1.). For manufacturing technology department - material features and manufacturing requirements. For purchasing department - material and its amount, standard and purchased parts.
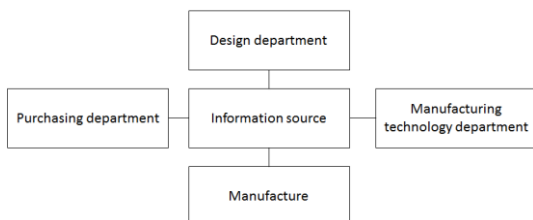
Figure 1. Schema of departments dependent to information source.

Due to computing technology expansion there was also a fundamental change in manufacturing. Not only the using of CAD (Computer Aided Design) software spread but also manufacturing possibilities of using CNC (Computer Numeric Control) machines.

After CAD software drawing documentation - 2D drawings - began digitize, in the beginning it was actually digitized with preserving basic information source - drawing. The information was still put manually. Just own drawing didn't go at drawing board, but in computer (see the Fig. 2.).

Fig. 2. *Designing at drawing board [1], and in computer [2]*

The more advanced CAD software (3D) brought the change of the basic information source (drawing) to 3D model. In comparison with the past times the part is defined by 3D model and its drawing. The drawing became "only" model viewing and its properties. Although this fact the important information (related to manufacture) is included in the drawing. In addition to clearly visible parameters with model viewing – like geometry and material of the part - a lot of other information are given in 3D model. Besides standard information assigned by CAD software (part description and number, author, weight, etc.) is possible to define own (user) properties. Moreover, the parts are interconnected due to the software types. Example, in assembly BOM can be listed only existing parts, compared to BOM and its manual filling in.

However, the passing time and increasing data caused the problem with their classification. The systems for CAD data management, so-called PDM (Product Data Management) were made. Due to these systems is possible to keep the order in datas – the placement of own models and drawings and their relations (BOMs), manufacturing technology information (NC programs) etc. Further is possible (due to PMD) to manage the data status. The system keeps information, if the data are in progress,

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checked, in revision process etc. Factories are sufficiently flexible and competitive, because of using these systems.

2. 3D Models Properties

PDM systems taking the information (in 3D software it is called properties) from 3D models. The most important property is, of course, part number (identical to drawing number). It's also a unique sign for data distinction. Other property is "Part description", that corresponds to part / assembly function. The material for the part manufacture must be specified. In CAD is available materials library, from which the required material can be chosen. The materials in library are fully defined, including designation via density to appearance. Part weight is automatically computed by material density from volume. Other properties are related to semiproduct used for part manufacture. They are two basic properties, "Dimension" and "Standard". Property "Dimension" consist of characteristic dimension defined by standard, if it's standard semiproduct, and length (eventually also width). In property "Standard" is included semiproduct standard – it is related to characteristic dimension. Further, other properties as author, who created it and creation date was included. In the drawing other properties are included. Except author and creation date are there regulations giving tolerances of dimensions, edges, corner etc.

However, much more properties are used in practice, and their quantity and values depend on each factory. Also the database of semiproducts is used. Each database item has its characteristic dimension, standard and material. Stock numbers are then assigned to each semiproduct and purchased part.

3D model properties have different placement in application standard user interface [3]. If the addin for simply work with properties (and connection to factory database) isn't installed to application, it's then complicated and slow properties filling for user in many placements. However, the user's productivity is with manually filling reduced user productivity. And it even brings making the mistakes.

A new addin is created for easier and quick models and drawings properties manage. It is described in the follow chapter. It enables the management of all these properties in one place, in one dialog.

In Table 1. are listed properties used in part model.

Table 1. Textboxes names in addin dialog for part and assembly model

Part model	Assembly model
Part description	Assembly description
Part number	Assembly number
Model author	
Model creation date	
Material	

| Density	
Weight	
Semiproduct dimension	Description by catalogue
Semiproduct standard	Producer name
Assembly number	
BOM (bill of materials) number	
Part type	

In Table 2. the properties used in drawing by the addin are listed.

Table 2. Textboxes names in addin dialog for part and assembly drawing

Part drawing	Assembly drawing
Drawing author	
Drawing creation date	
Edge lower limit	
Edge upper limit	
Corner lower limit	
Corner upper limit	
ISO 2768	
ISO 8062	

3. Addin Function and User Interface

Software for 3D design enable the using so-called addins. They are programmed functions which use application standard functions and objects. In fact they are calling standard functions within one programmed function. For programming addin is used API (Application Programming Interface). Applications producers provide API just for user customization. For example in application Autodesk Inventor it is API Object Model (Fig. 3.).
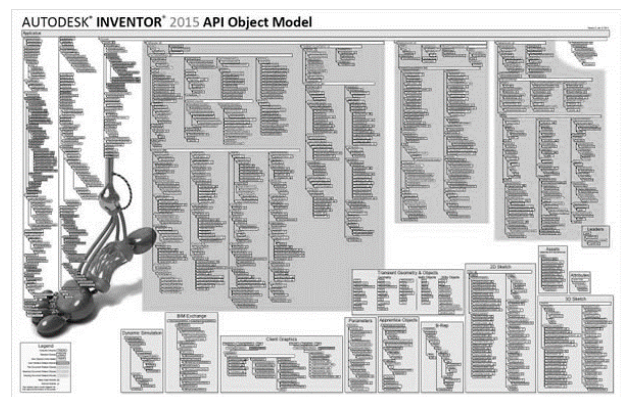
Fig. 3. Autodesk Inventor API object model [4]

Addin is created as class library (*.dll), which is automatically loaded by CAD application when it is application started. The addin is programmed in language called Visual Basic.

The described addin is created for Autodesk Inventor and Solid Edge applications. Each of them has own API schema, for this reason is impossible to use the addin over the applications. For each of applications is necessary to create the special one.

CAD applications have different working environment according to the type of opened document. The basic environments are for part environment, assembly and drawing. The available functions differ according to the environment. As it was described in Tables 1. and 2., different models / drawings have different properties. For that the addin function differs according to different documents type / working environment. Addin displays dialog, in which is a form to fill in the properties. For all working environments are common these textboxes:

Part (drawing) number – if it is filled in, there are visible textboxes for filling in semiproduct dimension and standard and also textbox for assignment a material. If part number isn't filled in, it's a purchased part. In that case are filled textboxes with part designation (dimensions) by producer catalogue. Other common textboxes are description of part or assembly, model author, creation date, weight, parent assembly number and BOM number.

3.1 Model Environment

3.1.1 Part Model

In figure 4. dialog is displayed. It is used as user's addin interface in part model environment.

Fig. 4. *The Addin dialog for part model environment*

Except common textboxes are shown other textboxes related to material and semiproduct in group called "Semiproduct". Part material can be selected from a drop-down list of material library. Semiproduct dimension – designation according to standard and relevant dimensions (length, eventually width) is filled in textbox "Dimension". The relevant semiproduct standard designation is filled in textbox called "Standard".

The right side of dialog is shown group „Part weight", in which is stated material density and part weight. The group also contains button „Part weight update", by that is possible to make (after change of material) update of part weight. When user press the button, the immediate material and part appearance change is carried.

In the dialog bottom side is shown document path, if it was saved. In right part are shown part maximal dimensions in each axes (X, Y a Z). There can be filled semiproduct dimension according to axes textbox values without manual control of part dimensions.

3.1.2 Assembly Model

In assembly environment is dialog appearance adapted to assembly properties (see Fig. 5.). Textboxes and buttons for assembly correspond to common textboxes.

Fig. 5. *Addin dialog for assembly model environment*

3.1.3 Purchased Part

Purchased part can be defined in part model environment and in assembly model environment too. For such part inclusion is important in group „Drawing number and part (assembly) description" let the textbox „Part number" empty. It is shown in Fig. 6. Then the group „Part designation and producer" is displayed. There is filled-in part designation by producer catalogue and producer name.

It is opened up part weight textbox at the same time. It is possible to fill in manually according to producer catalogue.

Fig. 6. *Addin dialog for purchased part*

3.2 Drawing Environment

Dialog can be shown only if there exist any drawing view at first sheet, else dialog will not be shown them. Textboxes values (drawing number, description, etc.) are derived by first included drawing view at first sheet. Also same textboxes (as model environment) are shown in dialog. There is shown main drawing view scale (first view scale) and eventually other drawing views scale.

If the textboxes values in drawing environment are changed, the changes are saved direct to model properties. After submiting the dialog by press button „OK" the title block is automatically included in all sheets and fill-in

scale of main drawing view, eventually other drawing views scale.

3.2.1 Part Drawing

Except part textboxes are shown also textboxes for part drawing in dialog in part drawing environment (see Fig. 7.). These are textboxes „Drawing author" and „Creation date" and in group „Accuracy and tolerances" are textboxes „ISO 2768", „ISO 8062" and state of corners and edges.

Fig. 7. *Addin dialog for part drawing environment*

3.2.2 Assembly Drawing

Except assembly model textboxes are shown other textboxes for assembly drawing in dialog for assembly drawing environment. They are textboxes including "Drawing author" and "Creation date" (see Fig. 8.).

Fig. 8. *Addin dialog for assembly drawing environment*

4. Conclusion

Created addin allows filling model and drawing properties at one place, in one dialog. It is not necessary to open model when the drawing is modified. The addin of the drawing environment fill the properties in model. In standard application it wouldn't be impossible without this addin. If the entry should be carried without the addin, it meant the necessity to open the model and fill in the properties in the model environment. By that is the time for filling properties shortened and making mistakes is minimalised. The addin also brings part automation for including title block and filled in drawing views scales.

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