How to cite this article:

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Title of article: „Model based definition in SOLIDWORKS®”

Mechanik, No. 1 (2019)

DOI: <https://doi.org/10.17814/mechanik.2019.1.15>

Model based definition in SOLIDWORKS®

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Need for exchanging details about designed structure among cooperating manufacturers and integration of various IT systems, forced CAX programs developers to change their attitude to technical documentation. The method of notation reference MBD (Model-Based Documentation) data and its implementation in SOLIDWORKS® MBD are described.

KEYWORDS: *computer aided manufacturing, drawingless technical documentation, SOLIDWORKS, MBD module*

Introduction

The finale of the design work involves the description of the part or submission in the technical documentation. 2D drawings are its traditional form, including with marked geometrical dimensions and tolerances. For the needs of the subsequent stages of production, drawings are made of assembly, procedure, operation, etc. [2].

With the advent of CAD (computer aided design) in the industry, digital 3D models began to be used and based on them to generate 2D drawings (projections obtained directly from the 3D model). Such solutions are still used today in most companies using design support tools. However, the future belongs to MBD (model based definition).

This method belongs to the numerical product definition – DPD (digital product definition), i.e. recording of geometry, construction requirements, comments and specifications in the form of electronic data. MBD is one main file that contains 3D geometric information, dimensions and tolerances (GD&T – geometry dimensions & tolerancing), as well as annotations (FT&A – functional tolerancing & annotation) [1].

The base model definition allows designers to enter all necessary information into the 3D model (e.g. base coordinate system, dimensions, tolerances, material type, surface roughness and general comments). This eliminates the need for flat documentation.

Replacing traditional documentation with MBD methods shortens the stage of construction and technological preparation of product production, especially by the time needed to create 2D drawings. One no longer needs to perform simple but time-consuming tasks, such as: selection of the size of the sheet, determination of the scale or selection of the appropriate number of views, sections and layouts that will clearly define the detail.

MBD allows to apply information and assign it to specific views, which provides instant access to the data one needs. An additional advantage is the ability to select a specific dimension and automatically highlight the corresponding geometry, so one can quickly determine the relationship between the elements of the part and their dimensions. This solution allows to view the measurement bases assigned to the shape and location tolerances marked on the detail, facilitating work with documentation at the design, production, assembly and even quality control stages. It is also possible to display all information at the same time and use the dynamic annotation options. As the model orientation changes, only the information assigned to a particular view is displayed.

The use of a single digital file facilitates the management and implementation of design changes at every design stage [1]. Digitization of documentation also facilitates the exchange of information between company departments. By using single files containing all design information, one can significantly increase production accuracy and reduce the number of data created and stored [1].

MBD in rapid prototyping

The MBD module (fig. 2) is also used to make elements with incremental technologies, which have recently gained popularity. These technologies are usually used at an early stage of design when there is a need to make continuous changes and quickly create real objects. This process is called rapid prototyping.

Fig. 2. Window of the SOLIDWORKS® MBD module [4]

To make a prototype of a detail using, e.g. the FDM method, a 3D model is needed with technical specifications in the form of annotations, containing information about the direction of printing, location of the base, the need to use supports, degree of filling, type of material, nozzle temperature, table temperature or number of layers. Based on such documentation, the operator's work boils down to loading the model into a slicer program (program for dividing the 3D model into layers and determining printing parameters) and setting appropriate parameters (also those on the device). All this can be done in the simplest of workshop or office conditions, communicating without using flat documentation and moving within one universal data file.

Base model definition in SOLIDWORKS® MBD

Creating a model with dimensions on it in the SOLIDWORKS® MBD module begins with standard 3D modeling. After defining the 3D model of the part, one can start working with the MBD module. It is started by activating the "SOLIDWORKS® MBD" option in the bar above the workspace.

The basic model definition starts with adding selected annotation views (fig. 3), e.g. "Front". Then, using the tools "Base dimension", "Size dimension" and "Basic location dimension", the desired dimensions are defined on the previously prepared model.

Fig. 3. SOLIDWORKS® MBD module window when defining views

One can add shape and position tolerances to the part designed in the SOLIDWORKS® MBD module (fig. 4), as well as information about surface roughness. The following tools are used for this purpose: "Measuring base", "Position and shape tolerance" or "Surface finish". To facilitate work with the file, assign each dimension and tolerance to the appropriate view (fig. 5).

Fig. 4. Example view with base dimensions and tolerances

Fig. 6. MBD information layout before and after using the "Dynamic annotation view" option

Fig. 5. Assigning dimensions to specific views

Fig. 7. Example note with information about the part

After defining all dimensions, notes, tolerances and assigning them to appropriate views, the model may become illegible. The solution to this problem is the "Dynamic annotation view" option, which, as the model is manipulated, displays only the dimensions assigned to the given view (fig. 6). At this stage, one can also decide to arrange the dimensions in views so that one can read them conveniently and transparently.

Information traditionally included in the title block (in 2D documentation) can be added due to the "Note" option.

MBD information exchange – 3D PDF and eDrawings® formats

A common problem for designers around the world associated with the electronic recording of structures is the exchange of graphic information between cooperating plants that use different environments and CAD formats. It would seem that the use of the MBD method and electronic documentation applied to the model will aggravate this problem.

The software implementing the MBD concept allows exporting the prepared model to 3D PDF and eDrawings formats. The SOLIDWORKS® MBD module contains a ready library of 3D PDF templates for free editing. One can also define own template – both a single part and an assembly.

To export a ready file, select a template from pre-defined views as well as product properties and information. The document prepared in this way can be easily opened in the PDF viewer and it is very easy to interpret. An additional advantage is the ability to rotate the model and quickly switch between individual views.

The subsequent format, eDrawings, works similarly. It also gives the ability to freely navigate between views, rotate the model and highlight reference geometry for individual dimensions. Both formats not only facilitate the work with documentation, but also work well on devices with touch screens.

Fig. 8. Documentation in MBD in the eDrawings® Viewer and 3D PDF [5]

Summary

In the near future, the use of the MBD module – in which there is one main file with all information – can become the basic form of technical documentation. The more work is done and saved in digital form, the faster one can start producing a new product.

Implementation of the MBD method in an enterprise eliminates the time allocated to the preparation and maintenance of traditional documentation. This obviously translates into shortening the time from designing to make parts, as well as reducing the costs of developing flat documentation (printing, designers work) and administration (storage, ordering).

REFERENCES

- [1] Adamski W. „Zasady stosowania i pracy z systemami CAD/CAM w światowym przemyśle lotniczym”. *Mechanik*. 11 (2016): 874–876.
- [2] Romanowicz P., Bondyra A. „Rysunek techniczny w mechanice i budowie maszyn – dotychczasowe i aktualne zasady odwzorowań rysunkowych”. Kraków: Wyd. Politechniki Krakowskiej, 2015.
- [3] www.solidworks.com/media/SOLIDWORKS-mbd-first-look.
- [4] www.dps-software.pl/SOLIDWORKS/mbd/.
- [5] www.blogs.solidworks.com.