THE APPLICATION OF MANUFACTURING TEMPLATES IN CAD/CAM SYSTEMS

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Abstract: The paper deals with specific application of manufacturing (MFG) templates in CAD/CAM system Pro/ENGINEER Wildfire. The preparing time for manufacturing simulation is possible to decrease by using the MFG templates on 3D model of manufacturing part in module Part. The set up of MFG templates relates to standard part features. The manufacturing process parameters is defined directly on part features by means of reference annotation features by XML language notification. The mentioned annotation features are inserted into MFG templates that could be edited for re-using in case of manufacturing the similar part features of other manufacturing part.

Key words: CAD/CAM system, MFG template, annotation, XML language

1 XML LANGUAGE APPLICATION IN CAD/CAM SYSTEM Pro/ENGINEER WILDFIRE

Solving the concrete part design and its following manufacturing, we use knowledge of knowledge system establishment and XML Language. We follow the following steps:

1. Create 3D model.
2. Identification pattern element of model
3. Create database of material/ XML item
4. Create tool and sketch tool/ XML item
5. Saving and retrieving tool parameters/ XML item
6. Attaching CL Command(s) to tools/ XML item
7. Customizing tool manager layout/ XML item
8. Defining custom parameters for tools/ XML item
9. Reading parameter from tool/ XML item

At the fig. 2, 3D model of workpiece with tool that is modelled in Pro/ENGINEER Wildfire is described.

We make engineering design in module Part by modelling the 3D model of part. In Manufacturing module, we design technological process of manufacturing by CNC machine. It means that we define NC sequences for manufacturing. Our applied research focused in CAM field in Pro/ENGINEER system using the XML Language for communication between CAM system and some of knowledge system components.
At the Figure 1, 3D model of work piece with tool that is modelled in Pro/ENGINEER Wildfire is described.

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The main idea of usage the XML language in CAM system is its application for making the templates. Such way, it is possible to save the time either in modelling the part with similar shape or in generation of the production run by receiving process information inside 3D model. Consequently, it is also applied in manufacturing process of the same design feature.

The manufacturing (MFG) templates is possible to apply into two groups:
1. MFG template: it contains information on geometry and manufacturing process.
2. User Defined Feature/UDF: it contains information only on geometry.

At the Figure 2, the example of MFG template for hole with thread is shown.

At the Figure 3, the example of MFG template item is shown.
1.2 The example of MFG template application

The existing MFG template for manufacturing of hole with thread is applied into model by means of Annotation Feature. The selected feature can be patterned.

The first step is the opening of model (for example the model of armature – Fig. 4). The existing MFG template created on model at the Fig. 2 is applied to new model (Fig. 4).

At the Figure 4, the 3D model of armature is shown.

The next step is the creation of users coordinate systems CS1 and CS2 that is used for location of existing MFG template. The mentioned coordinate systems are located so that the axis Z is situated against tool axis.

The window MFG template - AE setup is displayed and the required parameters are marked:
- Step orientation,
- Start surface,
- **Hole Axis**

  The next step is the patterning of annotation. The pattern is selected automatically by reference and the pattern parameters are defined automatically.

  At the Figure 5, the Patterning of Annotation is depicted.

![Fig. 5 Patterning of Annotation](image)

By the process table and by means of function „View Builder“, the extraction method is chosen in table Sort Setup. In this table, we can decide how to arrange the individual manufacturing operations. In our case, we select:

- „Group Special Parameters“: „Orientation Z“, 
- „Group Special Parameters“: „Extraction Priority“,

Next step is made in MFG template – AE extraction and in folder Options is marked Apply AutoMerge.

AutoMerge merges and optimises every tool paths according to defined parameters. In regard to our parameters, the holes are completely manufactured “face by face”. This solution is suitable for 3-axis manufacturing machines users.

At the Figure 6, the final transformation of MFG template and NC Sequences are shown.

![Fig. 6 Final NC Sequences](image)
2 CREATION OF STANDART TOOL AND PROCES PARAMETERS

Standard tools also called parameter tools are Pro/NC supported tools with known geometry that can be described using an APT 7 type set of parameters. Pro/NC will use the resulting geometry for tool path computation, material removal (when possible) and degauging.

The parameters for each tool are listed in the general panel of the tool description area using a graphic representation of the tool shape. Pro/NC proposes a list of predefined supported tool shapes.

These tool types correspond to the types of NC sequence performed in the work cell. The tool type, in turn, defines the tool’s cross-section and, therefore, the set of parameters you have to specify for the tool. [2]

At the Figure 7, tool selection and tool setting is shown.

![Tool Selection and Tool Setting](image)

**Fig. 7 Tool selection and tool setting**

2.1 Saving and retrieving tool parameters

Tool parameters can be saved in the form of ASCII text files; XML based, and then reuse these tools in a different manufacturing process without having to set them up from scratch. When you save a tool, the system stores its type and parameter values in a text file named .xml, where is the tool Name. In previous, the default extension for the tool parameter files used to be .tpm. Old files with this extension will be recognized by the system as tool parameter files, that is, they will be retrievable. Whenever a tool parameter file is stored, however, it will now have the .xml extension. [1]

In dialog window Tool Setup, the technological parameters for CNC machine defined for concrete feature, i.e. for chosen NC Sequence, are depicted. The text item is in XML Language and is in final table of processes for purpose either the archiving or the re-using in case of the same or similar design features.
3 CONCLUSION

XML Language was used for communication between some components of knowledge system, which was established for selected sections and parameters, and single modules of CAD/CAM Pro/ENGINEER Wildfire system.

The mentioned language is simple, clear and easy to apply and in the main it is easy to learn for everyone who manages the Microsoft Office products. This fact made the many companies to use XML Language and its formats even though its simplicity cases large text items.

XML Language allows us to make simple text item of identified features for model and thereafter to assign the tool parameters and manufacturing conditions. Using the XML Language, we loaded concrete data into manufacturing process manager. If we will assign certain identification marks, we will be able to make selection of different variants of features and manufacturing process parameters considering the concrete manufacturing conditions. The repeated usage is also possible.

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4 REFERENCES


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