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APPLICATION OF THE ILOGIC TECHNOLOGY, IMPLEMENTED IN THE INVENTOR SOFTWARE, TO THE REALIZATION OF A PARAMETERIZED MODEL OF A CYLINDRICAL GEAR - RULES DEVELOPMENT

Abstract: An elaboration of a model and a full technical documentation of a cylindrical gear is the process classified to the group of activities consuming a significant amount of time, due to the complexity of strength calculations (related, among other things, to the determination of functional dimensions of coupled assemblies - a pinion and a gear, and the geometry), selection of many standardized components, determination of dimensions of a housing (body, covers, etc.). The paper presents the ability of a rationalization of an entire process based on the Autodesk Inventor 2012 iLogic technology [4]. On the basis of enumerated software the authors' elaborated parametric model of the cylindrical gear transmission with full documentation of described technical system. The authors also used a Microsoft Excel spreadsheet as a tool for purposes of a calculation of all of the dimensions of standardized constituent elements.

1. Introduction

At the present time it is possible to notice the increasing development of science and technology. Manufacturing companies are on the one hand in a front of the huge challenge of meeting the requirements of the customers connected with the expected quality, time restrictions and a complexity of the project; on the other hand they are obliged to obtain an advantage over competitors.

Often on the basis of one standard structure designers generate several structural variants of the element, forming the series of types. Usage of a parameterization significantly improves the entire process, because the dimensions are linked with specific functions and dependences. The parameterization provides the correct fitting of related dimensions, so that treatment enables easily avoiding of errors associated with the redesign process of elements in assemblies (mechanisms, machines, etc.). The use of the parameterization in modern CAD systems significantly improves a quality of a design and a construction process, simultaneously reducing the time [1, 2].

2. The iLogic technology

The iLogic technology allows to the development of models (including rules) and forms, so in this case such created projects form the basis of the considered issue and improve the design process [6]. The rules significantly expand the creation ability of parametric models, because the parameter values are entered directly by the user or as a result of outcome formulas based on other parameters. These values can be obtained from a spreadsheet. The forms allow to a creation of transparent windows (adapted to the specific model) allowing to data input, a selection of relevant data, a rules launching or an activation of external programs.

The browser window is composed of tabs, which allow to a preview (or an addition) of rules and forms (Fig. 1).
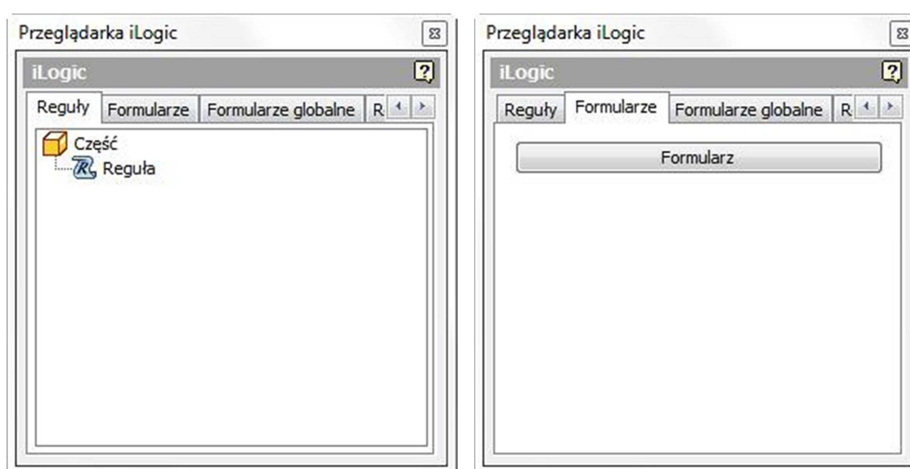
*Fig. 1. View of tabs of the iLogic viewer*

The iLogic technology makes possible an automation of many tasks, among other things [5,6]:

- an activation or a deactivation of individual parts in assembly, their relations (drilling operations, extrusions made on items), by using a command containing rules based on text values (true/false)
- an automatic updating of the document structure (if made some modifications in the model),
- an upload and a download of parameter values to an Excel spreadsheet, along with the possibility of reading and writing,
- an establishment of a communication process between the model and external databases (such as the SQL Server or the Microsoft Access).

3. iLogic rules

Rules are small programs written using the Visual Basic through which it is possible to control the model (modification of parameters) and the behavior determination of the elements (operations on them, depending on certain conditions). Allow also the use of parameters, including numeric and text variables. The rules are stored in the same file as the

created part, or assembly (no errors associated with the name of the object, or a path). Figure 2 shows the window dedicated to an edition of the rules.

The project elements viewer   Parameter values of the selected element
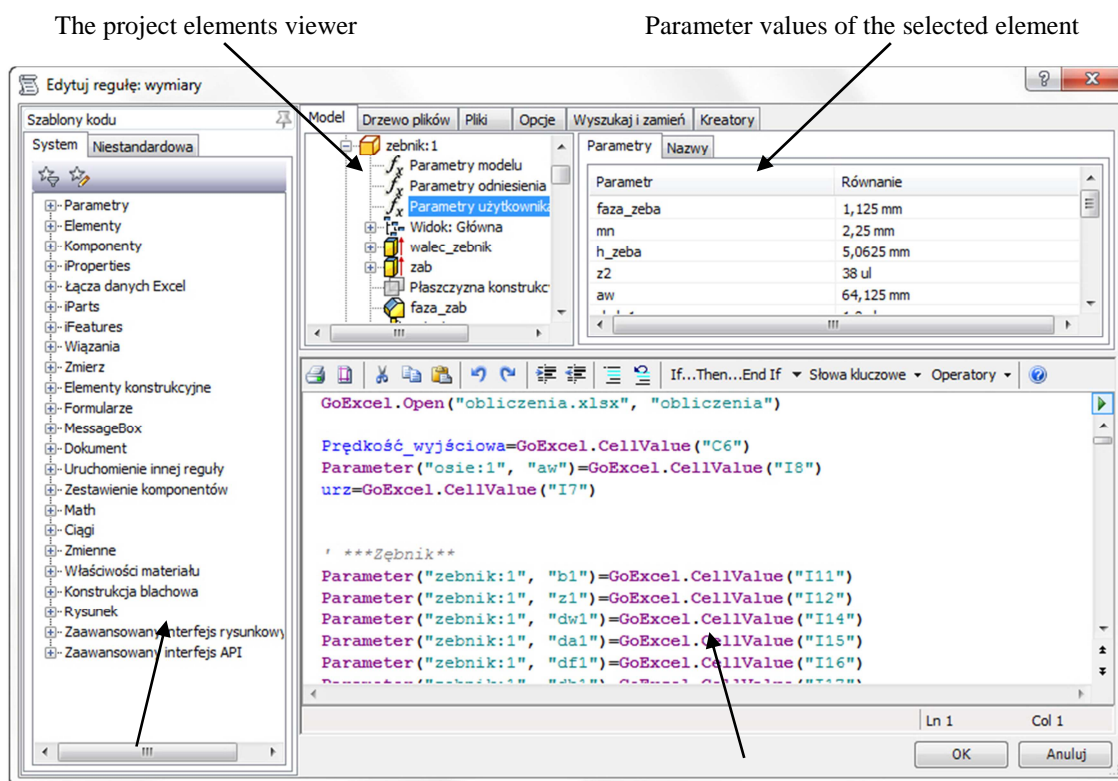
A field of available
functions   An area dedicated to a definition of new rule function

Fig. 2. View of the window dedicated to an edition of the rules

The high transparency of the editing window and a collection of all of the available features make easy to add another command rules.
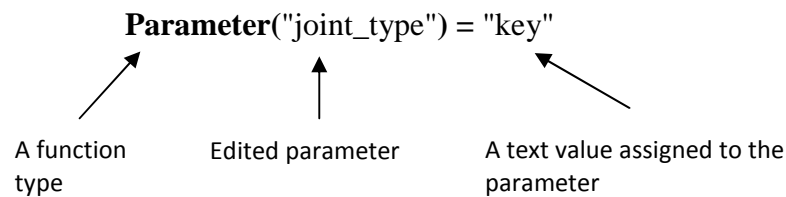
4. Functions in the iLogic rules

A procedure connected with the development of a function starts with a definition of the appropriate codes (inside the area shown in Figure 2). For beginners facilitation is a list of commonly used codes located in the left side of the editing window. Functions are arranged in the form of a tree, classified in accordance with a category.
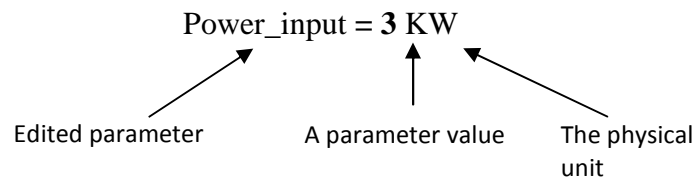
Developed functions are implemented within the program and may base on data included in the model, received from external databases or required specific values inserted through the dialog boxes. Each function is created independently from the rest of the code contained in the rule.
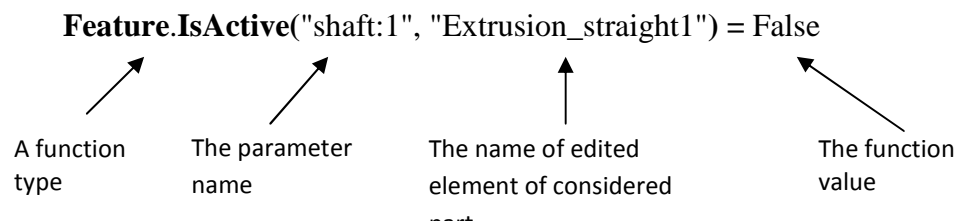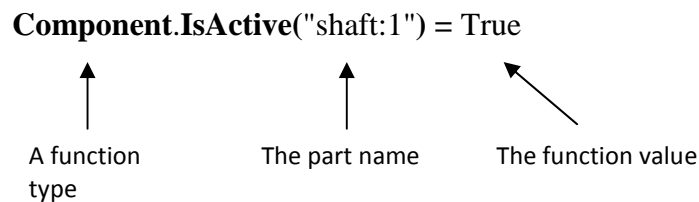
Function arguments can take a form of:
- a text string:

Parameter("joint_type") = "key"

A function
type   Edited parameter   A text value assigned to the
parameter

- a numerical value:

Power_input = **3** KW

Edited parameter   A parameter value   The physical
unit

- a logical value (True/False) – an activation or a deactivation of a concrete part or their element:

Component.**IsActive**("shaft:1") = True

A function
type   The part name   The function value

Feature.**IsActive**("shaft:1", "Extrusion_straight1") = False

A function   The parameter   The name of edited   The function
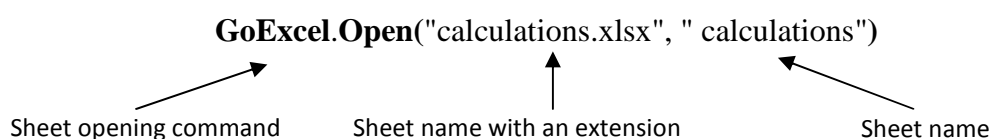type   name   element of considered   value
part

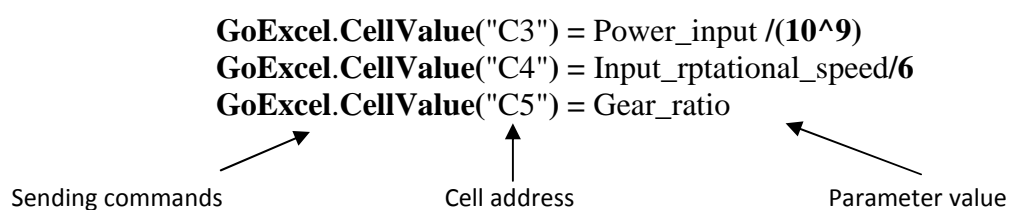## 5. Usage of a spreadsheet in order to collection of parameter values

Due to the large amount of processed data and a complexity of design options in the phase of generation of a cylindrical gear transmission (on the basis of data provided by the user, such as power, a input speed and a gear ratio) the Microsoft Excel spreadsheet was used. The described sheet contents a definition of statements containing all the necessary standard parts (bearings, snap rings, prismatic grooves, splines, etc.) [3].

Then, using the iLogic technology combined with the Excel spreadsheet, the authors' elaborated dynamic connection that enables an uploading and a downloading of data between the user model and created spreadsheet cells. For proper communication between the model and the sheet were made following commands, used in the rules used for:

- opening of the Excel spreadsheet:

GoExcel.**Open**("calculations.xlsx", " calculations")

Sheet opening command   Sheet name with an extension   Sheet name

- sending of parameter values of defined cells:

GoExcel.**CellValue**("C3") = Power_input **/(10^9)**
GoExcel.**CellValue**("C4") = Input_rptational_speed**/6**
GoExcel.**CellValue**("C5") = Gear_ratio

Sending commands   Cell address   Parameter value

Appended values (/(10^9) and /6), to the end of command lines, are the conversion coefficients of power (given in kilowatts) and speed (given in rev/min), in order to properly sending of parameter values to a spreadsheet cell. With the iLogic technology the authors made the clear form shown in Figure 3.

The final step of the rule edition is saving the changes and closing the spreadsheet, with a purpose of appropriate commands:

- saving the changes command::

GoExcel.**Save**

- closing the spreadsheet:

GoExcel.**Close**

Fig. 3. The form window

Fig. 4. A generated construction variant of a cylindrical gear

Elaborated form allows to enter the input data (generation of a new variant of a gear design, shown in the Figure 4), and then generation of a complete design documentation. Additionally the user has the possibility to export the model to IGES or STEP formats.

6. Summary

The paper presents the possibilities of using the Autodesk Inventor iLogic technology for definition of rules, and forms used for a development of the parametric model of helical gear units. By using the described technology user may perform any variant of considered structure, based on defined inputs recorded within the range of the form.

The process works on the principle of communication (by iLogic rules) made between the model (in the Inventor software) and the Microsoft Excel spreadsheet, which are made all the calculations and a choice of the dimensions of the standard.

The proposed solution significantly reduces the whole time of a design and a construction associated with the development of a new variant structure and its documentation, bringing the whole process to introducing a new input data and then generation of all documentation.

References

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