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MANAGEMENT OF PARAMETERIZED DESIGN ASSEMBLY CODING SYSTEMS

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Abstract: In the machine building industry, the classification and coding of parts, subassemblies and assemblies have a special importance. The relationship between classifications and codifications is defined by the degree of their interdependence or overlap. The main objective of coding, which also determines its basic function, is identification. If it also takes on the meanings of the relations between the elements of the set, it also fulfills the function of representing the classification. In this paper we want to present an innovative coding system for assemblies in the design phase, more precisely the parameterized design.
Keywords: parameterized modeling, configuration, classification and coding, variable parameters

1. INTRODUCTION

Manufacturing design is a multilateral approach to the production of goods and it integrates constructive design processes with materials, processes/manufacturing methods, design of technological processes, assembly, testing, quality assurance and maintenance [6].
Simultaneous engineering (also called parallel or convergent) can be defined as a systematic approach to integrating the simultaneous design of products and processes related to this, including manufacturing, preparatory activities, maintenance and many other product life cycle considerations such as the required series of tests, verifications, reliability, safety, human factors and material recycling. The purpose of simultaneous engineering is to design and manufacture a product in pursuit such a way that the product meets the customer's requirements to the greatest extent.
Basically, these codes consist of a series of fields that encode the type parts/surfaces, materials, overall dimensions, accuracy, certain aspects with technological character.

2. DESCRIPTION OF THE OPERATING PRINCIPLE FOR PARAMETER CODING SYSTEM

It is considered the linear hydraulic motor in the figure, from which the rod/piston will be extracted together with the hydraulic seals mounted on the piston body, in order to exemplify the method of coding for the parameters associated with the 3D model [1-4, 8].

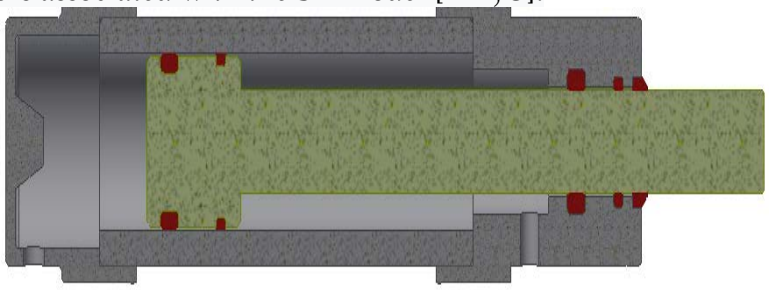

Figure 1 - The linear hydraulic motor

To perform the calculations necessary to determine the values of the parameters necessary for the 3D model, a configurator file designed in excel is used. To filter the parameters, in the sense of allocating them only to the components that use them directly, an ipt file is used in which all the parameters from the excel file are imported.

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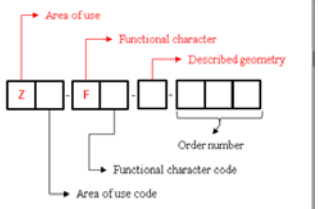
	A	B	C	D	E
1	Parameter	Value	u.m.	Description	Group
2	Z2_F2_D_001	30	mm	Piston rod diameter	
3	Z4_F2_L_001	280	mm	Rod length	
4	Z2_F2_D_002	50	mm	Piston body diameter	
5	Z4_F2_L_002	50	mm	Piston body length	
6	Z2_F3_L_001	7	mm	Channel 1 positioning	
7	Z2_F2_L_003	10	mm	Channel 1 width	
8	Z2_F2_L_004	5	mm	Channel 1 depth	
9	Z2_F2_R_001	2	mm	Channel 1 radius	Piston + rod
10	Z2_F3_L_002	20	mm	Distance between channels	
11	Z2_F2_L_005	5	mm	Channel width 2	
12	Z2_F2_L_006	3	mm	Channel 2 depth	
13	Z2_F2_R_002	1	mm	Channel 2 radius	
14	Z2_F2_D_003	52	mm	Inner diameter	
15	Z2_F2_D_004	72	mm	Outer diameter	Cylinder
16	Z2_F2_L_002	200	mm	Cylinder length	
17	Z2_F2_L_007	7	mm	Sealing element	Sealing
18	Z2_F2_D_005	52	mm	Sealing element	element
19	Z2_F2_L_008	5	mm	Sealing element	piston

Figure 2 - Default parameters from the excel configuration file

Area of use	
Description	Code
Input data	1
Sketching environment	2
Features of the 3D model	3
Part modeling environment	4
Assembly environment	5
2D drawing environment	6
Calculation report	7
Functionality	
Description	Code
Acționare	1
Dimensională	2
Poziționlă	3
Descriptivă	4
Mărimi tehice	5
Described geometry	
Description	Code
No geometry	F
Linear dimensions	L
Diameter	D
Radius	R
Angles	U

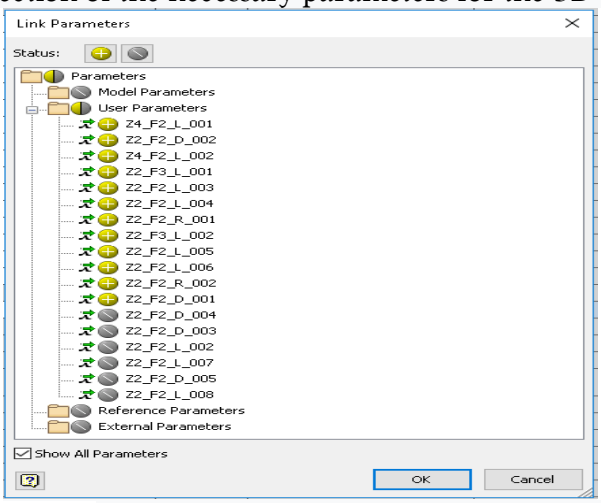
Parameter code structure



Example:
Z5-F3-L-001 – parameter used in the assembly environment with positional function characterized by the length dimension having the order number 001
Z6-F4-F-001 – parameter used in the 2D drawing environment (probably in the indicator) with descriptive function, without geometry (probably a text) with serial number 001

Figure 3 - Coding system used

The parameters imported from the excel file into the ipt file are shown in the image below which is the parameter management register within Autodesk Inventor from the ipt file used as a database for configured parameters.
Selection of the necessary parameters for the 3D model of the rod / piston.




imported parameters in the .ipt database file


parameters available for import from the .ipt database file

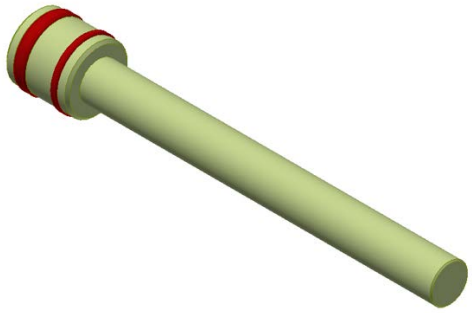
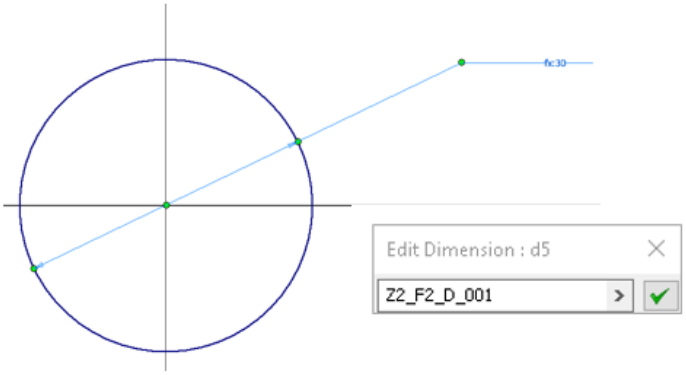


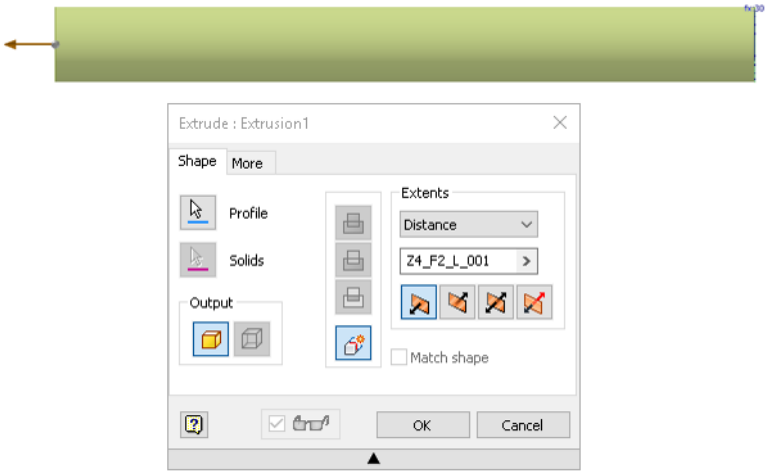
Figure 4 - Selection of the necessary parameters for the 3D model of the rod / piston

The speed for updating the 3D model is higher if there are fewer parameters imported in the elements that make up the model (parts and subassemblies).
If the excel file had been linked directly as a database, it would not have been possible to select only the necessary parameters, each time a parameter was needed, inevitably the whole list of parameters generated by the file will be imported [5, 7].



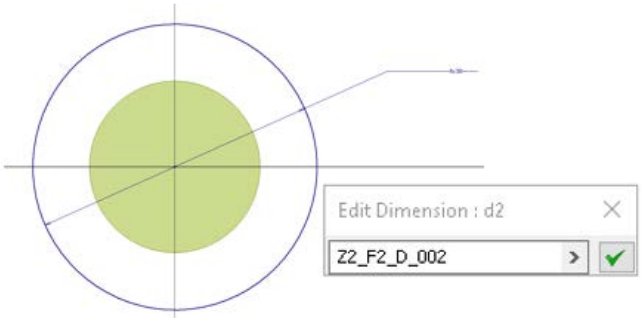
Step 1 - Create a sketch that characterizes the shape and size of the rod

Z2 we are in the environment of 2D sketches;
F2 the parameter describes a dimension;
D the parameter represents a diameter;
001 it is the first parameter defined in the final assembly which holds the code prefix Z2_F2_D;



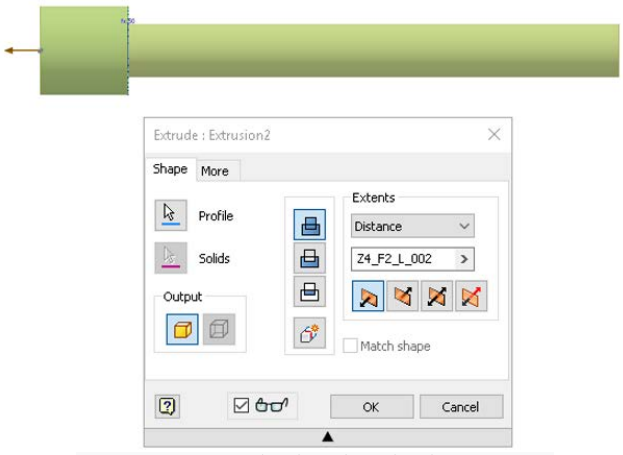
Step 2 - Extrude the sketched geometry

Z4 we are in the modeling environment of 3D parts;
F2 the parameter describes a dimension;
L the parameter represents a length;
001 it is the first parameter defined in the final assembly which holds the code prefix Z4_F2_L



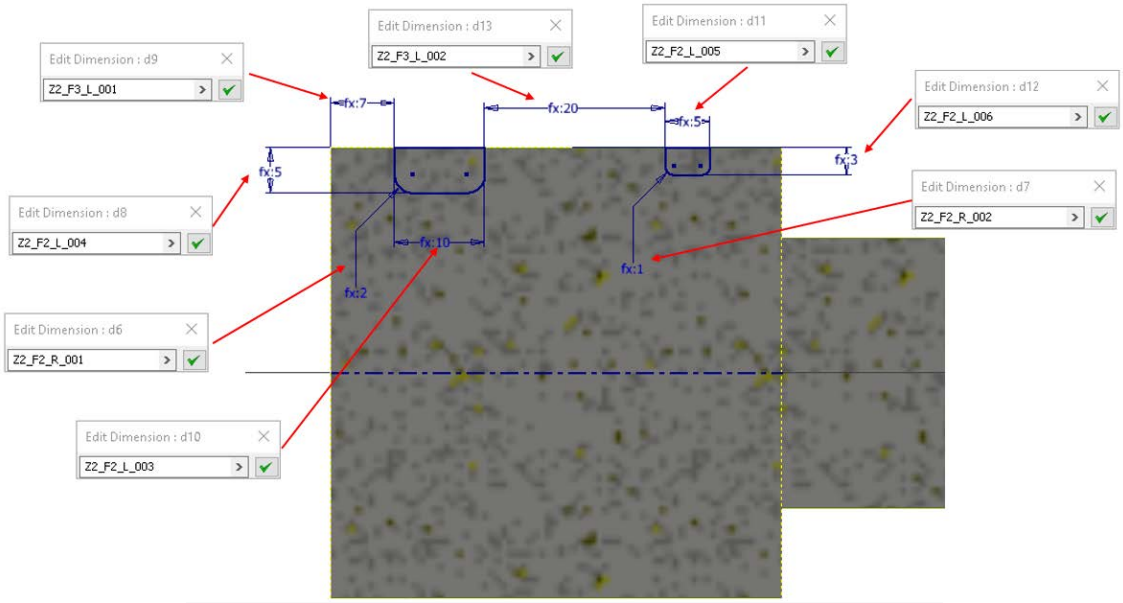
Step 3 - - Create a sketch that characterizes the shape and size of the piston body

Z2 we are in the environment of 2D sketches;
F2 the parameter describes a dimension;
D the parameter represents a diameter;
002 it is the second parameter defined in the final assembly which holds the code prefix Z2_F2_D



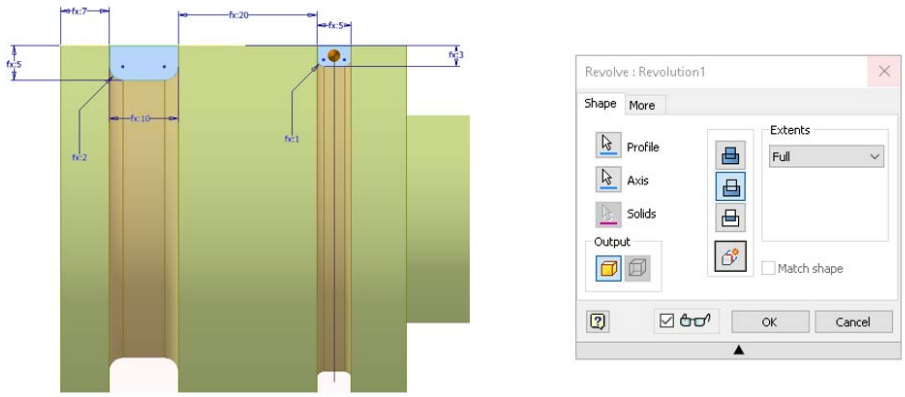
Step 4 - Extrude the sketched geometry

Z4 we are in the modeling environment of 3D parts;
F2 the parameter describes a dimension;
L the parameter represents a length;
002 it is the second parameter defined in the final assembly which holds the code prefix Z4_F2_D



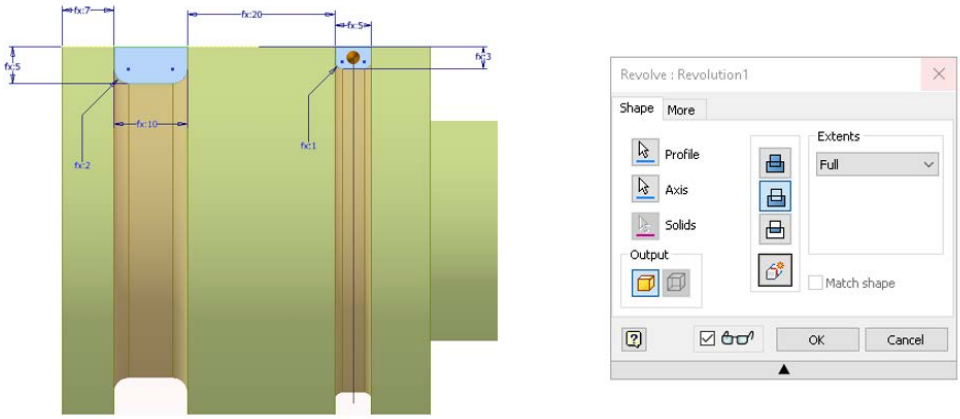
Step 5 - Sketch the geometry of the channels in the piston body

Z2_F2_L_003 describes a dimension - representing a length - with order number 003;
Z2_F2_R_001 describes a dimension - representing a length - with order number 001;
Z2_F2_L_004 describes a dimension - representing a length - with order number 004;
Z2_F3_L_001 describes a dimension - representing a length - with order number 004;
Z2_F3_L_002 describes a dimension - representing a length - with order number 002;
Z2_F2_L_005 describes a dimension - representing a length - with order number 005;
Z2_F2_L_006 describes a dimension - representing a length - with order number 006;
Z2_F2_R_002 describes a dimension - representing a diameter - with order number 002;



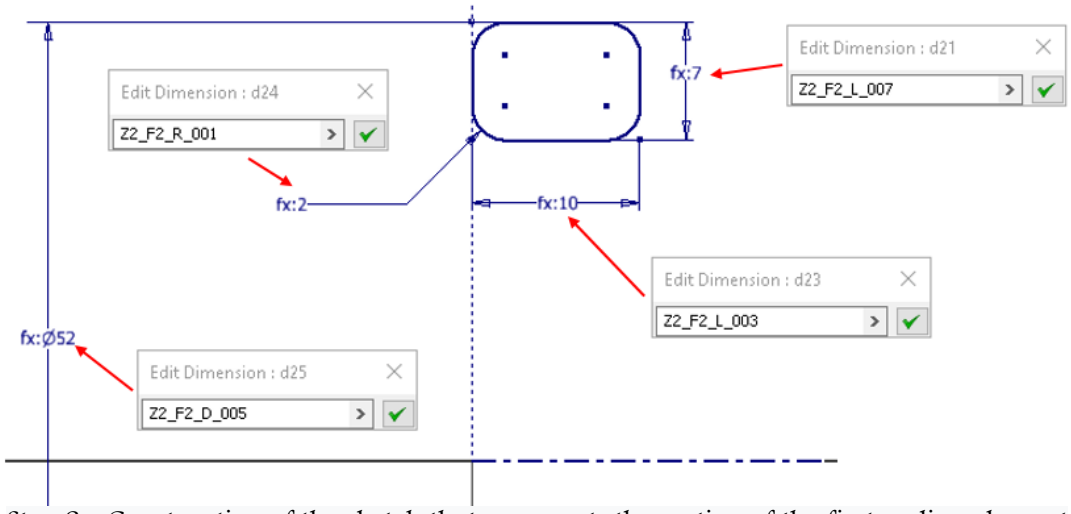
Step 6 - Extrude the previous geometry around the revolution axis of the part in order to obtain the channels

This operation is performed without the help of a variable parameter.



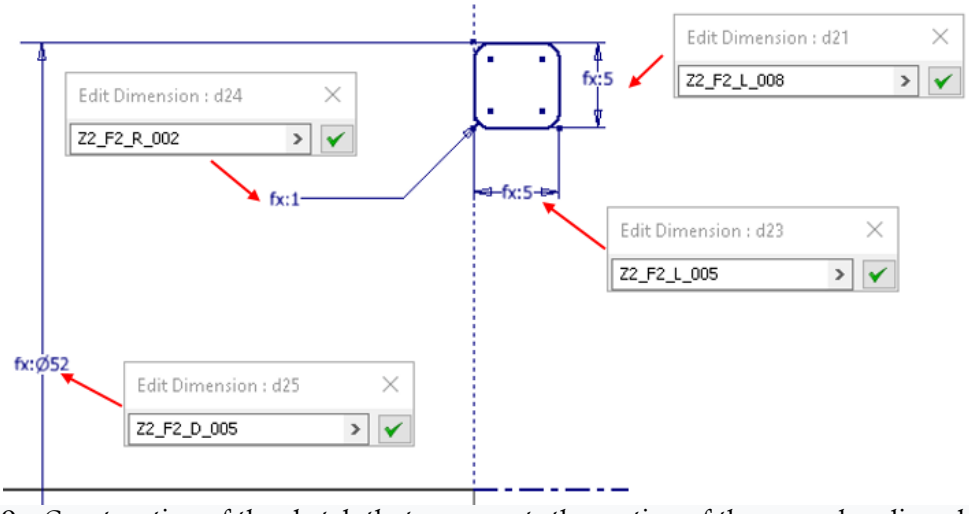
Step 7 - Perform the side chamfers of the piston edges

This operation is performed without the help of a variable parameter, having a fixed parameter of 2 mm.



Step 8 - Construction of the sketch that represents the section of the first sealing element

Z2_F2_L_003 describes a dimension - representing a length - with order number 003
Z2_F2_R_001 describes a dimension - representing a radius - with order number 001
Z2_F2_L_007 describes a dimension - representing a length - with order number 007
Z2_F2_D_005 describes a dimension - representing a diameter - with order number 005



Step 9 - Construction of the sketch that represents the section of the second sealing element

Z2_F2_L_005 describes a dimension - representing a length - with order number 005;
Z2_F2_R_002 describes a dimension - representing a radius - with order number 002
Z2_F2_D_005 describes a dimension - representing a diameter - with order number 005
Z2_F2_L_008 describes a dimension - representing a length - with order number 008

The parameters marked in red are also used in the cases presented above, having the character of common parameters.

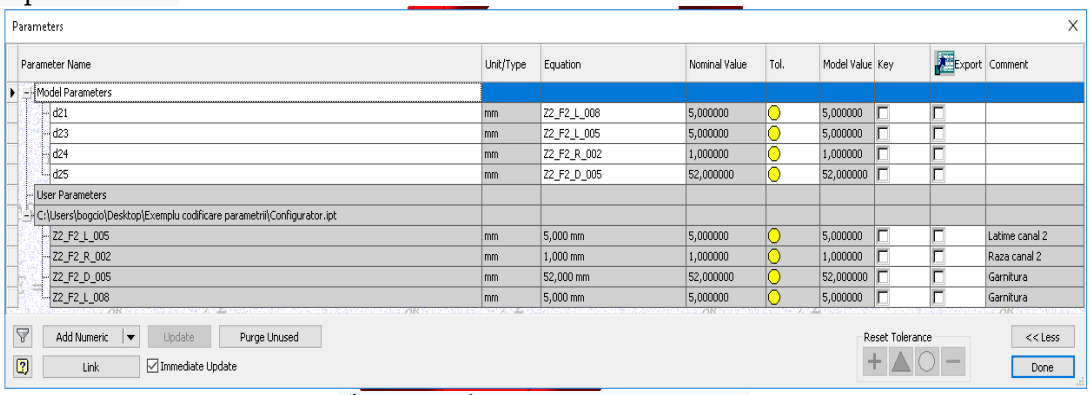


Figure x. The common parameters

3. CONCLUSIONS

— variable parameters are always processed in the source files (in our case the excel configuration file) before being exported to the 3D model or to the filter file (example of the .ipt file);
— the 3D model can be driven through a set of a predetermined parameters with fixed value but especially by variable parameters belonging to a specific coding system;
— the code structure is based on a root used as a prefix, which has the role of describing the area of use within the 3D model of the parameter, its functionality and the type of geometry described where applicable. The code suffix is based on the serial number of the described root, being the number resulting from the chronological registration of the root of the parameter within the final set;
— parameters can be common or dedicated to a particular element or for a portion of that element;
— the large number of variable parameters increases the update time of the 3D model governed by them. An optimization solution being the selection for importing only the parameters strictly necessary for modeling certain geometries and using such a parameter in as many areas as possible;
— in the case of parts that are mutually assembled, in most cases there are common variable parameters in the contact areas through which the assembly is performed.

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