

## BUILDING PROCESS AUTOMATIZATION OF THE FURNITURE FOR REST FROM A GARDEN

### AUTOMATIZAREA PROCESULUI DE CONSTRUIRE A MOBILIERULUI DESTINAT REPAOSULUI DINTR-O GRĂDINĂ

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**Abstract.** Benches are furniture elements from a garden that permit relaxation and resting. They can have various shapes and may be built from different materials. In this paper, the authors present a study referring to the possibility of design automatization of these furniture' elements using the interface named iLogic that is a programming interface included in the Inventor software. In the end, the authors present the conclusions they reached and some recommendations regarding the use of the iLogic interface for benches design.

**Keywords:** ornaments, iLogic, Inventor

**Rezumat.** Băncile sunt elementele de mobilier dintr-o grădină care permit relaxarea sau odihna. Ele pot avea diferite forme și pot fi construite din diferite materiale. În această lucrare autorii prezintă un studiu referitor la posibilitatea de a automatiza proiectarea acestor elemente de mobilier prin folosirea interfeței numită iLogic din cadrul programul de calcul Inventor. În finalul lucrării autorii prezintă concluziile la care au ajuns și câteva recomandări legate de utilizarea interfeței iLogic pentru proiectarea băncilor.

**Cuvinte cheie:** ornamente, iLogic, Inventor

## INTRODUCTION

Benches are furniture elements from a garden used for resting and relaxation. The shape, the dimensions, and the ornaments are usually in harmony with other furniture or decorative elements from the garden.

So, the architect must find the most suitable shapes that, together with the chosen material and, with the decorative elements, to do bench to fit with the architectural line imposed by the rest of the existing furniture elements and with the decorative elements from the respective garden.

For designing the benches may be used the Autodesk Inventor software. Starting from this, the authors made a study to find out how much flexibility offers this computer program for this specific task and how easy it may be to change the shapes of the elements that are part of the benches.

It is well-known that when the designer has already achieved a particular form and tries to improve it, he must have the possibility to easily and rapidly modify the particular shape (Prună and Slonovski, 2018).

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The 3D models created in Autodesk Inventor software are based on three types of dimensions: driving dimensions, driven dimensions, and user dimensions. These kinds of drawings are known as parametric drawings (Waguespack, 2014; Scott Hansen, 2019).

Being about parametric drawings, it can be showed that there is already a significant degree of flexibility regarding the rapid change of shapes and contours.

The authors questioned whether more than that is possible and chose to analyze the interface called iLogic, which is part of the Autodesk Inventor computer program. Using the iLogic interface offers the possibility to write small calculation programs that model simple design rules established by the engineer or in, this case, by the architect.

This thing is done by setting the values of the parameters that characterize the working model. Moreover, the iLogic platform allows the user to define their parameters that afford to control, not only for the numerical values of the parameters that characterize the work piece, these being of several types.

The user parameters can be text type, true/false type, or list type that contains several values for the same parameter (Waguespack, 2014; Scott Hansen, 2019). In other words, “iLogic is an interface that allows Inventor users to create routines that automate the common tasks” (<https://clintbrown.co.uk/2019/12/14/what-exactly-is-illogic/>), says Clint Brown. Forrest Judd says about iLogic that “... it allows complex ways to update parts and subassemblies by changing parameters” (<https://blog.hagerman.com/understanding-autodesk-inventor-illogic>).

Starting from the above, the authors decided that, in their research work, it is necessary first to create a type of a bench, after that to think about variants of the model and, finally, to discover if that iLogic interface is suitable for such a task.

## MATERIAL AND METHOD

The authors started by setting up some specific guidelines, named them, from now on rules that can be automatically accomplished using the iLogic interface.

The first rule refers to the possibility to be able to set fixed values and/or values that vary in a certain range, for a parameter considered to be the reference parameter. In this case, the authors considered that the reference parameter is the length of the base of the bench's leg and named this parameter Lung\_baza (fig. 1).

Then this parameter was transformed into a value list type parameter, figure 2, it receiving the following values: 350, 380, 400, 420, 450, and 500.

The next step was to find that iLogic has a function called RunDialogs. Input ListBox, who allows selecting a value for a parameter from the list of values assigned to it. The computer program shown in figure 3 has as result the dialogue box shown in figure 4.

For this parameter, the values can be entered directly from the keyboard without having a predefined string of numbers.

The Lung\_baza parameter has not been transformed into a value list parameter, and iLogic has the Interaction. InputBox function that allows you to enter any numeric value from the keyboard. The computer program shown in figure 5 has

as result the dialogue box shown in figure 6.

The second rule refers to the possibility to automatically generate some features of that model.

For example, in figure 7, it may be seen that the leg of the bench can have a cutout in the shape of a semi-cylinder or in the form of a prism with a rectangular base.

The model can be provided with several such features and the ICadFeature.IsActive function allows, at a given time, whether or not to generate a particular one. The feature's generation may be conditioned or not on the value of a parameter of the model.

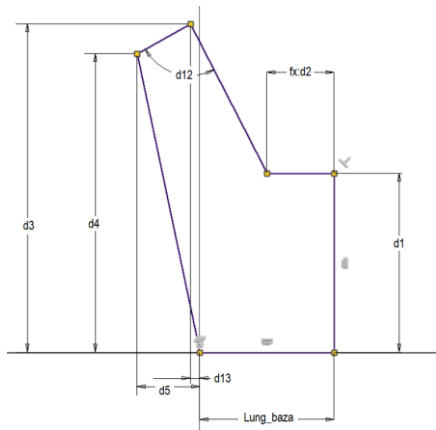


Fig. 1 The contour includes a reference parameter “Lung\_bază”.

```
Lung_baza = InputListBox("Alegeți din șirul de valori  
lungimea bazei", _  
MultiValue.List("Lung_baza"), 400, Title := "Perete bancă",  
ListName := "Valori pentru dimensiunea bazei:")
```

Fig. 3 The code that allows the dialogue box in Figure 4 to be displayed.

Parameters

| Parameter Name | Consumed   | Unit/Ty | Equation   | Nominal V. t |
|----------------|------------|---------|------------|--------------|
| Model Param... |            |         |            |              |
| Lung_baza      | d80, d7... | mm      | 450 mm     | 450.000...   |
| d1             | Sketch1    | mm      | 450 mm     | 600.000...   |
| d2             | Sketch1    | mm      | 350        | 225.000...   |
| d3             | Sketch1    | mm      | 400        | 1100.00...   |
| d4             | Sketch1    | mm      | 420        | 1000.00...   |
| d5             | Sketch1    | mm      | 210.310 mm | 210.310...   |
| d6             | Extruso... | mm      | 20 mm      | 20.0000...   |
| d7             | Extruso... | deg     | 0.0 deg    | 0.000000     |
| d8             | Filet1     | mm      | 20 mm      | 20.0000...   |
| d9             | Filet2     | mm      | 30 mm      | 30.0000...   |
| d13            | Sketch1    | mm      | 32 mm      | 32.0000...   |
| d15            | Sketch2    | mm      | 350 mm     | 350.000...   |
| d16            | Sketch2    | mm      | 70 mm      | 70.0000...   |

Buttons: Add Numeric, Update, Purge Unused, Link, Immediate Update (checked)

Fig. 2 The parameter “Lung\_baza” is transformed in a list of values parameter.

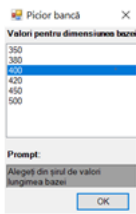
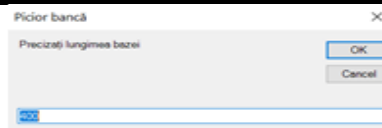


Fig. 4. The dialogue box generated by the code from figure 3.

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```
Lung_baza = InputBox("Precizați lungimea bazei",  
"Perete bancă", Lung_baza)
```

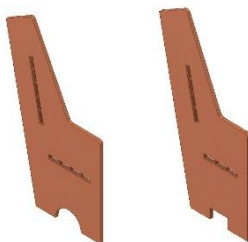
**Fig. 5** The code that allows the dialogue box in figure 6 to be displayed.



**Fig. 6** The dialogue box generated by the code from figure 5.

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**Fig. 7** Features that can be automatically changed.



**Fig. 8** The automatic change of a feature position of the model.

In addition, in figure 7, it is observed that the number of slots that allow the mounting of the seat slats differs.

Their number can be set in close connection with some parameter, the iLogic function, used to display this feature being the one mentioned above.

The third rule refers to the possibility to automatically change the position of a model's feature. In figure 8, it may be observed that the position of the slots that permit the mounting of the seat slats can be changed.

In iLogic interface, this thing can be done by changing the values of a parameter that controls the position of these slots.

The fourth rule is referring to the possibility to facile choose the material and the colors. The liProperties. Materials function allows you to set the material from which the part is made.

The last problem analyzed was the possibility to groups, in dialogue boxes, all the rules that were implemented, using codes written in the iLogic interface.

This interface offers the possibility to build custom dialogue boxes with which you can easily work with all the previously created rules. This capability of the iLogic interface is known as iLogic forms.

## RESULTS AND DISCUSSIONS

Starting from the ideas presented above, the authors built a set of rules that allow an easy design of a bench leg model and wrote the program codes for them.

The set of rules can be easily accessed by any user, as they can be easily launched in execution using checklists, buttons, and sliders, figure 9.

The dimensions of a bench leg vary within the limits set by the authors. All other dimensions depend on the length of the base of the bench's leg called

“Base\_Length”, figure 10.

Therefore, the user pressing the “Tipul de date” button launches the program code contained in the first rule that, in the first step, launches the dialogue box shown in figure 11.

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Therefore, the user pressing the “Tipul de date” button launches the program code contained in the first rule that, in the first step, launches the dialogue box shown in Figure 11.

This allows the user to choose values from a standard string or to type from the keyboard any value for the size called “Lung\_baza” figure 4 and figure 6.

If the option of specifying a particular value has been chosen, the program code checks if that value is in the range of 350 - 500 mm.

If this criterion is not respected, the program code asks the user to enter another value figure 12.

If the value of the length of the bench leg base was accepted by the program code, that calculates the values for the rest of the dimensions, as presented in figure 1 and figure 2.

The program code for the first rule, depending on the value chosen for the base leg length, launches the program codes for the other two rules, two and three.

The program code for rule number two determines the number of slots that allow fixing the seat slats, and the program code for rule number three determines the number of the slots for the backrest slats.

There can be 3 or 4 slots horizontally and 4 or 5 slots vertically.

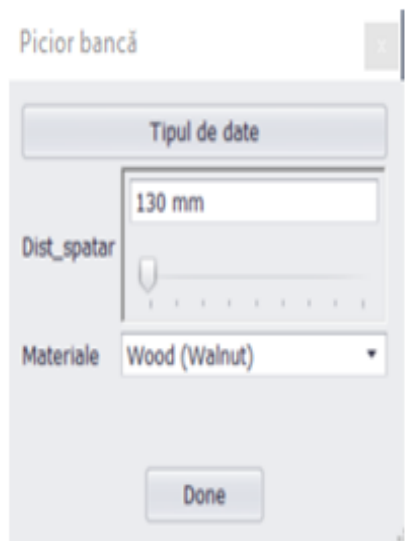
Further, the program code contained in the first rule launches the number four rule, which, through its program code, establishes the type of cutout at the base of the leg.

Thus, if the length of the leg's base is less than 400 mm, the cutout will be in the shape of a rectangular prism, and otherwise, it will be in the form of a semi-cylinder, figure 7.

Rule number five, through its program code, controls the distance between the slots, used to fix the backrest slats and the back of the bench leg. This distance is controlled by a slider, figure 9, the name of the parameter that controls this distance is “Dist\_spatar”.

The use of the slider makes the changes, did by the user, visible on the monitor in real-time, the position of the slats continuously changing on the foot of the bench.

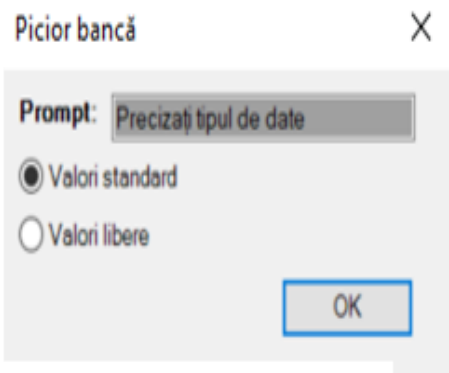
Rule number six allows, through its program code, the use of the different types of wood figure 9. The available types of wood are displayed in the list to the right of the word “Materials”.



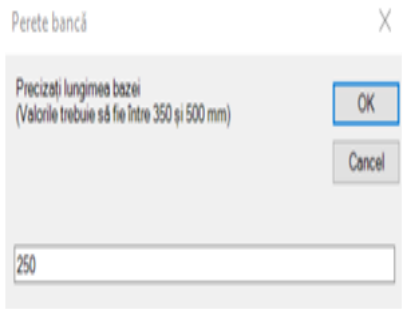
**Fig. 9.** The panel allows the control of the construction rules of the bench leg.



**fig. 10.** The size in relation to whom the rest of the dimensions are automatically calculated



**Fig. 11** Choosing the type of data



**Fig. 12** The specified value does not fall within the set range

As a result of using the six rules, the user obtains the desired bench leg. Figure 13 shows a narrow bench and figure 14 shows a wide one.



Fig. 13. Bench with small dimensions

Fig. 14. Bench with big dimensions

## CONCLUSIONS

1. The program codes written inner the rules developed in the Autodesk Inventor computer program, to obtaining the legs of benches, demonstrate that this software provides the flexibility to design the desired shapes and sizes for pieces of furniture in a garden.

The architect can easily design shapes and decorations that are in harmony with the rest of the decorative elements in the garden.

Then can be identified the rules that must be followed in the design of the furniture and can be written the program code that models those rules.

2. The authors managed to group the rules built in the so-called form of Autodesk Inventor.

This thing allows easy modification of the constructive parameters of these furniture elements with the help of buttons, value lists, sliders, or values entered from the keyboard.

3. The authors, using the iLogic interface within the Autodesk Inventor computer program, automated the construction of some model of benches leg in that, not only the dimensions but also the ornamental part varies.

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