DETERMINING THE DIMENSIONS OF THE PLANE SEMIFINISHED MATERIALS FOR BENT PARTS SUING LABVIEW APPLICATIONS.

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Abstract: Given the increasingly large scale use of parts manufactured by cold plastic deformation methods in all industrial areas, in the detriment of parts obtained by molding or cutting, the ever increasing world-wide interest in the development of new solutions for the optimization of cold plastic deformation technologies appears to be totally justified. This paper describes an application developed with LabView graphical programming language, through which the length of the flat semifinished material can be determined for the processing of parts through cold plastic bending deformation, based on the sizes prescribed in the detailed drawing for part execution.
Key words: LabView, programming, length, bending, product.

1. INTRODUCTION

The special preoccupation of researchers in finding new solutions to improve the technologies for the processing of the products obtained through cold plastic deformation procedures are justified by the increase in the ever grater weight of usage of such products in all industrial fields. The time allowed to designing of the processing technology can be significantly shortened, if various "designing tools" are employed, which are simple to use and, at the same time, capable to ensure high speed and precision. The applications developed with LabView graphic programming language satisfy the requirements of all the engineers and researchers in the field and do not necessary need them to have software programming knowledge, thus ensuring an easy to use interface. Applications developed with LabView are used in research and development activities and are made available to students and teachers over the E-Learning platform of the Faculty of Technological System Engineering and Management, in the form of executable files, so that each E-Learning user may use these "design tools" without the LabView software installed on their PC.

2. LABVIEW APPLICATIONS FOR CALCULATING THE DIMENSIONS OF PLANE SEMIFINISHED MATERIAL AT BENDING

Bending is the process of cold plastic deformation without intentional modification of the thickness of the material consists of bending the plane semifinished around certain rectilinear edges (Braha et al. , 2003).

The analysis of a part technologiticy in terms of its shape and technical conditions implies the determination of the shape and dimensions of the plane semifinished material of which the part is to be executed. For bent parts with bending radius other than zero, the length of the plane semifinished is equal with the length of the neutral layer (the layer whose shape changes, but whose length remains constant) is determined with the formula 1 (Sindilă, 2001):

$$L = \sum_{i=1}^{i=k} l_i + \sum_{i=1}^{i=k-1} l_{\varphi_i} \qquad (1)$$

where:
L – unfolded length of the part;
l_i – length of rectilinear portions of the neutral layer;
l_{φ_i} – length o neutral layer over the bent portions of the part, determined with the formula 2 (Sindilă, 2007):

$$l_{\varphi_i} = \frac{\pi \times \varphi_i}{180}\left(r_i + x \times g\right) \qquad (2)$$

where:
φ_i – bending angle;
r_i – internal bending radius;
x – neutral layer displacement coefficient;
g – part thickness.
These apparently simple calculation formulas need precise calculus, as they are specific for each type of part that can be manufactured through bending. An application developed with LabView graphic programming language, to be made available to users in the form of an executable file, will solve this problem, regardless of shapes and dimensions of the parts, facilitating the attaining of a high level of precision in a very short time. The graphic programming environment LabView is used both for the monitoring and control of industrial processes, and for specific activities in the academic and research environment, offering special benefits compared to traditional programming languages.

The graphic application in LabView used to determine the dimensions of the plane semifinished for parts obtained through bending is made of two components: the user interface (front panel) and the block diagram where the logic of the applications was described using icons and connection threads.

Using the elements on the panel, the user sends input data to the programme and then displays the output data resulting from running the programme, as indicator elements (figure 1).
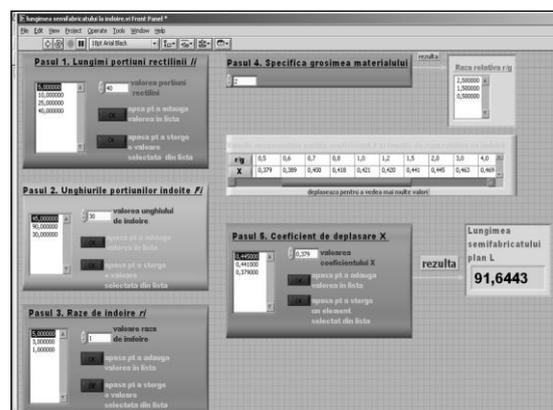

Fig. 1. Application front panel

To determine the dimensions of the plane semifinished, the user will follow five steps:

- **step 1.** in the numerical control element, specify the value of a rectilinear portion in mm. By pressing a Boolean type of command element, the numerical value of the rectilinear portion will be added, so that it may be visualized, in the List box type of element. Depending on the part type, the user may introduce as many values as are needed. If the user introduces a wrong or useless value, the user has the possibility to eliminate it from the list and exclude it from the size calculation, by selecting the value concerned and then pressing the delete button;
- **step 2.** using control elements similar with those described in step 1, the user specifies the value of the angles of the bent portions. He may also add an unlimited angle values and delete any wrong ones. Virtually, by running the application the user will generate a string of numerical values to be taken into account when calculating the dimensions according to formula 1;
- **step 3.** the user specifies the values of the bend radiuses corresponding to the bent portions, and will have the possibility to visualize the values introduced and to delete the wrong ones;
- **step 4:** user specifies the thickness of the material. Depending on thickness and the value of the bending radiuses the software will calculate, for each bent portion, the relative radius.
- **Step 5.** in the numerical control element, the user specified the values of the displacement coefficient x, according to the values displayed in the indicator element of Multicolonlist box type, as recommended by the specialized literature.

After running the application, the numerical indicator element will display the value of the length of the plane semifinished material, expressed in millimeters.

The diagram is the window in which the user has opened the algorithm based on which the application will make the calculations and lines of reasoning as are necessary for processing the information (figure 2).

The application for the determination of plane semifinished material's dimensions uses the "structure case", which is a Wile type of repetitive structure, driven by the Stop button, as well as functions for converting numerical type of data into text type of data, functions for converting text data into numerical data, property nodes for Listbox type of elements with Item Names property, functions that operate with values of numerical values string type such as Build Array, Delete from Array, Add Array Elements, functions performing simple arithmetical operations such as Divide, Compound Arithmetic, and numerical and Array type of constants.
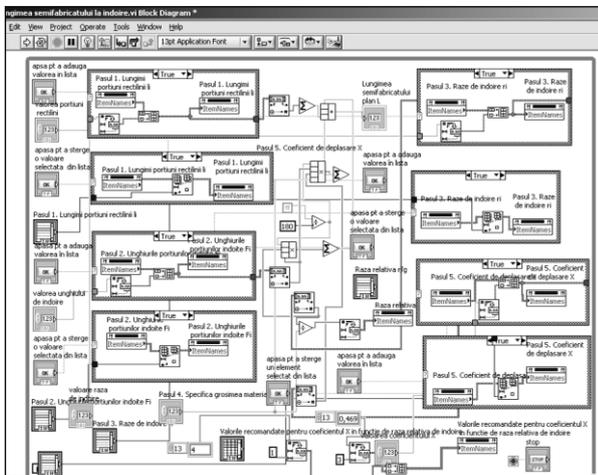

Fig. 2. Application Diagram

3. ACCESSING THE APPLICATION OVER THE INTERNET

Apart from being used as a standalone application, the VI can be embedded in a HTML page to be remotely accessed over the Internet. To allow the users to access the remote application, the VI has to be open on the server where the HTML page is hosted and the LabView Web Server has to be enabled (figure 3).
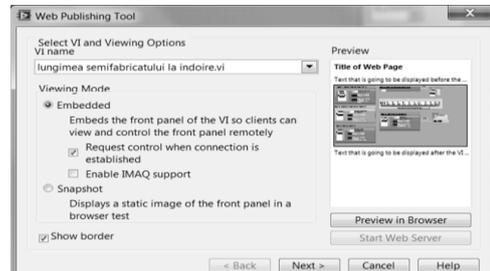

Fig. 3. LabView Web Server

If only one user is allowed to have the application's control, the feature can be enabled on the LabView Web Server and the embedded application can be used only after the control is requested and granted (figure 4).

Fig. 4. Request control of VI

4. CONCLUSION

This application made in the graphic programming environment LabView may be successfully used to improve the design activities of the cold plastic deformation technologies. Using this tool, which is available on the E-learning platform of the IMST faculty, users can determine the dimensions of the plane semifinished with high precision, following only five steps, for any type of parts without be necessary mathematical calculations laborious.

5. REFERENCES

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