THE PARAMETRIC DESIGN OF ACTIVE PLATE OF A CUTTING DIE

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Abstract:. Due to high productivity punching process is one of the most efficient methods of manufacturing and it is designed especially for large series production.
The punching process ensure technical compliance required by the functional role of piece in terms of size tolerances, deviations of shape and reciprocal position of surfaces, so it can get quite high precision parts, which in most cases do not require further processing by cutting
In addition to high productivity and high accuracy is ensured a low consumption of material, resulting a very low cost of obtained pieces. This paper presents the parametric design of an active plate for a simple die-cut perforated piece type washer.
By cold pressing it is possible to obtain parts with complex configuration and accurate details in series of large production, at very low cost of production.
Keywords: punching process, parametric design

1. INTRODUCTION

Cost reduction can be achieved by proper tailoring of the material so that as many parts can be obtained from the same amount of material, but also by reducing the number of operations, simplifying the design of dies.

Quality of parts produced by stamping is influenced by factors involved during manufacturing process, such as geometry of edges and surfaces of active elements, the quality of surfaces of active elements, the physico – mechanical properties of workpieces material and active elements, and the clearance between the active elements.

The evolution of products, dictated by the need to survive in the market, requires changing of manufacturing processes.

This requires an integrated approach to constructive aspects, technological, organizational and management of stages of development with the aim to reduce as much as possible the time and the cost of new products.

In developing a new product, the design has an important place, the time needed for the product design mainly determining in terms of time-to-market.

In this context, the aim of this paper is to present an efficient method for designing cutting plate dies for a family of parts and low cost labour and time by using parametric design.

Parametric design involves defining the parameters and rules which allow variations of these parameters within certain limits.

The parameters of the virtual environment are the same as those from the real environment and can be measurable parameters (distance, temperature, volume, density, pressure, etc.), but can also be parameters defining emotion (joyful-sad), aspect (good - bad), etc. .

Parameterization concept is old and over the years has been used in many different areas (clothing, footwear, watches etc.) to reproduce some items to a specific scale by changing some parameters.

By establishing relationships between parameters, their variation limits are restricted and also the variants of solution, thus contributing to clarity and coherence and systematic design process.

Engineering is a field in which the parametrization can lead to spectacular results.

The design needed to product development is laborious and time-consuming human resources. The practical character of parametrization arises from the fact that by parametrization is possible to analyze a wider variety of solutions to a problem, being able to respond quickly to new product development.

Advanced parametrization involves the use of mathematical programming in which designers develop their own mathematical models for different parameters constraints.

With all its advantages, the parametrization is still rarely put into practice. There are many causes and can be disputed.

- terms of design are often too short, and designers do not have enough time to research and develop new tools
- high cost of computers systems that can run parametric cad software
- high cost of parametric cad applications
- sometimes difficult collaboration between parametrization application software and cad application.

For using digital parametric design is necessary to identify common features and differences in products, and identifying parameters variation and establishing the relationships, then you have to create the algorithm for calculating the constraints between the parameters.

The parametric design can be applied successfully to achieve families of pieces. These have similar shapes, but different sizes.

2. CASE STUDY

This paper presents the parametric design of an active plate for a simple die-cut perforated piece type washer.

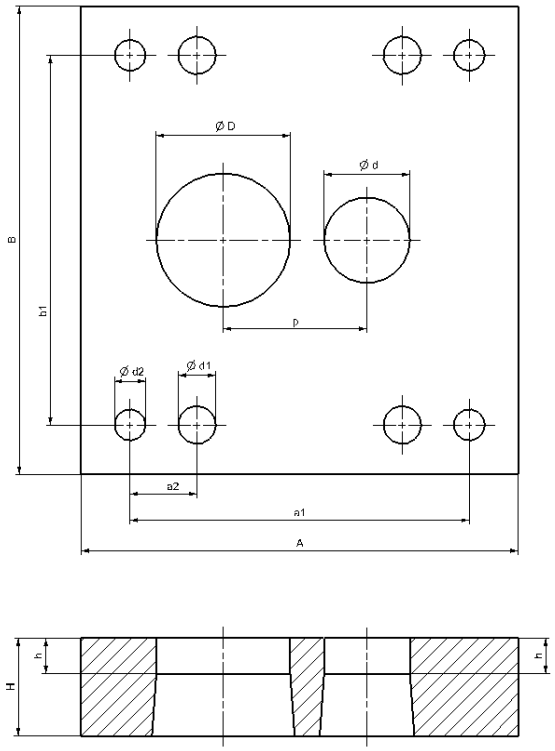

Fig.1. The sketch of active plate

Based on part dimensions were identified variables that can be parameterized and constraints between them. All this information was used to constrain dimensional parameters that define the geometry of active plate presented in figure 1.

Using mathematical relationships presented in the literature has developed a computer program in Excel that allows the determination of constructive parameters for punching elements designed.

Based on the program were determined the step, the clearance between the active elements, material coefficients for calculating force, work and power required for stamping. Block diagram of the computer program is presented in figure. 2.

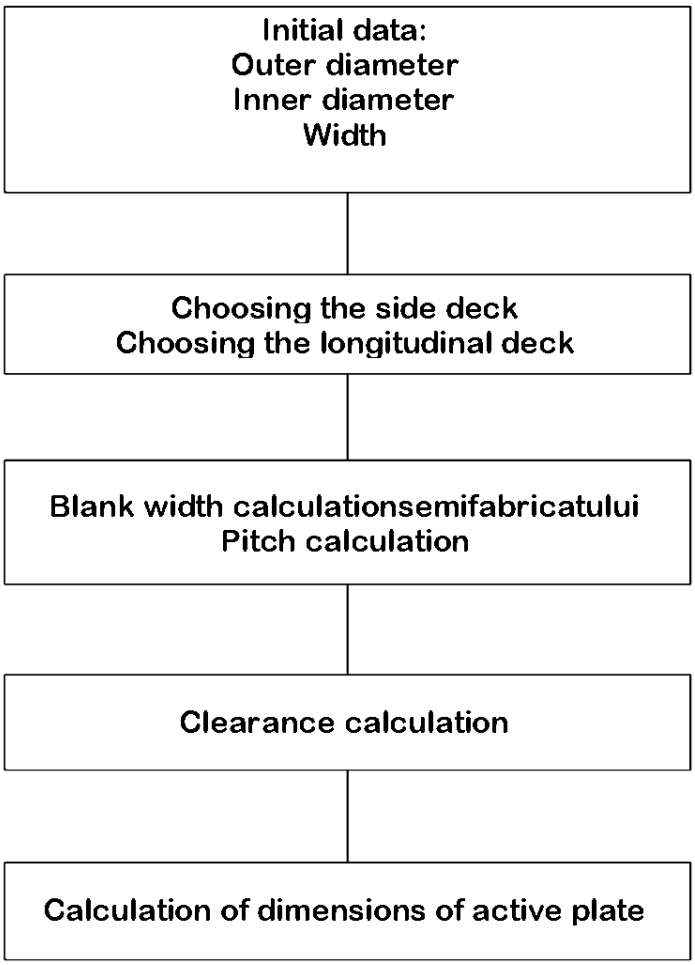

Figure.2. Block diagram of the computer program

Parametric CAD applications are generally specialized in mechanical or architectural design and maintain the connection between various elements during interactions between these.

Active plate design was performed using Unigraphics NX application that offers the possibility to perform parametric constraints between geometric elements designed punch.

It has been made several case studies, active plate design of a die cut punching parts washer type.

Case 1. In table 1 are presented the calculated dimensions for parameters of the plate

Table 1 Calculated dimensions

Dimensiuni saiba		
Diametrul exterior	D	20
Diametrul interior	d	15
Grosimea	g	2
Semifabricat		
Puntitele		
Longitudinla	n	1.5
Laterala	m	1.8
Latimea semifabricatului	L	23.6
Pasul	p	21.5
Placa activa		
Grosimea placii	H	18
Lungimea placii	A	75
Latimea placii	B	93
Diametrul gaurilor pentru suruburi	d1	8.5
Diametrul gaurilor pentru stifturi	d2	7
Distanta intre gauri de stift pe orizontala	a1	53
Distanta intre gaurile de suruburi si stifturi	a2	15
Distanta intre gaurile de stift pe verticala	b1	71
Gulerul orificiului la placa activa	h	7

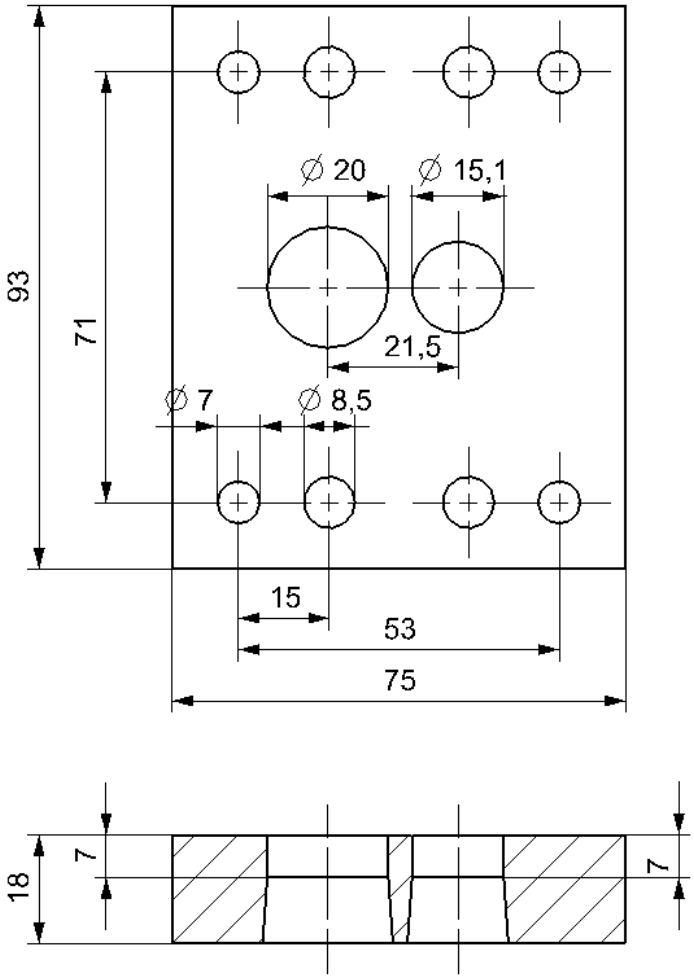

Fig. 3 The calculated dimensions for case 1

Case 2

Table2. Calculated dimensions

Dimensiuni saiba		
Diametrul exterior	**D**	**40**
Diametrul interior	**d**	**25**
Grosimea	**g**	**3**
Semifabricat		
Puntitele		
Longitudinla	**n**	**2.2**
Laterala	**m**	**2.5**
Latimea semifabricatului	**L**	**45**
Pasul	**p**	**42.2**
Placa activa		
Grosimea placii	**H**	**25**
Lungimea placii	**A**	**117**
Latimea placii	**B**	**115**
Diametrul gaurilor pentru suruburi	**d1**	**10.5**
Diametrul gaurilor pentru stifturi	**d2**	**8**
Distanta intre gauri de stift pe orizontala	**a1**	**90**
Distanta intre gaurile de suruburi si stifturi	**a2**	**18**
Distanta intre gaurile de stift pe verticala	**b1**	**88**
Gulerul orificiului la placa activa	**h**	**8**

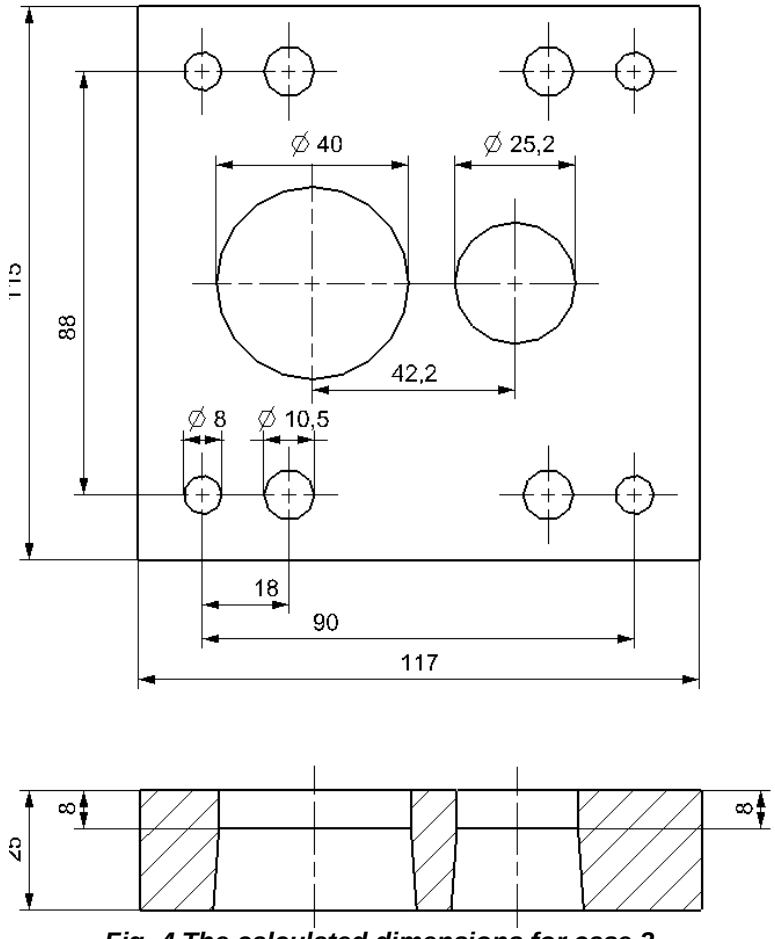

Fig. 4 The calculated dimensions for case 2

The 3D model of active plate is presented in figure 5.

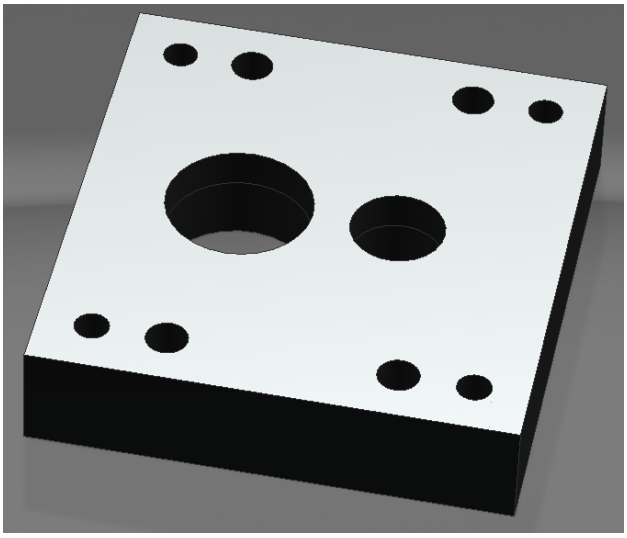

Figure 5. The 3D model of active plate

3. CONCLUSIONS

- parametric cad software applications have the ability to store data model as tables and maintain their associativity in different environments of cad applications (modelling, assembly, drafting),
- by using mathematical relationships presented in the literature was developed a computer program in excel, which allowed the determination of constructive parameters for punching the designed elements.
- if one component is changed, updated information in real time (parts list, odds, material, mass, volume, etc.).
- based on part dimensions were identified variables which can be parametrized and constraints between them.
- the change is realized with a minimized volume of work
- by using another input data the obtained 3d model has no errors
- the 2d documentation is automatically obtained
- the procedure can be adjusted to other configurations of part.

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