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RESEARCH REGARDING THE MODULAR STAMPING TOOLS

Alin SĂCARĂ, Marian BORZAN, Gheorghe ACHIMAŞ

Abstract: *The stamping tools designed in a modular system, due to the high universality, have broad possibilities to be adapted according to the different geometrical shape and degree of complexity of the parts to be obtained. The execution of the tools in this system reduces the design, execution and assemblage time of the afferent elements. It also assures the organization of the administration and repairing in superior condition, comparatively to the stamping tools realized in a classical manner. As a result of the possibilities to reuse the elements for different assemblies, the modular tools are characterized by superior technical and economical parameters, as compared to those manufactured in the standard conditions.*

Key words: *stamping tools, modularity, complexity*

1. INTRODUCTION

Making parts by cold forming operations consists in transforming the initial shape of the blank in a geometric shape corresponding to the form proposed. The tools used for the forming operations are known as stamping dies. Upgrading technologies on the execution by punching or stamping of parts used in machinery industry, machinery and equipment requires proper and continuous improvement of the tools.

However the design and development of the dies used: achieving various milestones, achieving a single operation, increase the manufacturing costs of these tools, this is due to the fact that the forming dies in classical construction (Fig.1) and adjacent components have a limited use[1] [3].

The elimination of these drawbacks imposes replacing the classical with modular elements (Fig.2], which can be reused, put back and grouped so that they can be used to produce new parts and tools, which provide reducing design time by about 45%, 55% and execution of metallic material consumption by about 40%[2].

Fig.1 Classical stamping tool

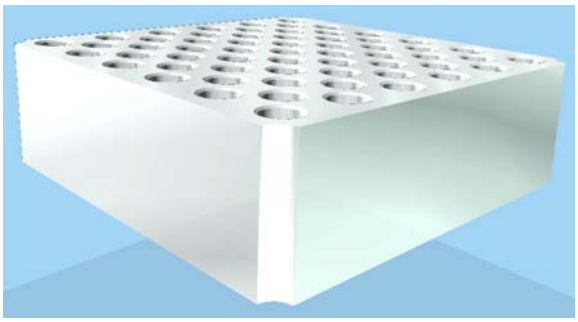

Fig.2 Modular die plate

2. METHODS

Modular die plates are elements that can be produced from grey cast iron Fc 25-30 STAS 568-75 or cast carbon steel OT 45-55 STAS 600-74 or 45-50 quality carbon steel OLC STAS 880-80 (Fig. 3).

Fig.3 Mazak–CNC machine used for manufacturing modular plates from quality carbon steel.

The geometrical shape and dimensions depend on the size of the modular plate, the size and the arrangement of the guiding columns and the size of the fasteners.

Modular die plates are equipped with T-channels or other guiding profiles for positioning and mounting the active components [2] . Because T channels carried on the front surface side of the die plate and allows the guidance system can be fitted in any position on the respective surfaces.

In the case of the square plate (Fig. 4) and T-channel arranged along two perpendicular directions distance between two successive channels is denoted by ***m*** and is given by the following relationship:

$$m = \pm\frac{1}{n+k}\sqrt{\frac{F}{\sigma_{ac}}} + b \ [mm]$$

where:

m - the distance between two T successive channels

$n_x = n_y = n$ - the number of T-channels along the Ox and Oy axes

F - maximum stamping force [daN]

σ_{ac} - admissible compressive strength of the steel [daN/mm^2]

k = 1 for casting steel or grey cast iron

k = 2 for hot rolled steel

b - width of the T-channel

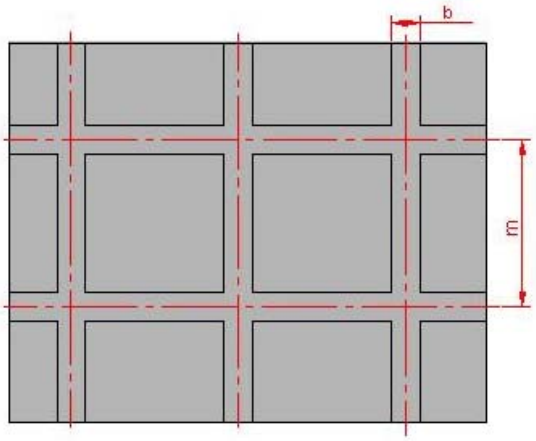

Fig. 4 Quarter of a square plate

3. APPLICATION AND RESULTS

Due to the advantages of stamping dies successfully applied in the engineering industry, the processing by cold forming of a variety of parts. The complexity of parts, technical equipment prescribed conditions and physical-mechanical properties of the workpiece lead to choosing and rearranging the elements component at the modulate dies and mould (Fig. 5).

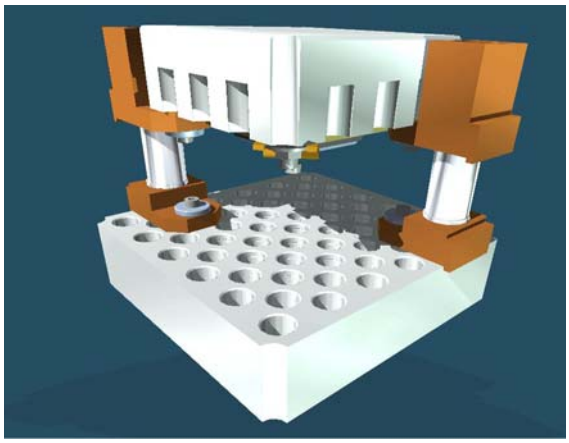

Fig. 5. Modular stamping die

Modular stamping dies can be used for parts requiring strength between 3000 and 24000 daN (see Figs. 6, 7 and 8). This range

corresponds to the ferrous and nonferrous parts with thickness less than 12mm, having variable width and length[2].

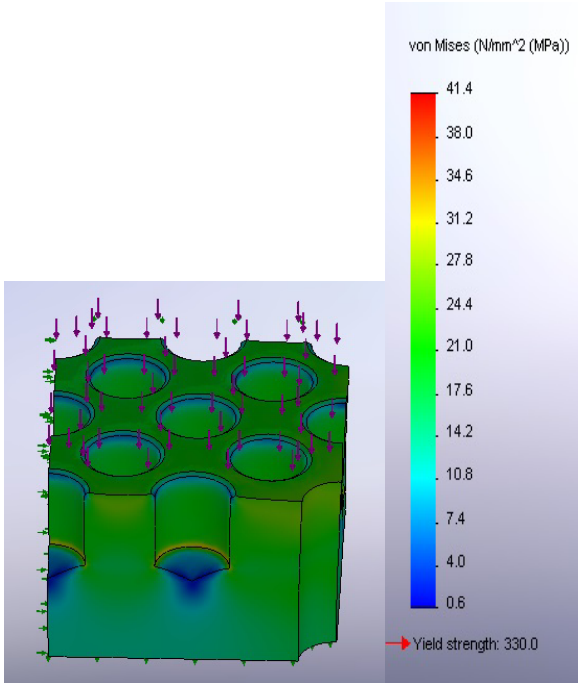

Fig. 6. Finite element analysis of a quarter of a modular die plate subjected to a stamping force (distribution of the von Mises equivalent stress)

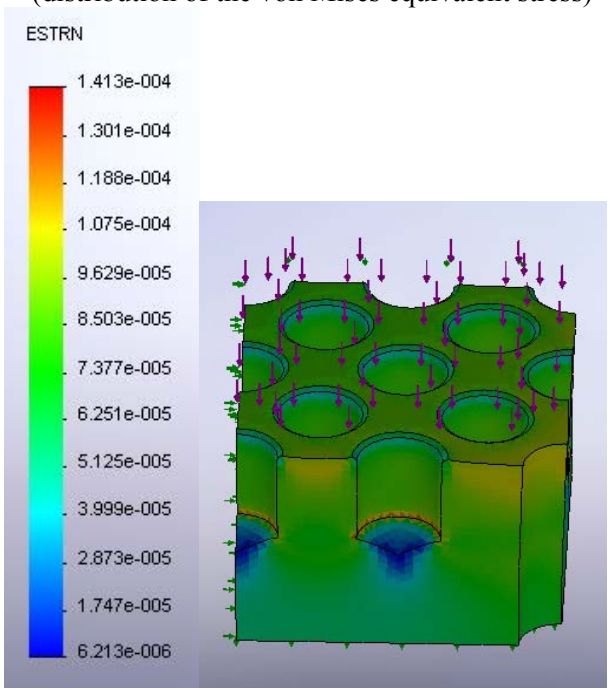

Fig. 7. Finite element analysis of a quarter of a modular die plate subjected to a stamping force (distribution of the von Mises equivalent strain)

Due to the high degree of mobility at modular elements adaptation to new conditions created by the improvement in manufacturing parts made or the introduction of new products, the costs of modular stamping dies are very low especially when it comes to small batches of parts and unique parts.

Thus the residence time decreases for modular elements and the depreciation costs for the performance of such parts is accomplished in a short time.

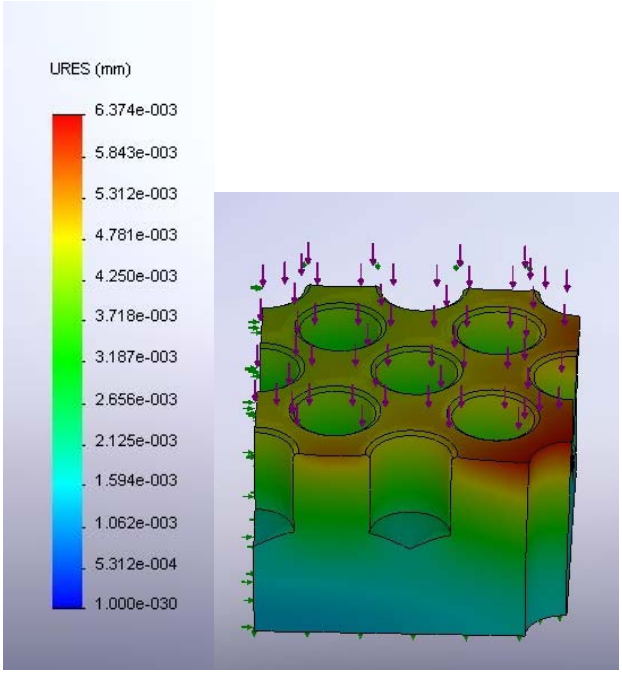

Fig. 8. Finite element analysis of a quarter of a modular die plate subjected to a stamping force (distribution of the total displacement)

4. CONCLUSIONS

Due to the economic and technical advantages, modular stamping dies with complex functionality can be used to manufacture a variety of parts that are different between them by geometric shapes and sizes. From the functional point of view, this type of forming tools can be classified into groups of similar complexity as those having classical construction, but are structurally different because there are essential differences between them.

5. REFERENCES

[1]http://www.alvimec.ro/module/produse_piese stantate.html

[2] **“**STANTE SI MATRITE DIN ELEMENTE MODULATE ”de Dr. Ing. Constantin Dumitras si colectiv, Editura Tehnica, Bucuresti, 1980;
[3] https://www.google.ro/search

Cercetări privitoare la ştanțe şi matrițe modulate

Rezumat : *Ştanțele si matrițele proiectate în sistem modular, din cauza gradului mare de universalitate, au posibilități mari de adaptare în funcție de diferitele forme geometrice şi gradul de complexitate a pieselor care urmează să fie obținute. Execuțiile ştanțelor şi matrițelor în acest sistem reduce timpul de proiectare, execuție si montaj a elementelor aferente. De asemenea, întreținerea şi repararea poate fi asigurată în condiții superioare, comparativ cu ştanțele şi matrițele realizate în sistem clasic. Ca urmare a posibilităților de folosire a elementelor pentru diferite ansambluri, ştanțele şi matrițele modulate sunt caracterizate de indici tehnici şi economici superiori, în comparație cu cei din sistemul clasic.*

Alin SĂCARĂ, PhD student, Eng Technical University of Cluj-Napoca, Department of Manufacturing Engineering, 103-105 Muncii Bvd., 400641 Cluj-Napoca, România,
E-mail: alinsacara@yahoo.com
Gheorghe ACHIMAŞ, Prof. Phd. Dr.h.c. Eng., Technical University of Cluj-Napoca, Department of Manufacturing Engineering, 103-105 Muncii Bvd., 400641 Cluj-Napoca, România,
E-mail: Gheorghe.Achimas@tcm.utcluj.ro
Marian BORZAN, Prof. Phd. Dr.h.c. Eng., Technical University of Cluj-Napoca, Department of Manufacturing Engineering, 11 Prof. Emil Petrovici Street, 400041 Cluj-Napoca, România,
E-mail: Marian.Borzan@tcm.utcluj.ro