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DESIGNING VARIABLE PARTS OF SHEARING TOOLS BY HELP OF COMPUTER TECHNIQUE

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Abstract: *The paper is oriented for designing variable parts of forming tools. The most effective is manner creating digital tool model on base parametric models and creating of catalog from these models according to logical continuity. It ensures optimization of needed number of production method, rebate of tool assortment, sharing of attested designed solution. It was made database of model parts of tool, material database, dimensional database by help of variables. It was designed stands of shearing die and model of shearing die. It is possible visual control of shear die in the term of laps, it is possible to check function of tool after assignments of kinematics joins.*

Key words: *variable parts, shear tool, parametric model, designing*

1. INTRODUCTION

Sheet metal forming appertains to progressive process of production. Pressing utilization depends to tools materials, to tool construction and production of pressing tools. Production every sort of pressings requires suitable single-purpose forming tool. Tools design and production in sheet metal forming especially shearing tools is very cost and time expensive process. It is necessary to hold dimensions precision and shapes, surface quality, setting-up precision, time of implementation is from tool request to finishing his production and examining in operation takes time a few months very often. By use of informational technology in tools suggestion area develops possibility of complex acquirement information about tool geometry, correlative positions of several parts, after materials assigning acquirement of mechanical properties and thereby shortening of development time.

2. SPECIALTY OF SHEAR DIE MODELLING BY SOFTWARE CATIA

Category CAD/CAM/CAE systems with support of parametric and open architecture has application in general machine industry [2]. Here is possible to assign software CATIA. The main reasons, which guide to decide to use 3D system in construction works:

- increase of productivity in construction works,
- reduce of mistakes in documentation,
- improve documentation, especially of big assembly at using axonometric views, which are easy deduced from 3D model,
- parametrization of each components, dies,

- the check is rises on models, not on drawing,
- consistent structure of assemblies,
- effective tool of eliminates crashes.

The possibilities of tools construction by software CATIA:

- translate of exist database of shearing dies created by similar CAD software, in our case are created models of tools by software Mechanical Desktop, it is possible load them, unlike without possibility of entire modification the base shape of individual parts,
- creation own database of tools, components, catalogization of constituent components

By creation of catalog is possible automation often-repeated jobs in tools suggestions and quick generation of drawing documentation.

In modeling of tool parts, as well as normalized parts, it is possible go out from standard, which are very often used and it is possible to use information about dimensions, about basic shape from its standard.

In term of using of several parts insertion of shear dies into construction series according to technological designation is very suitable to applied catalog creating method. It is advisable to suggest arrangement of catalog so, that construction series create logical structure of catalog on the base technological designation.

3. APPLICATION OF PARAMETRIZATION IN CATALOG CREATION

By creation of catalog it is possible to create superstructure, which contain special database of very often used components, for example die sets, bottom tool assembly, and top tool assembly of blanking tool, stop pins. [1] [3]

For more complicated and more precision tools is needed die set. In catalog was given die set from gray cast iron. It was modeled the stand of tool with circle work place what consist of four base parts. Every part has additional dimensions information in form of parameters, such that defined parametric model, the dimensions and other characteristics have not dedicated by

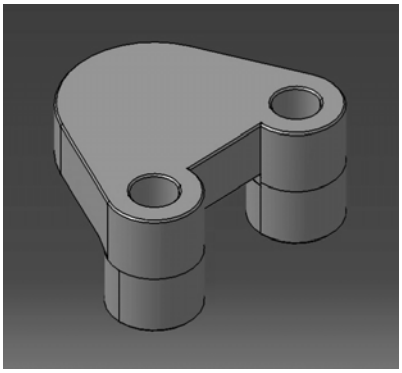

Fig.1 *Model of top plate*

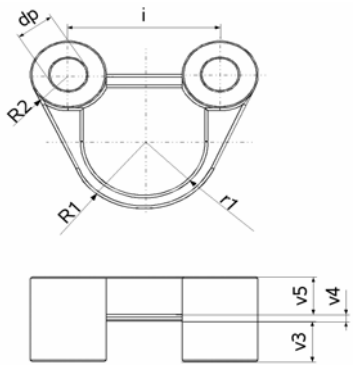

Fig.2 *Sketch of plate*

concrete values, but by help of variables, expressions and equations, which together interact. After assignment basically concrete values, automatically are calculated objective dimensions of commodity. The space parametric model of parts gives a lot of information about

geometric characteristics and also about relative location, about constrains parts in assemblies.

Table 1Parameters for creating of top plate variants

PartNumber	R1(mm)	R2(mm)	r1(mm)	v3(mm)	v4(mm)	v5(mm)	dp(mm)	i(mm)
D 80	50,0	25,0	40,0	30,0	3,0	30,0	25,0	100,0
D 100	60,0	35,0	50,0	30,0	3,0	30,0	31,0	120,0
D 120	70,0	45,0	60,0	36,0	4,0	40,0	31,0	140,0
D 140	80,0	55,0	70,0	36,0	4,0	40,0	38,0	160,0
D 160	90,0	65,0	80,0	45,0	5,0	50,0	46,0	180,0
D 180	100,0	75,0	90,0	45,0	5,0	50,0	46,0	200,0

Model of top plate generated upon variable is in Figure 1, the sketch of plate is in Figure 2. Part list is created in Microsoft Excel, and variables and parametric are synchronous connection with model (Table 1).

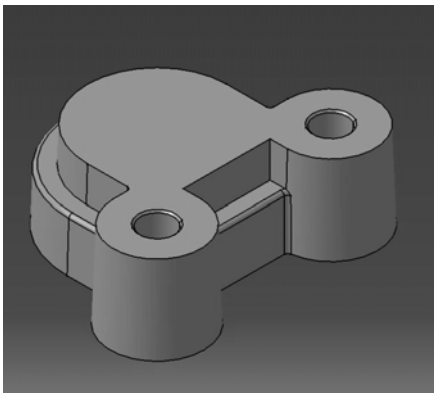

Fig.3 *Model of bottom plate*

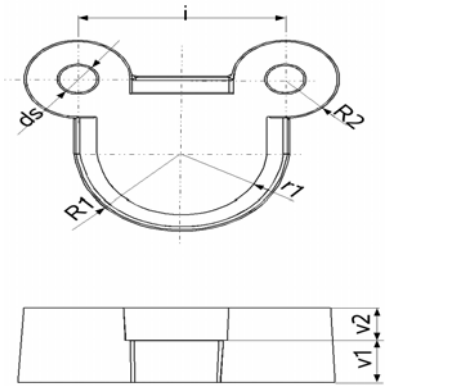

Fig.4 *Sketch of bottom plate*

Table 2. P*arameters for creating of bottom plate variants*

PartNumber	R1(mm)	R2(mm)	r1(mm)	v1(mm)	v2(mm)	ds(mm)	i(mm)
D 80	50,0	25,0	40,0	30,0	20,0	19,0	100,0
D 100	60,0	35,0	50,0	30,0	20,0	25,0	120,0
D 120	70,0	45,0	60,0	30,0	20,0	25,0	140,0
D 140	80,0	55,0	70,0	40,0	25,0	32,0	160,0
D 160	90,0	65,0	80,0	40,0	25,0	40,0	180,0
D 180	100,0	75,0	90,0	40,0	25,0	40,0	200,0

Alike parametric model of bottom plate is in Figure 3, the sketch of this plate is in Figure 4, created part list in Microsoft Excel is in Table 2. Each assembly component has information about name, material characteristics and piece list involves this information too. [4]

The parametric assembly of die set is in Fig. 5. Resultant assembly presentation is possible graphic disassemble, it is possible to create kinematics constraints and so trace motion of tool, such manner it is possible control setting of stroke size for chosen die set.

At modeling by this manner it is not necessary large drawing library of dimension options parts of tool, it is needed only dimension database. Drawing documentation is easy generated from model, model space and drawing space are each other connected, it is possible edit

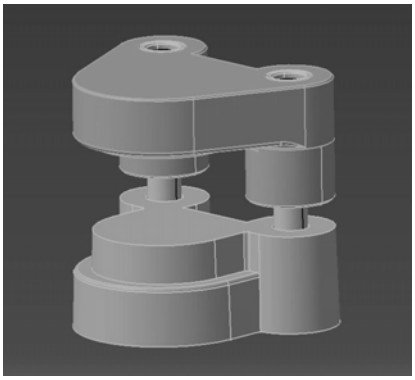

Fig.5 *Parametric grey iron die set*

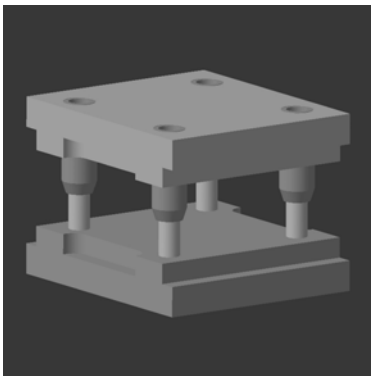

Fig.6 *Parametric steel die set*

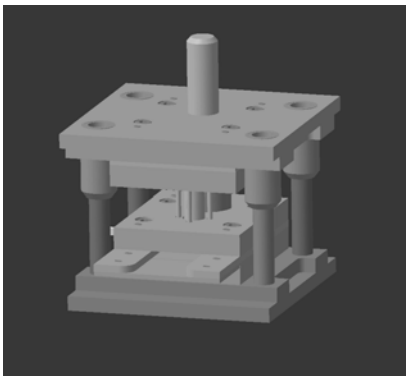

Fig.7 *Follow blanking die*

model shape from drawing space, existed there associative relation. It is possible to change of assembly structure without losing of define constrains. The parametric model of steel die set with rectangular workplace is in Fig. 6.

Die sets serves as base assembly for creating type similar blanking dies. After performance of construction-technological calculus for concretion blanking tool suggestion it is possible to set blanking die on base choice from database. By this manner was designed follow-blanking die for production pressed part type of washer (Fig.7). The created extension serves for quickly designing of shear tools in conditions of university and such education material for students.

4. CONCLUSION

The engineering process does not end with 3D product modeling. A design is possible use as input for various application areas, for example finite-element analysis, kinematics-dynamic analysis, NC programming. It is possible by means of CAM software without obligation of creating drawing documentation to manufacture toll. Modern machine with CNC or DNC control can upon control program generated by CAM software to manufacture individual parts of tool. Input is usually only 3D model of part.

After this manner, the time for product development is shortened, it is possible speeds up and simplify process from tool design to its manufacture.

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