CAD/CAM simulation of the connector terminals based on SolidWorks and its extensional software

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Abstract. This article uses the connector terminal’s three-dimensional entity as the model, and then imports it into 3D finite element analysis software-SolidWorks, the feasible stamping process plans and the multistage progressive die design are proposed by using the plug-in Logopress 3. The processing of the mold parts simulation and NC programming Steps are simulated by using the SolidCAM. Aiming at the problems of complex edge shape, large number of process stages and low overall design efficiency of terminal multistage progressive die. The application provides a reference for subsequent die design and die manufacturing.

1. Introduction

Various connector terminals as information technology components have been used extensively in the automation, computers, communications, consumer electronics, aerospace electrical connector, car on internet, etc. Connector terminals are integrated with charging data transmission, audio and video collection and other functions [1]. The wide variety of terminal is actually the metal reed of different shapes which are encapsulated in the insulation plastic [2]. The connector terminals have the following characteristics: ultra-thin materials, complex shape and small size, high precision of shape and position (size accuracy requirements close to millimeter level), complex forming process and so on. The connector terminals belong to the mass production of the series stamping products. The mold structure are similar and the sizes are different in its mold design of progressive die. According to the traditional design method, designers have to do a lot of repetitive work for the overall dimensions of general parts and standard parts design process, which cause the present situation of the high cost of mold design and the long mould design cycle.

In order to solve the problem of low efficiency of the overall design, CAD/CAM technology is proposed, which can realize the integration of process planning and die design and manufacture of [3-4]. Using the standard parts library of SolidWorks Logopress 3 plugin, the input parameters of the parts can be automatically generated in the design process, which can greatly improve the efficiency of mould design and reduce the designer's work [5]. The design thought of Logopress 3 is the inverse deduction of punch forming process, that is, first the finished product parts has been carried out to record each processing step, then an entity is generated after each processing step, next the optimization layout of two-dimensional blanking piece is applied [6]. According to the optimized layout, the punches are designed. After the strip layout, the mold design starting from the template design, and then various die parts assembled on the basis of the template [7-8]. After finishing the mould 3D design, we can analyze the various parameters of mould and modify to achieve the goal of optimization design. Animation function of Logopress 3 can be used to simulate the stamping process.
the optimal mold structure and related components of the three-dimensional entity model can be converted into a two-dimensional engineering graphics or other forms for mould manufacturing.

Finally, SolidCAM can be used in the simulation of mold parts processing process and CNC programming. The main steps include: pre-processing, process setting and post-processing. In pre-processing, process analysis can be implemented, which includes identifying process scheme and the processing route selecting cutting tools, determine the workpiece coordinate system and the cutting point, selection of machine tool, determine the cutting parameter; In the process selecting processing graphics Settings; Set the cutting tool; Setting processing parameters. In the post-processing, including simulation of machining method, the simulation control and the generated code.

2. Logopress 3 Mold Design Process

2.1. Analysis of key process issues

The rectangular connector terminal parts was used as an example, as shown in Fig. 1. The material is beryllium bronze and the thickness is 0.2 mm. The size of the part is small and the pitch of the contact needle is 1.250 mm. Contact needle length 15.80 mm, width 0.50 mm, central symmetry and position of 0.03 mm, a group of connector contact needles of 20. The pitch is 25.00 mm. The accuracy of other dimensions is ±0.02 mm, the stamping burrs is less than 0.01 mm. Good surface quality is required and scratches and stamping defects are not allowed. It belongs to mass production. The homogeneity of the punch clearance and the smoothness, step precision and die guidance precision of the feed are highly required. Due to the small pitch of the terminal pin and its low stiffness, its shape is easily affected by subsequent work steps. And the offset in the horizontal direction is hard to correct. The unreasonable step work arrangements will lead to failure of the whole mold design, Instability of bending angle can also cause the parts to be scrapped due to the bending characteristics of the parts. As the number of pins is higher, the spacing between the pins is narrower, and it is easy to cause problems such as lamination, vacuum adsorption, and scraping.[9-11]. In a word, it is very important to design layout and die structure reasonably.

2.2. Expand drawing and strip layout design

First, using the step by step expansion function to generate sheet metal parts to carry out operations and get the tape model. This method is more efficient and accurate than the traditional method of using empirical formula for manual calculation. As shown in Fig. 2. To ensure reliable and accurate positioning design, 4 positioning pin positioning holes are rushed on the first position to set positioning pin on the key position. In addition, a number of elastic top material devices are designed within the full length range of the strip to ensure the reliable lifting of the strip material. Since the pitch between the contact needles is 0.125 mm, the dressing process of 5 Oval holes or 5 different holes is used at a time, and there are 3 pins between each punching die, which ensures the accuracy of the punching and the possibility of processing. There are a total of 10 punching positions, 4 bending forming positions, and 3 empty positions. As shown in Fig. 3.
2.3. Create Templates and Punch Assembly
First, according to the width of the tape and the position, the template was created and the initial size of the template was set on the initial section of the independent body.

In Logopress 3, click the "add a template" button in the "template" option bar select template types, enter the name of the template, choose to cooperate with the reference entity, the template size options bar set parameters such as length, width, thickness and chamfer. The system automatically generate template model. As shown in Fig.4. Repeat the above steps, add other templates in the model, and then create the forming punch, and punch through the different templates and create holes in its through the template.

First of all, we assemble the blanking punches which were created during the layout. In the "punch assembly" option bar of punch property manager, we can choose punches. Then select the "punch fixing plate", the system automatically fixes the punch on the punch fixing plate and identifies other templates; input the gap value in the corresponding option bar of each template, click the "OK" button in the "Forming punch and die" property manager, and then the punch and die can be generated, including cutting holes on the template. As shown in Fig. 5.

Standard parts library of Logopress 3 can be used to complete the die design, including the creation of guiding-column and guiding-cover, unloading spring, unloading screw, supporting screw, supporting spring and positioning pin and fastening screw. Select and modify the parameters, add standard parts automatically assembled in the template, its position in the three-dimensional space is fully related to the template, hide the template assembly standard parts as shown in Fig.6.

2.4. The overall structure design of mould
In the Logopress 3 toolbar, click the "Standard Parts Library" button and pop up the "Select Standard Parts" drop-down list. Click the "six corner screws" button to pop up the "screw assembly" attribute manager. In the manager, we can complete the setting of the screw parameters according to the prompts of each option, then locate the screw in the sketch mode, and finally assemble the screw on each template. The system automatically completes the removal of screw holes on various templates. According to the above method, the assembly of guide pillar sleeve, unloading spring, unloading screw, supporting screw, supporting spring and positioning pin is completed. The finished die assembly drawing is shown in Fig.7, and a series of two-dimensional die engineering drawings are generated synchronously for production, as shown in Fig.8.

3. SolidCAM simulation and NC programming
Take concave die using Logopress 3 modeling as an example. Using NC machining software SolidCAM, The basic simulation and NC machining programming of drilling and wire cutting NC
machining process are carried out step by step. Firstly, the drilling process is simulated. According to the distribution of each hole, each hole is selected counterclockwise, and the tool diameter is set according to each hole diameter. The processing route is shown in Fig. 9. After setting all the data, archive and calculate. Then simulate and simulate, if meet the requirements, we can generate NC machining G code. After drilling, wire cutting is done. The lower template has 10 elliptical holes and 6 special-shaped holes. According to the requirement of punch and concave die matching accuracy, WEDM adopts the technology of cutting, repairing and finishing three times. As shown in Fig. 10. Finally, each design parameter of the concave die structure had achieved, and obtained the anticipated result.

4. Conclusions
This study shows that the problem of low efficiency of the the connector terminal progressive die design which have more complex mould shapes and process stages can be improved by Logopress 3 and SolidCAM tool. Based on SolidWorks software platform, we can quickly complete the strip layout, punch assembly, adding templates, and the use of standard parts library to finish the automatic installation and position of mold standard parts. According to the previous design results, we can also intuitively demonstrate the basic machining simulation and NC programming for non-standard parts such as concave template. In a word, By using SolidWorks software platform, it can improve the design efficiency and quality of multistage progressive die for middle and small size series stamping products.

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Fig. 4 template for forming punch

Fig. 5 layout of punch
Fig. 6 3D drawing of standard parts

Fig. 7 die assembly drawing

Fig. 8 engineering drawing of concave template

Fig. 9 processing route of all holes
Fig. 10 line cutting contour

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