

Machining Accuracy Control Technology of Mechanical Mould

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Abstract: In the process of mechanical mould processing, it is necessary to ensure the processing accuracy, and only in this way, the performance of mechanical mould can be ensured. When processing and producing mechanical moulds, it is required to fully appreciate the importance of accuracy. There are several factors which may cause accuracy problems in the process of machining and production. Then this paper studies the relevant control strategies for these problems. In this paper, combined with the mechanical mould processing and production technology characteristics, the research on machining accuracy control of mechanical mould is carried out.

1. Introduction

From the view of numerical control system, there are three main reasons for machining accuracy error of mechanical mould. First, mechanical hardware defects themselves affect the machining accuracy, such as tool accuracy, fixture accuracy, reverse clearance, guide rail straightness error. Second, the cutting process affects the machining accuracy, such as the tool deformation, tool wear. Third, the control error of the control system affects the machining accuracy, such as the multi-axis position loop gain mismatching, the hysteresis response of the servo system. The final die error is the combination of the above three errors. The mechanical hardware defects and cutting process errors can be compensated by improving the mechanical hardware geometric accuracy or the geometric error compensation method. The control error is mainly reduced by improving the servo control algorithm or servo control parameters.

2. The Importance of CNC Machining Technology in Mechanical Mould Processing

Industrial products are constantly developing towards high performance and diversification. Customers often demand that manufacturers can develop moulds for their new products in a short time. In order to meet the needs of customers, CNC machining technology has been widely used in the mould manufacturing industry. With the continuous development of electronic technology, numerical control technology developed from the former hardware numerical control to computer control. Computer control not only improves the machining accuracy of CNC machine tool, but also expands the application range of CNC technology. Along with the numerical control machining technology unceasing research, CAD/CAM unceasingly develops. At present, numerical control technology and CAD/CAM system play an irreplaceable role in the field of mould design and machining. In the process of mould processing, we should use CNC machining control technology to shorten the mould manufacturing cycle and reduce costs, while improving the mould manufacturing accuracy. Numerical control milling is the most commonly used machining method in numerical control machining of mould.

3. Main Factors Affecting the Machining Accuracy of Mechanical Mould

3.1 Spindle rotation error

Spindle rotation error is an important factor in machining. When the machining equipment spindle coaxiality error, it will produce spindle radial rotation error. Error will occur in the whole machining equipment, so that there will be errors in the processing of products. When the spindle shoulder face and bearing bearing face of the mechanical equipment are not well matched, and there

is an error in the verticality with other axes, it is easy to cause the error of axial movement. This error will have an important impact on the plane of the processed product, which will also reduce the accuracy of the product parts.

3.2 Mechanical hardware defects

Mechanical hardware defects affect the machining accuracy, such as tool and fixture accuracy. The impact of tool and fixture accuracy is huge. In the processing of mechanical products, we need to carry out a comprehensive analysis, and then choose the right tool and fixture. At the same time, we need to adjust the accuracy, and ultimately improve the product accuracy. Because of the tool error, it has a direct impact on the machining dimensional accuracy. If the tool appears to wear during the processing, it will affect the surface position of the parts. So that the processing of parts will appear error. When the tool is subjected to thermal expansion resulting in elongation, this will cause machining parts error. The fixture accuracy directly affects the quality of workpiece. If the location, installation and indexing of the fixture error, it will lead to machining parts error. At the same time, the heat of the fixture will affect the accuracy of the workpiece.

3.3 The cutting process affects the machining accuracy

In the process of product processing, the mould is easy to deform under the action of force, which will also affect the accuracy of the product. At the same time, mechanical processing equipment in the long working process will be heated, which will lead to errors in the whole equipment. When the mould stress point changes or deforms, the shape error will appear. This will make the product processing error, and then affect the accuracy of the product.

4. Methods on Improving Machining Accuracy of Mechanical Mould

4.1 Direct error reduction method

Direct error reduction method is a commonly used method to improve the product accuracy in machining process, which can effectively ensure the machining accuracy of mechanical products. Direct error reduction method needs to analyze the causes of product errors, and then find ways to reduce errors, so as to improve the accuracy of product processing. Such as, in the turning process, the shaft will be affected by the force and heat, and they will often be bent or deformed under the action of the force. In this time, we can use the large forward reverse cutting method, and then add a spring tip in the reverse product. In this way, we can reduce the overheating elongation in the product processing, and then improve the accuracy of mould processing.

4.2 Real-time compensation control technology

Real-time compensation control technology is not common in improving the accuracy of machining products. It is mainly used in machining products with high transmission accuracy. The real-time compensation control technology also has some limitations, such as, the accuracy of compensation is excessively dependent on the correction ruler accuracy. Once the correction ruler accuracy appear error, it will bring error to product processing. There are three compensation systems in the actual mould processing. The first is the closed-loop feedback compensation control, the schematic diagram is shown in figure 1.

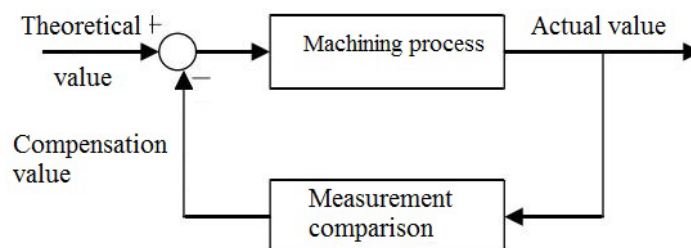


Figure 1 the schematic diagram of closed-loop feedback compensation control

The second is the open-loop feedback compensation control, the schematic diagram is shown in figure 2.

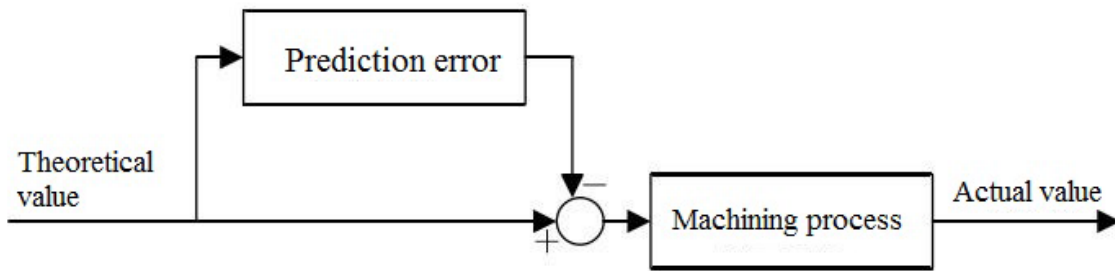


Figure 2 the schematic diagram of open-loop feedback compensation control

The third is the semi-closed loop feedforward compensation control, the schematic diagram is shown in figure 3.

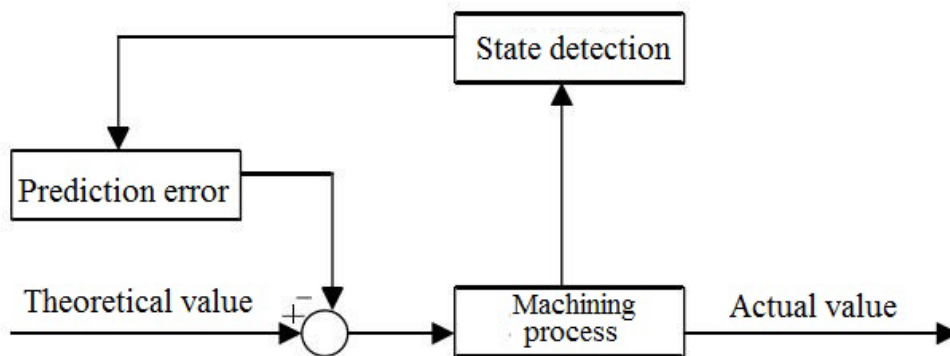


Figure 3 the schematic diagram of semi-closed feedback compensation control

5. Conclusion

There are many factors that affect the machining accuracy of mechanical moulds, such as processing technology, processing equipment and processing means. With the continuous development of social economy and technology, the market for machinery is bound to be higher and higher in quality. Higher requirements are put forward for machining accuracy of mechanical mould. So, we need to pay enough attention to the machining accuracy of mechanical moulds, and then constantly improve the machining accuracy of mechanical moulds.

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