

Research on Intelligent Manufacturing Technology of Precision and Ultra Precision Couples Parts

Lifeng Zhu¹, Kai Wang², Zheng Li², Wei Wei², Huan Wu²

¹Changchun University of Science and Technology, Changchun 130022, China

²Changchun Institute of Equipment and Process, Changchun 130012, China

Abstract

Precision and ultra precision Couples parts are widely used in many fields such as aerospace, precision machinery, and so on. With the rapid development of science and technology, all kinds of intelligent manufacturing technology, this paper introduces the latest progress of intelligent manufacturing technology, the gap between China's manufacturing technology and the world's advanced manufacturing technology, summarized the development of intelligent manufacturing technology, and put forward the corresponding suggestions and measures.

Keywords

Precision machining; Couples Parts; intelligent manufacturing.

1. Summary on Intelligent Manufacturing Technology of Precision and Ultra Precision Couples Parts

Precision and ultra precision pair parts, which are the important parts of the product quality, are the important parts of the product quality.

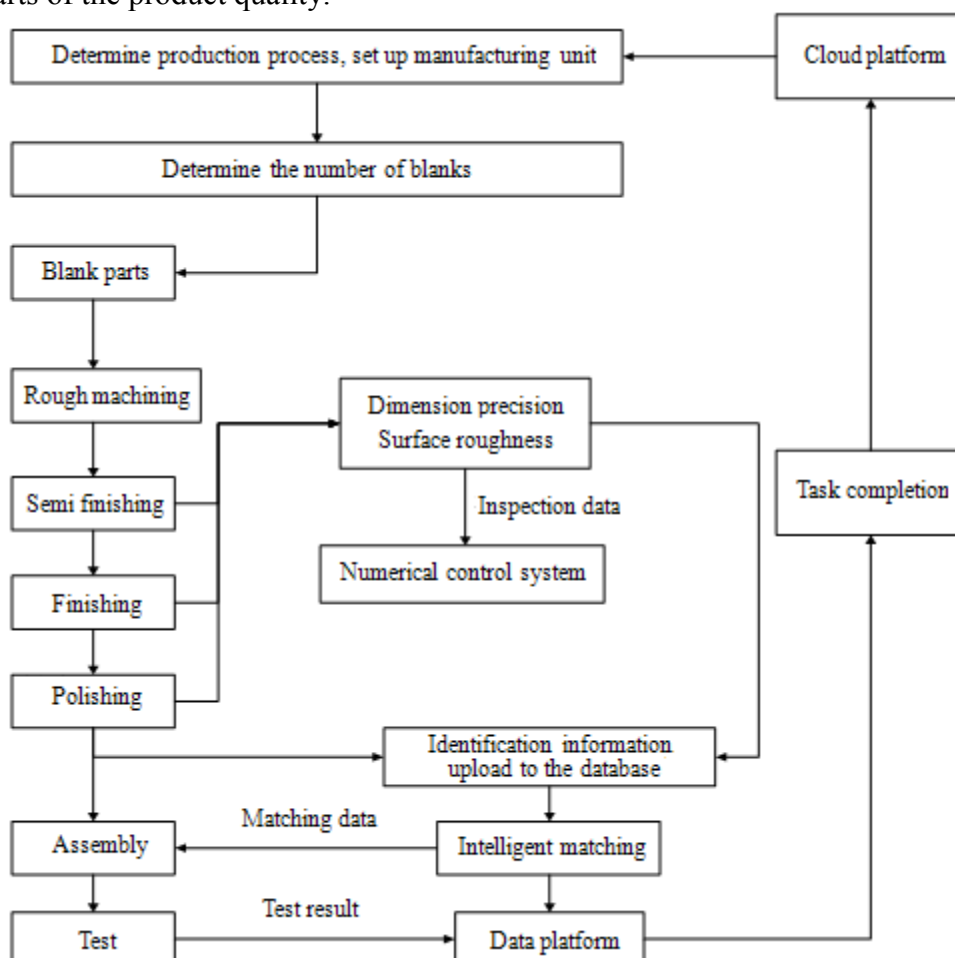


Fig.1 Process of Intelligent Manufacturing Technology

Intelligent manufacturing technology of precision, ultra precision pair parts is a smart manufacturing unit, which is a smart manufacturing unit, which is a smart manufacturing unit, which is a smart manufacturing unit, which is highly intelligent, integrated, and ultra precision. To production planning center cloud platform release production tasks as the starting point, in order to produce unit portfolio, production data measurement, parts processing, intelligent matching, assembly storage, and finally product information feedback back to the cloud platform to complete a precision, ultra precision even parts intelligent manufacturing cycle. As shown in figure 1.

The main module functions are as follows:

1. Manufacturing unit module

According to the size of the parts of the production and the structure characteristics of the parts, the equipment manufacturing unit, according to the characteristics of the shaft, the hole, respectively, to form a parallel manufacturing unit, so that the axis, hole parts parallel production, the number of reasonable matching. At the same time according to the manufacturing process level to estimate the product qualification rate, according to the procurement, production cycle to determine the number of raw materials to minimize inventory, reduce operating costs.

2. Intelligent manufacturing module

According to the process arrangement of the parts in the process of rough machining, semi finishing, finishing, in the whole process of processing, the position detection, and the test data is passed to the next process of CNC system, guidance. In the end, the shaft and hole parts are identified, and the identification data is transmitted to the database together with the test data. The shaft parts and the whole parts are assembled according to the matching result. Ensure that all parts can reach sub micron size, and ultimately achieve the sub micron gap intelligent control. The specific matching and finishing drawing are shown in figure 2.

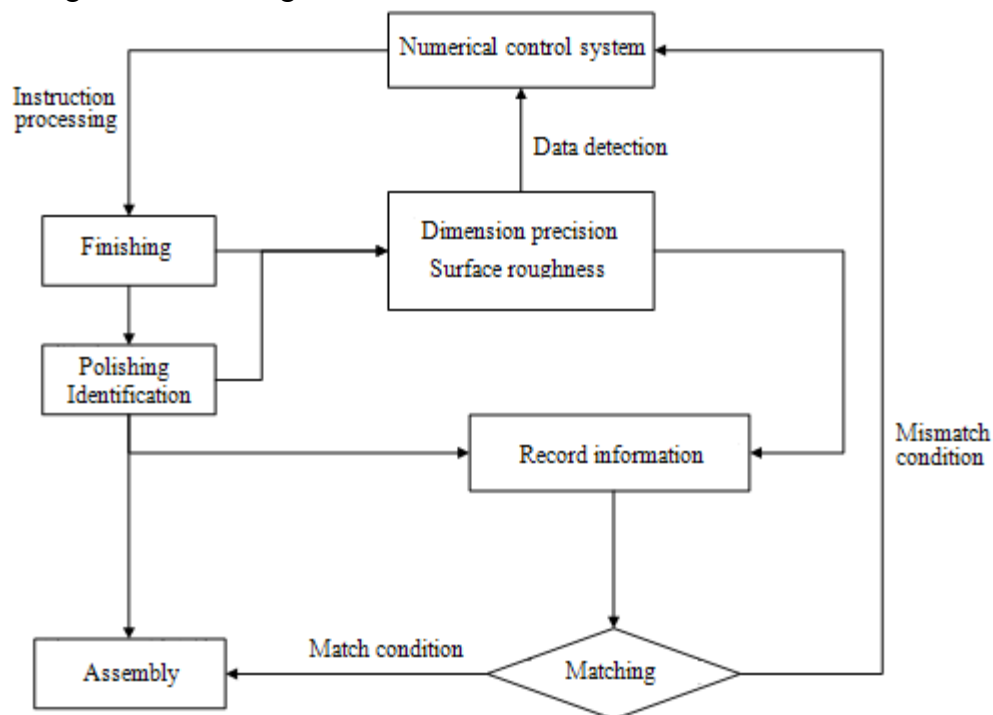


Fig.2 Process of intelligent control of sub micron gap

3. Data transmission and storage module

Will complete the assembly of the logo, while recording the shaft, the hole and the corresponding value of the corresponding dimension, the above data will be transmitted to the data platform for internal quality personnel, as well as product quality data statistics. Finally, the product model, the number of products delivered to the cloud platform to complete the release of even pieces of product manufacturing information.

2. Present situation and trend of domestic and international development

At present, developed countries engine manufacturing enterprises such as the United States Cummins engine company, Germany DEUTZ, Japan Isuzu Motor Ltd in the international leading level, the engine matching parts production realized automatic production and detection. The deviation of each pair is minimal, and the gap is in the 0.0008-0.0012mm, the reliability is high, and the matching accuracy can be ensured, and it can be used normally. Oil pressure has reached 200MPa, has formed the scale of production.

In our country, most of the manufacturing enterprises' informationization level is not high, the basic does not exist the intelligent processing technology. Through continuous technology introduction and independent research and development of China's engine parts precision machining technology has made great progress. Can produce a relatively high accuracy of the parts, with the gap is about 0.02mm. But it is still in the exploration stage, even the reliability is not high, the durability is poor, can achieve the oil supply pressure is not high. In the process of the process, there is no realization of the whole assembly line, the integration of the process is low, and the degree of the intelligence is low, although the equipment is more advanced but the efficiency is lower.

3. Development ideas

Make full use of the existing processing technology, in the "Twelfth Five Year" to break even pieces of precision machining, assembly and other key technologies, realize the micron level gap control, oil supply system, oil pressure to reach 180MPa. In 2020, we actively expand the experimental means and testing means, through independent research and cooperation to improve the level of manufacturing process, develop more intelligent process equipment, realize the position detection of the processing process. At the same time, we are constantly expanding the communication channels, promoting the combination of production, learning and research, and we recommend that a specialist technical personnel complete, clear and efficient exchange of scientific research team. To further improve the processing accuracy, so that the oil supplies system oil pressure to reach 200MPa. Through the development of enterprise, and strive to build a precision and ultra precision intelligent manufacturing platform in the next 10-15 years to meet the needs of the rapid manufacturing of precision, ultra precision parts, realize the processing automation, even part matching intelligent, technology exchange information, technology guidance, data transfer platform. Finally, the supply pressure of the oil supply system can reach 220MPa, and the gap between the developed countries and the developed countries is reduced.

4. Suggestions and measures

Intelligent manufacturing technology of precision and ultra precision parts is a complicated system engineering, which must be guided and driven in many aspects, such as personnel, equipment, management optimization, technical communication, etc.. Through the depth of integration of human, material, information and other resources can be a greater span, more flexible combination, remote customization release, remote design, collaborative manufacturing will become a reality. Specifically as follows:

1. Precision and ultra precision intelligent manufacturing technology must have a high accuracy of automatic equipment, these devices must be high enough accuracy, 0.1 micron, and even higher accuracy, while supporting the position detection device must also be high accuracy, high reliability. In intelligent matching parts of those who do not have to be matched to the size of the parts must be processed so as to have a matching parts, so as to form more even pieces, to avoid the emergence of substandard products.
2. Precision, ultra precision parts manufacturing needs through the material production, precision machining, heat treatment, surface treatment and other aspects of each link must be strict, must improve the technical level and quality of technical personnel, so as to make a good product.

3. Because the precision, ultra precision parts manufacturing needs to experience a lot, it is difficult to integrate so many excellent resources in the same place, the same business to manage, which requires a lot of members of the cooperation, this mode of cooperation is a loose management mode, the model is loose to be efficient, low cost of production must have a certain interface mode, set up an efficient communication platform, each enterprise direct active communication to achieve precision, ultra precision parts intelligent manufacturing.

References

- [1] YUAN Julong,ZHANG Feihu. Development Research of Science and Technologies in Ultra-precision Machining Field[J]. JOURNAL OF MECHANICAL ENGINEERING, 2010, 46(15):161-176
- [2] YUAN Julong, WANG Zhiwei, WEN Donghui, et al. Review on ultra-precision machining technology[J].Chinese Journal of Mechanical Engineering, 2007, 43(1):35-48.
- [3] Society and Technology Association of China, Chinese Mechanical Engineering Society. Report on advances in mechanical engineering between 2008 and 2009[M].Beijing:China Society and Technology Press, 2009.