High-speed machining and demand for the development

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High-speed machining is contemporary advanced manufacturing technology an important component of the high-efficiency, High-precision and high surface quality, and other features. This article presents the technical definition of the current state of development of China's application fields and the demand situation.

High-speed machining is oriented to the 21st century a new high-tech, high-efficiency, High-precision and high surface quality as a basic feature, in the automobile industry, aerospace, Die Manufacturing and instrumentation industries gained increasingly widespread application, and has made significant technical and economic benefits. Contemporary advanced manufacturing technology an important component part.

HSC is to achieve high efficiency of the core technology manufacturers, intensive processes and equipment packaged so that it has a high production efficiency. It can be said that the high-speed machining is an increase in the quantity of equipment significantly improve processing efficiency essential to the technology. High-speed machining is the major advantages : improve production efficiency, improve accuracy and reduce the processing of cutting resistance.

The high-speed machining of meaning, at present there is no uniform understanding, there are generally several points as follows : high cutting speed. usually faster than that of their normal cutting 5 -10 times; machine tool spindle speed high, generally spindle speed in -20000r/min above 10,000 for high-speed cutting; Feed at high velocity, usually 15 -50m/min up to 90m/min; For different cutting materials and the wiring used the tool material, high-speed cutting the meaning is not necessarily the same; Cutting process, bladed through frequency (Tooth Passing Frequency) closer to the "machine-tool - Workpiece "system the dominant natural frequency (Dominant Natural Frequency), can be considered to be high-speed cutting. Visibility high-speed machining is a comprehensive concept.

1992. Germany, the Darmstadt University of Technology, Professor H. Schulz in the 52th on the increase of high-speed cutting for the concept and the scope, as shown in Figure 1. Think different cutting targets, shown in the figure of the transition area (Transition), to be what is commonly called the high-speed cutting, This is also the time of metal cutting process related to the technical staff are looking forward to, or is expected to achieve the cutting speed.

High-speed machining of machine tools, knives and cutting process, and other aspects specific requirements. Several were from the following aspects : high-speed machining technology development status and trends.

At this stage, in order to achieve high-speed machining, general wiring with high flexibility of high-speed CNC machine tools, machining centers, By using a dedicated high-speed milling, drilling. These equipment in common is : We must also have high-speed and high-speed spindle system feeding system, Cutting can be achieved in high-speed process. High-speed cutting with the traditional cutting the biggest difference is that "Machine-tool-work piece" the dynamic characteristics of cutting performance is stronger influence. In the system, the machine spindle stiffness, grip or form, a long knife set, spindle Broach, torque tool set, Performance high-speed impact are important factors.

In the high-speed cutting, material removal rate (Metal Removal Rate, MRR), unit time that the material was removed volume, usually based on the "machine-tool-work piece" whether Processing System "chatter." Therefore, in order to satisfy the high-speed machining needs, we must first improve the static and dynamic stiffness of machine spindle is particularly the stiffness characteristics. HSC reason at this stage to be successful, a very crucial factor is the dynamic characteristics of the master and processing capability.

In order to better describe the machine spindle stiffness characteristics of the project presented new dimensionless parameter - DN value, used for the evaluation of the machine tool spindle structure on the high-speed machining of adaptability. DN value of the so-called "axis diameter per minute speed with the product." The newly developed spindle machining center DN values have been great over one million. To reduce the weight bearing, but also with an array of steel products than to the much more light ceramic ball bearings; Bearing Lubrication most impressive manner mixed with oil lubrication methods. In the field of high-speed machining. have air bearings and the development of magnetic bearings and magnetic bearings and air bearings combined constitute the magnetic gas / air mixing spindle.

Feed the machine sector, high-speed machining used in the feed drive is usually larger lead, multiple high-speed ball screw and ball array of small-diameter silicon nitride (Si3N4) ceramic ball, to reduce its centrifugal and gyroscopic torque; By using hollow-cooling technology to reduce operating at high speed ball screw as temperature generated by the friction between the lead screw and thermal deformation.

In recent years, the use of linear motor-driven high-speed system of up to"" Such feed system has removed the motor from workstations to Slide in the middle of all mechanical transmission links, Implementation of Machine Tool Feed System of zero transmission. Because no linear motor rotating components, from the role of centrifugal force, can greatly increase the feed rate. Linear Motor Another major advantage of the trip is unrestricted. The linear motor is a very time for a continuous machine shop in possession of the bed. Resurfacing of the very meeting where a very early stage movement can go, but the whole system of up to the stiffness without any

influence. By using high-speed screw or linear motor can greatly enhance machine system of up to the rapid response. The maximum a celebration linear motors up to 2-10G (G for the acceleration of gravity), the largest feed rate of up to 60 -200m/min or higher.

2002 world-renowned Shanghai Phuong maglev train project of maglev track steel processing, Using the Shenyang Machine Tool Group Holdings Limited McNair friendship company production plants into extra-long high-speed system for large-scale processing centers achieve . The machine feeding system for the linear guide and rack gear drive, the largest table feed rate of 60 m / min, Quick trip of 100 m / min, 2 g acceleration, maximum speed spindle 20000 r / min, the main motor power 80 kW. X-axis distance of up to 30 m, 25 m cutting long maglev track steel error is less than 0.15 mm. Maglev trains for the smooth completion of the project provided a strong guarantee for technology

In addition, the campaign machine performance will also directly affect the processing efficiency and accuracy of processing. Mold and the free surface of high-speed machining, the main wiring with small cut deep into methods for processing. Machine requirements in the feed rate conditions, should have high-precision positioning functions and high-precision interpolation function, especially high-precision arc interpolation. Arc processing is to adopt legislation or thread milling cutter mold or machining parts, the essential processing methods.

Cutting Tools Tool Material development

high-speed cutting and technological development of the history, tool material is continuous progress of history. The representation of high-speed cutting tool material is cubic boron nitride (CBN). Face Milling Cutter use of CBN, its cutting speed can be as high as 5000 m / min, mainly for the gray cast iron machining. Polycrystalline diamond (PCD) has been described as a tool of the 21st century tool, It is particularly applicable to the cutting aluminum alloy containing silica material, which is light weight metal materials, high strength, widely used in the automobile, motorcycle engine, electronic devices shell, the base, and so on. At present, the use of polycrystalline diamond cutter Face Milling alloy, 5000m/min the cutting speed has reached a practical level. In addition ceramic tool also applies to gray iron of high-speed machining;

Tool Coating : CBN and diamond cutter, despite good high-speed performance, but the cost is relatively high. Using the coating technology to make cutting tool is the low price, with excellent mechanical properties, which can effectively reduce the cost. Now high-speed processing of milling cutter, with most of the wiring between the Ti-A1-N composite technology for the way of multi-processing, If present in the non-ferrous metal or alloy material dry cutting, DLC (Diamond Like Carbon) coating on the cutter was of great concern. It is expected that the market outlook is very significant;

Tool clamping system : Tool clamping system to support high-speed cutting is an important technology, Currently the most widely used is a two-faced tool clamping system. Has been formally invested as a commodity market at the same clamping tool system are : HSK, KM, Bigplus. NC5, AHO systems.

In the high-speed machining, tool and fixture rotary performance of the balance not only affects the precision machining and tool life. it will also affect the life of machine tools. So, the choice of tool system, it should be a balanced selection of good products.

Process Parameters

Cutting speed of high-speed processing of conventional shear velocity of about 10 times. For every tooth cutter feed rate remained basically unchanged, to guarantee parts machining precision, surface quality and durability of the tool, Feed volume will also be a corresponding increase about 10 times, reaching 60 m / min, Some even as high as 120 m / min. Therefore, high-speed machining is usually preclude the use of high-speed, feed and depth of cut small cutting parameters. Due to the high-speed machining cutting cushion tend to be small, the formation of very thin chip light, Cutting put the heat away quickly; If the wiring using a new thermal stability better tool materials and coatings, Using the dry cutting process for high-speed machining is the ideal technology program.

High-speed machining field of application

Flexible efficient production line

To adapt to the needs of new models, auto body panel molds and resin-prevention block the forming die. must shorten the production cycle and reduce the cost of production and, therefore, we must make great efforts to promote the production of high-speed die in the process. SAIC affiliated with the company that : Compared to the past, finishing, further precision; the same time, the surface roughness must be met, the bending of precision, this should be subject to appropriate intensive manual processing. Due to the extremely high cutting speed, and the last finishing processes, the processing cycle should be greatly reduced.

To play for machining centers and boring and milling machining center category represented by the high-speed machining technology and automatic tool change function of distinctions Potential to improve processing efficiency, the processing of complex parts used to be concentrated as much as possible the wiring process, that is a fixture in achieving multiple processes centralized processing and dilute the traditional cars, milling, boring, Thread processing different cutting the limits of technology, equipment and give full play to the high-speed cutting tool function, NC

is currently raising machine efficiency and speed up product development in an effective way. Therefore, the proposed multi-purpose tool of the new requirements call for a tool to complete different parts of the machining processes, ATC reduce the number of ATC to save time, to reduce the quantity and tool inventory, and management to reduce production costs. More commonly used in a multifunctional Tool, milling, boring and milling, drilling milling, drilling-milling thread-range tool. At the same time, mass production line, against the use of technology requires the development of special tools, tool or a smart composite tool, improve processing efficiency and accuracy and reduced investment. In the high-speed cutting conditions, and some special tools can be part of the processing time to the original 1 / 10 below, results are quite remarkable.

HSC has a lot of advantages such as : a large number of materials required resection of the workpiece with ultrafine, thin structure of the workpiece, Traditionally, the need to spend very long hours for processing mobile workpiece and the design of rapid change, short product life cycle of the workpiece, able to demonstrate high-speed cutting brought advantages.