Servo Motor

1. Servo Motor definition

Also known as the implementation of the motor servo motor, the automatic control system for the implementation of components to convert signals received from the motor shaft angular displacement or angular velocity output DC and AC servo motor is divided into two categories, the main feature is that when the signal voltage is zero, no rotation of the phenomenon, the increasing speed with uniform torque decreased. Servo motors to control mechanical servo system in the operation of the engine components. Is a servomotors device. Servo motor can control the speed, position accuracy is very accurate. The voltage signal into a torque and speed to drive the control object. Rotor speed by the input signal control, and can respond rapidly, in the automatic control system for the implementation of components, and has electrical and mechanical time constant, linear and high initiating voltage low.

2. Servo motor works

Servo mainly rely on impulse to locate, basically can be understood, the servo motor receives a pulse, a pulse will rotate the corresponding point of view, in order to achieve the displacement, because the servo motor itself has issued a pulse function, so the servo each motor to rotate a point of view, is issued by the corresponding number of pulses. So that the pulse and servo motors to accept the formation of the echo, or called closed-loop, this way, the system will know the number of pulse sent to the servo motor, while the number of received pulse came back, so that we can very accurately control the motor rotation, in order to achieve accurate positioning, can reach 0.001mm DC servo motor into brush and brushless motors. Brush motor low cost, simple structure, starting torque, wide speed range, easy control, need to maintain, but easy to maintain(replacement carbon brushes), generate electromagnetic interference, the environment requirement. So it can be used for cost-sensitive general industrial and civil applications. Brushless motor, small size, light weight, large output, fast response, high speed, small inertia, rotational smoothness, torque and stability. Control complex, easy to implement intelligent, flexible way of their electronic commutation, the commutation can be square wave or sinusoidal commutation. Motor maintenance-free, high efficiency, low operating temperature, electromagnetic radiation is very small, long-life, can be used for a variety of environments.

2 Brushless AC Servo motor is divided into synchronous and asynchronous motors, motion control in the current synchronous motor is generally used, and its power range, can do a lot of power. Large inertia, the maximum rotation speed is low, and with the power increases rapidly decreased. Thus suitable for applications that run on low speed steady.

3. Servo motor rotor is permanent magnet, the drive control of the U/V/W three phase power to form fields, the rotor in the magnetic field under the rotation, while the motor comes with encoder feedback signal to the drive, the drive according to the feedback value compared with the target value, adjusting the angle of the rotor rotation. Depends on the accuracy of the servo motor encoder accuracy(lines).

三、Introduction permanent magnet AC servo motor

80 years since the 20th century, with the integrated circuits, power electronics and AC variable speed drive technology, permanent magnet AC servo drive technology with outstanding development, national electrical manufacturers have launched their own well-known AC servo motor and servo drive series and continue to improve and update products. AC servo system has
become a contemporary high-performance servo systems the main development direction, so that the original DC servo facing the crisis of being eliminated. 90 years later, the world has been commercialized by AC servo digital control system is a sine wave motor servo drive AC servo drive the rapid development of the field in the transmission. Permanent magnet AC servo motor compared with DC servo motor, the main advantages are: (1) without brush and commutator, it is reliable and maintenance requirements for maintenance and low. (2) cooling the stator winding more convenient. (3) inertia is small, easy to improve the system fast.(4) adapted to high-speed high torque working condition. (5) under the same power, smaller size and weight. Since the German MANNESMANN of Rexroth Indramat division in the company’s Hanover Trade Fair 1978 was officially launched MAC permanent magnet. AC servo motor and drive system, which marks this new generation of AC servo technology has entered the practical stage. To the late 20th century, 80 years, the company has a complete line of products. The servo device market are turning to the exchange system. Early analog systems such as zero-drift, interference, reliability, accuracy and flexibility in areas such as lack of motion control is still not fully meet the requirements, in recent years with the microprocessor, the new digital signal processor(DSP) applications the emergence of digital control system, the control section can be carried out entirely by the software, called Jiang hazy or Tuan Shen Jing only fresh coarse, hempen fabric, valiant only Shen of the permanent magnet AC servo system. So far, high-performance servo systems mostly use electrical permanent magnet synchronous AC servo motor, control the drive to use more fast, accurate positioning of the all-digital servo system. Typical manufacturers such as Siemens of Germany, The United States and Janpan Kollmorgen companies such as Panasonic and Yaskawa. Yaskawa Electric has launched a small-scale production of AC servo motors and drives, in which D series for CNC machine tools(maximum speed of 1000r/min, torque is 0.25-2.8Nm), R series is suitable for the robot( the highest speed of 3000r/min, torque is 0.016-0.16Nm). Launched after the M,F,S,H,C,G six series. 90-20th century, has introduced a new D-series and R series. Rectangular wave drive from the old series, 8051 to control the sine wave drive, 80C, 154CPU and gate array chip control, torque ripple from 24% to 7%, and improved reliability. Thus, the formation of only a few years, eight series(power range of 0.05-6kw)more complete system to meet the working machinery, transportation agencies,welding robots,assembly robots, electronic components, processing machinery, printing presses, high speed winding machine, winding machines for different needs. CNC equipment to produce the famous Japanese law that g(FANUC) company, in the 20th century has introduced the mid-80s S series(13 specifications), and L series( 5 specifications) of the permanent magnet AC servo motor. L Series has a smaller moment of inertia and the mechanical time constant, particularly for applications that require fast response servo system. Other Japanese manufacturers, such as Mitsubishi Motors(HC-KFS,HC-MFS,HC-SFS, HC-RFS and HC-UFS series), Toshiba Seiki(SM series), Okuma Iron Works(BL series), Sanyo Electric(BL series), standing stones motor(S series) and many other manufacturers have entered the permanent magnet AC servo system fray. Germany Rexroth(Rexroth) The MAC Indramat Division Series AC servo motor Total 7 Frame 92 specifications. Germany’s Siemens(Siemens)’s IFT5 series three-phase permanent magnet AC servo motor standard and short form is divide into two categories, a total of 98 species of 8 frame size specifications. Allegedly the same series AC servo motor and DC servo motor output torque compared IHU series, which weighs only 1/2, supporting the transistor PWM drive 6SC61 series, the most for 6-axis motor control. Bosch ferrite magnets produced the SD series(17
standard) and rare earth permanent magnet of the SE series(8 specs) AC servo motor and drive controller Servodyn SM series. American production companies Gettys servo device as Gould Electronics, once a division of (Motion Control Division), production of M600 series A600 series AC servo motor and servo drives. After the merger to the AEG, Gettys name restored, the introduction of A700 all-digital AC servo system. U.S.AB(ALLEN-BRADLEY)1326-based production company driver division ferrite permanent magnet AC servo motor and servo controller PWM AC 1391. Frame size motors including 3 of 30 specifications. ID(industrial Drives) is a famous Cole Morgan(Kollmorgen) of industrial drives division, has produced BR-210, BR-310, BR-510 a total of 41 specifications of the three series of brushless servo motor and servo BDS3drive. Since 1989, launched a new series designed solely doped Jian Pirates(Goldline)permanent magnet AC servo motor, including the B(small inertia), M(Middle Inertia) and EB(explosion proof)three categories, 10,20,40,60,80 five frame sizes, each of 42 categories of specifications, all using NdFeB permanent magnet, torque range of 0.84-111.2Nm, a power range of 0.54-15.7kW. Supporting the drive has BDS4(analog),BDS5(digital type, with position control)and the Smart Drive(digital type) of three series, the maximum continuous current of 55A. Goldline Series represents contemporary art in permanent magnet AC servo technology. Ireland’s inland formerly a division of Kollmorgen abroad, now merged into the AEG, the production of DC servo motors, DC torque motor and servo amplifier is known. Production BHT1100, 2200,3300 three frame sizes of 17 kinds of specifications of SmCo permanent magnet AC servo motor and eight controller.French Alsthom Group factory in Paris Parvex LC series(long form) and GC series(short) 14 AC servo motor specifications, and production AXODYN series of drives. The former Soviet Union for the CNC machine tools and robots servo control developed two series of AC servo motor. OneДВBy series uses ferrite magnets, there are two frame sizes, frame sizes are 3 for each core length, each with two winding data, a total of 12 specifications, a continuous torque range of 7-35N. M. 2Д By series uses rare earth permanent magnet, 6 frame size 17 specification, the torque rang is 0.1-170N.m, supporting the 3ДБ CONTROLLER. In recent years, Panasonic has introduced the all digital AC servo system based MINAS series, in which permanent magnet AC servo motor with MSWA series of small inertia-type, power from 0.03-5kW, a total of 18 kinds of specifications; the inertia type with MDMA, MGMA,MFMA three series, the power from 0.75-4.5kW, 23 kinds of specifications, MHMA series of large inertia motor power range from 0.5-5kW, 7 kinds of specifications. Samsung developed in recent years, all –digital AC servo motor and drive system, which FAGA AC servo motor series of CSM,CSMZ,CSMD,CSMF,CSMS,CSMH,CSMN,CSMX a variety of models, the power from 15W-5Kw. Now often used(Powerrate) This comprehensive index as the servo motor quality factor, measuring a variety of AC and DC servo motor contrast and dynamic response performance stepper motor. Continuous motor power, said the rate of change(rated)torque and rotor inertia ratio. Change rate is calculated by power analysisi, the permanent magnet AC servo motor technology indicators for the United States ID, Goldline Series is the best, followed by Germany’s Siemens in IFT5 series.