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Building A Motor Test Bench For Low Power Motor

Liu Miao, YanXiao[1], Huang BiXiong[2], Xie Zuoshuang[3], Luo Hao[4],

(College Of Automotive Engineering, Shanghai University Of Engineering Science, Shanghai, China,201620)

Abstract: The paper will presents a process of building a performance test system for permanent magnet synchronous motor under 3kw. The system is able to complete rapid performance index test for prototype motors. Letting the motor run under different power supply can help us get correspondent speed-torque curves. The whole system has the advantages of simple and reliable mechanical structure and easy adjustment of the coaxial degree. It is highly universal for different size prototypes and has a module for data acquisition at the same time.

Keywords: Motor Performance, LabVIEW, Testing System, highly universal, data acquisition

I. INTRODUCTION

With the rapid development of electric vehicle industry, how to make evaluation on a newly-developed motor quickly and effectively has been paid more and more attention by research institutes and manufacturers. The performance evaluation of a motor drive system on test bench has become an indispensable means. This paper shows the process of building a small motor test system using the existing resources of the laboratory and how to complete the collection and recording of the experimental data through the serial communication function of Labview.

II. THE GENERAL LAYOUT OF THE TEST BENCH

Motor test bench is mainly composed of power module, motor and AC load dynamometer, frequency converter, dynamometer controller, data acquisition equipment, platform control and other equipment. According to the design requirements of each part and considering the specific situation of the laboratory, the overall program structure diagram as shown in Figure 2-1 .

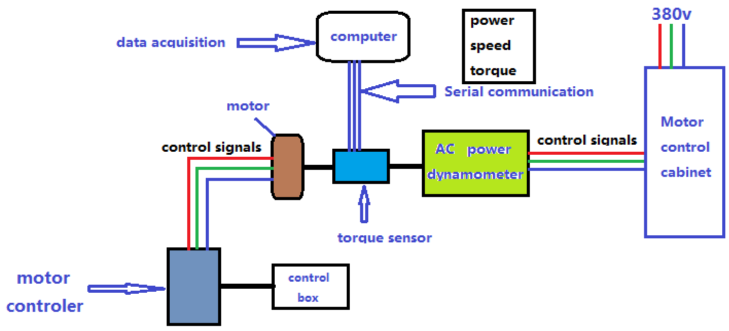

Figure 2-1 The general layout of the test bench

In the structure diagram, the AC power dynamometer, measured motor, frequency converter and a variety of sensors above are arranged in a straight line. Adjacent components are connected by couplings.

III. PARAMETERS, DESIGN, STRUCTURE AND SELECTION OF TEST SYSTEM'S MAIN PARTS

3.1 Cast iron platform

The cast iron platform provides a stable basis for main parts in the system. Every part can be firmly fixed with screws to the T shaped groove on the surface of the platform. The structure as shown in the fig 3-1

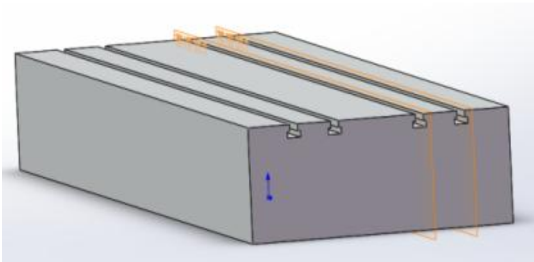

Fig 3-1

Dimensions:

Length: 1500mm

Width: 500mm

Height: 150mm

The platform was made of high strength cast iron HT200-300 and manual processed for two times with the quality of strong rigidity,precision,stability,good wear resistance.

3.2 AC power dynamometer

Main parameters

Continuous power	2kw
Continuous torque	28N
Peak power	3kw
Constant rotate speed	3000rpm
Peak rotate speed	4000rpm

AC power dynamometer was controlled by ACS-800 series frequency converter through the method of direct torque control which regards torque as the core part to control the flux and torque. The stator current and voltage can be easily measured through the theoretical calculation of vector. In order to obtain optimal control effect of inverter switch state, pulse modulation signal of switch state is produced by two point of discrete directional adjusting and the method of stator magnetic field, so high dynamic performance of torque is get.

3.3 coupling selection

Since it is hard to avoid relative displacement led by many factors like assembly and machining error. we choose to use a elastic interval type couplings as shown in Figure 3-2, the model is MJC-65-EGR. It has the characteristics of high torque, high precision and convenience for assembling and disassembling. Using such coupling can effectively improve the efficiency of motor test.

Fig 3-2

3.4 Parameters of torque sensor

Model	JN338-30A
Torque error accuracy	0.1-0.2%FS
Overload capacity	150%FS
insulation resistance	≥200MΩ
working temperature	-20～60℃
Measuring range	0-30N

As is shown in the Fig3-3 JN338-30A torque sensor can be used for measuring dynamic torque and steady rotating torque.There is no need to adjust the zero point in torque measurement when the motor runs in either directions; With the help of digital processing technology,the sensor can complete signal detection without interference and operate stability in high precision; The sensor can extract torque signals using strain electrical measuring technology.[3]The measuring accuracy of torque won't be affected by rotation speed and direction; Input/output signals are transmitted in an Non-contact Electromagnetic Coupling way and it has advantages of light weight, small size, easy installation, long life, high reliability.

Fig 3-3

3.5 Configuration of fixation

When the torque sensor runs at high speed, coaxial degree must be strictly guaranteed , otherwise the sensor might be damaged and lead to large system error so we designed fixture tools as shown in the (Fig 3-4) to adjust the rough height and make precise adjustment later with Copper sheets

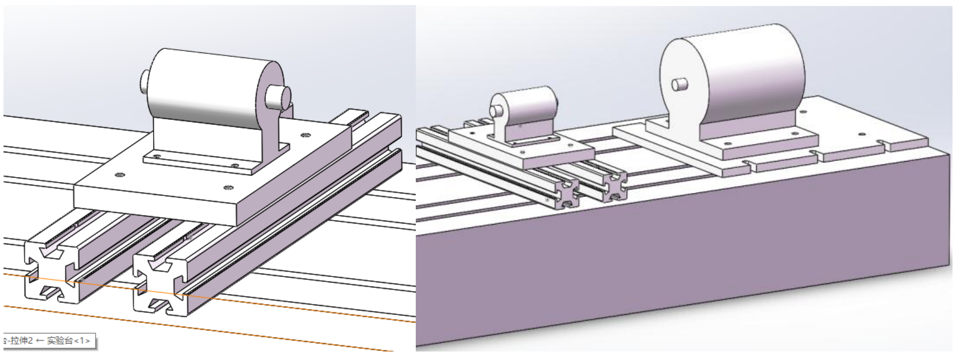

Fig 3-4

3.6 Data acquisition

LabVIEW is a virtual instrument software development platform based on graphical compiler language[4]. Compared with the traditional programming language, the interface is more friendly and intuitive, and the data processing is more convenient and diversified. The signal of the torque sensor can be transmitted to the PC end of the LabVIEW platform through the RS-232 serial port and then displayed and stored in real time[5]. The figure 3-5 below shows Instrument measuring microcontroller (CPU) of a data processing center

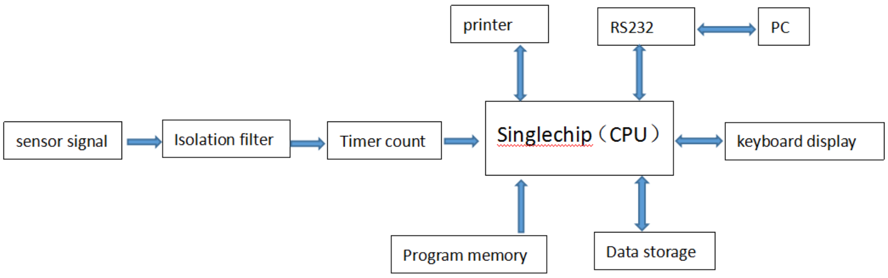

Fig 3-5

3.6.3 The final LabVIEW program after integrating all modules together

Program flow chart is as follows(Fig 3-6)

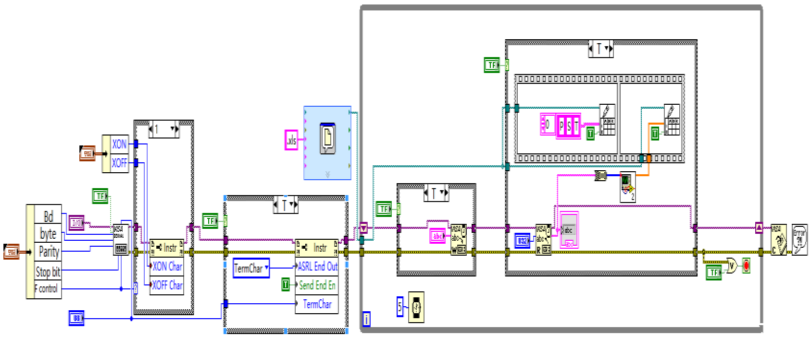

Fig 3-6

4 Assembly picture (Fig 4-1)

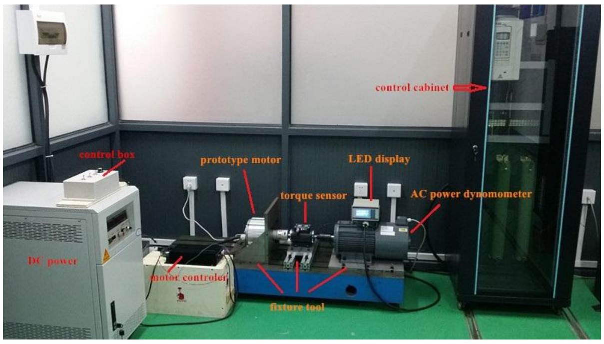

Fig 4-1

IV. CONCLUSION

In this paper, We restructured the existing equipment of the laboratory and redesigned some fixture tools to build a motor test system. The process of building the test bench has positive reference value to those similar systems and the approach of data acquisition is applicable to the systems that use Serial communication.

ACKNOWLEDGEMENTS

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REFERENCES

[1]. Suh N. P.The Principles of Design, 1990 (Oxford University Press, New York).
[2]. McCann, R. Variable effort steering for vehicle stability enhancement using an electric power steering system. SAE paper 2000-01-0817, 2000.
[3]. Zhang Y.New approach for vehicle system NVH analysis-part I: Vibration analysis. SAE paper 981168, 1998.
[4]. Jianqun Wang, Jinrui Nan, Fengchun Sun etc..Based on data collection system on LabVIEW.Computer Engineering and Applications,2003,122-125.
[5]. Bingcai Zhang,Liu Lin ,Guangfeng Gao etc..Data acquisition and signal processing based on LabVIEW.Instrument Technique and Sensor,2007,74-75,1002-1841.
[6]. Shanshan Liu.Design and Application of Data Acquisition System Based on LabVIEW.North Central University,2012.