Angle Analyzer of an Encoder using the LabVIEW

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Abstract—As we make progressive products for good works, and future industries want to get higher speed and resolution from various developments in the robotics as well as precise control system, the concept of control feedback is getting more important. Within a range of industrial developments, the concept is most responsible for the high reliability of a device. We explain an efficient analyzing method of a rotary encoder such as an incremental type encoder and absolute type encoder using the LabVIEW program.

Keywords—LabVIEW, PFI Function, Angle analyzer, Incremental encoder, Absolute encoder

I. INTRODUCTION

This demand for high position control of resolution is rapidly increasing in the precision manufacturing field. Especially, in precision rotary machine (stepping and servo motor), high-precision tools, industrial robots, automate guide vehicles are the main applications. Since those machines need position sensing device and they need the rotary encoder in the field. Encoder is composed of shaft and output (converts turning angle into electrical signal), and it detects various moving motions. The rotary encoder has many tiny slits on the corner of the circular plate. Rotary and fixed slits, between a transmitter diode and receive diode, make a signal from the transmitted or blocked light. Two digital signals have a difference of 90° electric phase [2, 3].

Fig. 1 Incremental rotary encoder

Fig. 2 Absolute rotary encoder

Fig. 3 Basic principle of incremental encoder

Each phase has an angle (360/Resolving power) about 1 pulse. It calculates a number of pulse and angle. But order signal must increase to constant values, and it must be included in the settings error [1].

A. Summary

We tried to find a method of efficient measurement and analysis from incremental and absolute type rotary encoder in this paper.

B. Basic Principle

Absolute rotary encoder output shows up the order signal from combinations of resolving power (2^0~2^12, maximum output is 13pcs). During the rotation, encoder applies the sampling signal of A or B phase [4].

Visually, each phase displays a grace angle of the circular plate. For example, each phase displays a difference of 90° electric phase. The phase display each number of pulse and angle. We can estimate the position from combinations of the resolving power. But order signal should be included in the settings error.
C. Experimental Equipment

The motor gives rated voltage and current as output. And standard encoder makes a pre-scaling four times than input, 5000P/R to 20000P/R, each signal use twenty sampling signal. And also there are several components such as power supply for source, PCB for receiving the output of the encoder, AC Inlet, fuse and connector [5].

D. Control circuit

Each relay decides test’s power and rated voltage of the encoder. And it also connects a pull up/down resistors according to the type of output (NPN/PNP).

E. Encoder Analyzer

Incremental encoder analyzer detects each phase (A, B, Z) of the output signal and displays the angle, duty, deviation and accumulation. Absolute encoder analyzer displays thirteen outputs (1024P/R, BCD output) of the combination of signal.
There are several things such as resolving power, error (angle phase difference, duty ratio), direction of rotation (CW, CCW), source (5, 12, 24V DC), motor speed and number of Z phase detection in the setting’s value. While the motor rotates, analyzer calculates the measured data and checks the distinction ‘PASS or FAIL’ of each phase and also displays a list of ‘FAIL’ and the reason [6].

F. LabVIEW Program Block Diagram

1. Motor Drive & Various Settings

The counter output function of DAQmx is used in the motor driving part. It makes a pulse about input frequency (motor RPM is decided from the combination of frequency and resolving power of motor drive). DAQmx digital output makes a signal (ON/OFF) to interface controller that motor and encoder.

2. Real Measuring Part

Measurement of Absolute encoder is made from Z phase detection. This part decides a start point of encoder measurement. The number of Z phase detection is used as reference points.

3. Data Arrangement

According to the types of output (BCD, binary, gray), data is converted to the number of array and saved.

Data arrangement converts a Boolean code to moderate code. It eliminates wrong data (very little impact signal, wrong arrangement impulse) and separates from Final analyzing part.
4. Data Analyzing

A table is generated regarding angle, deviation, accumulation and error using incremental and absolute encoder data.

Fig. 13 Data arrangement

Fig. 14 Data analyzing (Absolute type)

5. Final Analyzing

It compiles an output data table from the analyzing part. This table judges the final ‘PASS or FAIL’ and marks the number of several errors. So, user can identify the inspected items.

Fig. 15 Final analyzing part

III. CONCLUSION

Since complex equipment will be needed, verification field also will be changed by the professionals. In future, feedback system will be a very important factor in the control system of the robot industry. And an encoder also plays a key part in the reliability and development of the industry at the same time. It is meaningful that various industries have high accuracy encoder through the simple output control.

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