Design of magnetic suspension rotor control circuit based on ARM

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Abstract

The early magnetism aerosol bearing control usually uses the PID control algorithm. Simulates the controller to depend on completely uses the hardware electric circuit realization control, its merit is responds, the realization quickly is easy; The shortcoming is the parameter adjustment difficulty, the reliability is low. This design mainly collects signals through ARM processing. After converting the obtained signals to AD in the ARM development board, PWM signals are output. Then PWM signals enter the driving circuit and signal output to the driving circuit to control motor speed and steering. Studies one section to have the ARM programming control magnetism aerosol rotor electric circuit, magnetism aerosol rotor technology is one kind new, the high tech front technology. This kind of rotor has without the friction, does not have the attrition, does not need to lubricate, not to have the pollution, the energy consumption small as well as the service life long and so on the merits, is suitable in many kinds of high speed or supervelocity, the vacuum and so on the special environment situation.

Keywords

Magnetic suspension rotor control circuit, Magnetic levitation rotor technology, ARM.

1. Introduction

Since the beginning of the 21st century, with the development of human society and the progress of science and technology, people have gradually stepped into the new era of digitization and intelligence. Magnetic suspension bearing is a new type of high-performance bearing that USES magnetic force to suspend the rotor in space so as to realize non-contact support between the rotor and stator [1].According to the generation of magnetic field, magnetic suspension bearings are divided into three categories: passive magnetic suspension bearings, also known as permanent magnetic bearings, passive bearings; Active magnetic suspension bearing, also known as electromagnetic bearing, active bearing; Hybrid magnetic suspension bearing. Among them, active magnetic suspension bearing is the most commonly used one, which can carry out active control on non-contact bearing, and realize support between magnetic coil of active magnetic suspension bearing stator and ferromagnetic material on rotor. Active magnetic suspension bearings are usually composed of sensors, controllers, rotors and electromagnets.

2. Circuit Design.

2.1 Artificial Heart Control System

As Fig. 1 shown, the circuit of the magnetic suspension artificial heart control system is composed of a sensor, a signal amplifying circuit, an ARM processor, a JTAG interface, a PC and a driving circuit. The signal amplifying circuit will receive signals from the rotor displacement sensor A/B, the rotor torque sensor X, and the rotor angular displacement sensor Y, and the amplified signal will enter the

A/D conversion module inside the ARM processor to perform signal processing. After detection and comparison, the ARM processor issues a new PWM control through the calculation of the internal neural network algorithm of S3C6410, so that the suspension phase A-phase coil, the suspension force B-phase coil, the suspension force C-phase coil, and the suspension force D phase of the artificial heart The current in the coil and the rotational force X-phase coil, the rotational force Y-phase coil, and the rotational force Z-phase coil are controlled to ensure the normal operation of the magnetic suspension artificial heart.

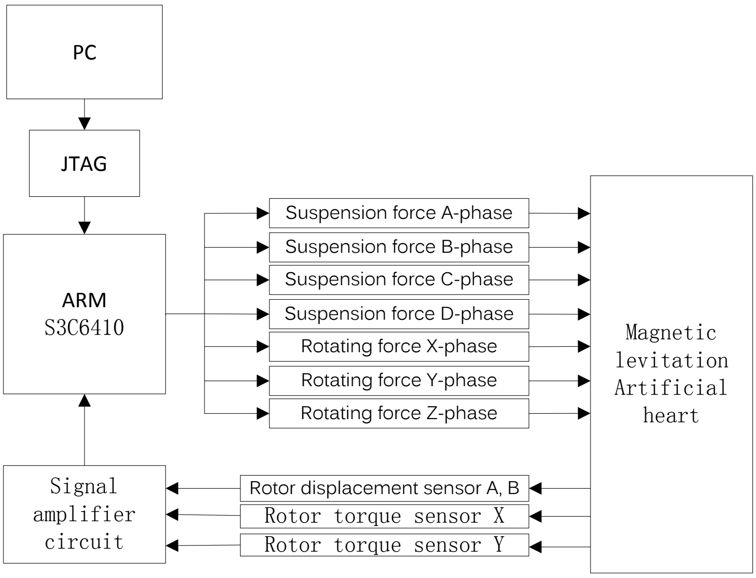

Fig. 1 Composition of control system

2.2 Drive Circuit Design

As Fig. 2 shown in the diagram of the drive circuit, the most important part of the principle of the drive circuit is the h-type link composed of 4 COMS and 4 diodes, which constitutes the drive and speed regulation function we need. When IN1 input high level, M1 conduction; IN4 input low level, then M4 conduction. The direction of current I is (" VCC → M1 → motor →M4 to →vcc "). The current is in the positive direction. When IN2 input high level, M2 conduction; IN3 input low level, then M3 conduction, the direction of current I is (" VCC to M2 to motor to M3 to -vcc "). This current is in a negative direction.

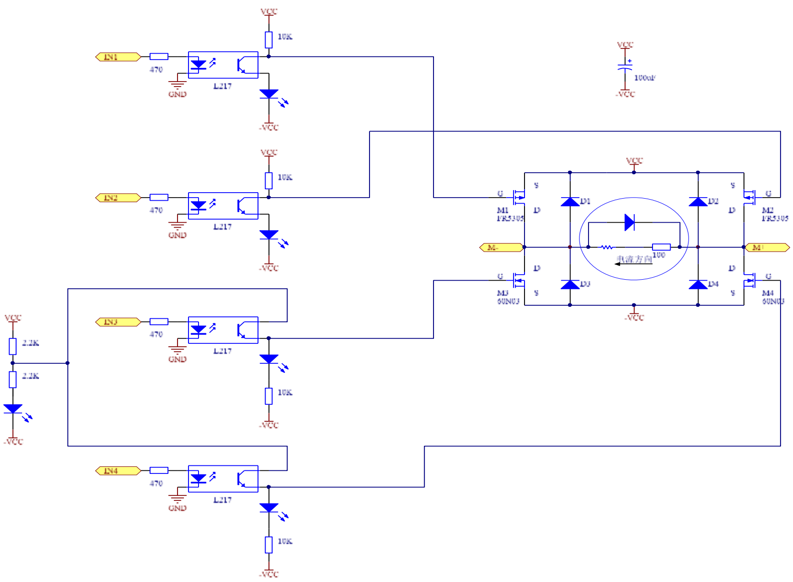

Fig. 2 Drive circuit diagram

2.3 CPU Minimum System

The core CPU of the control system circuit selects the ARM11 processor, and the ARM microprocessor is the new generation RISC processor introduced by ARM. The ARM11 processor is designed to effectively provide high-performance processing capability, while providing ultra-high performance. Also, ensure the power consumption and area availability. The ARM11's media processing capabilities and low power consumption are particularly well suited to the artificial heart's control system requirements. In this design, the artificial heart supply voltage is 12V, and the ARM processor can consume as low as 2mW/MHZ under the condition of 5V power supply, which can almost neglect the power consumption of the motor.

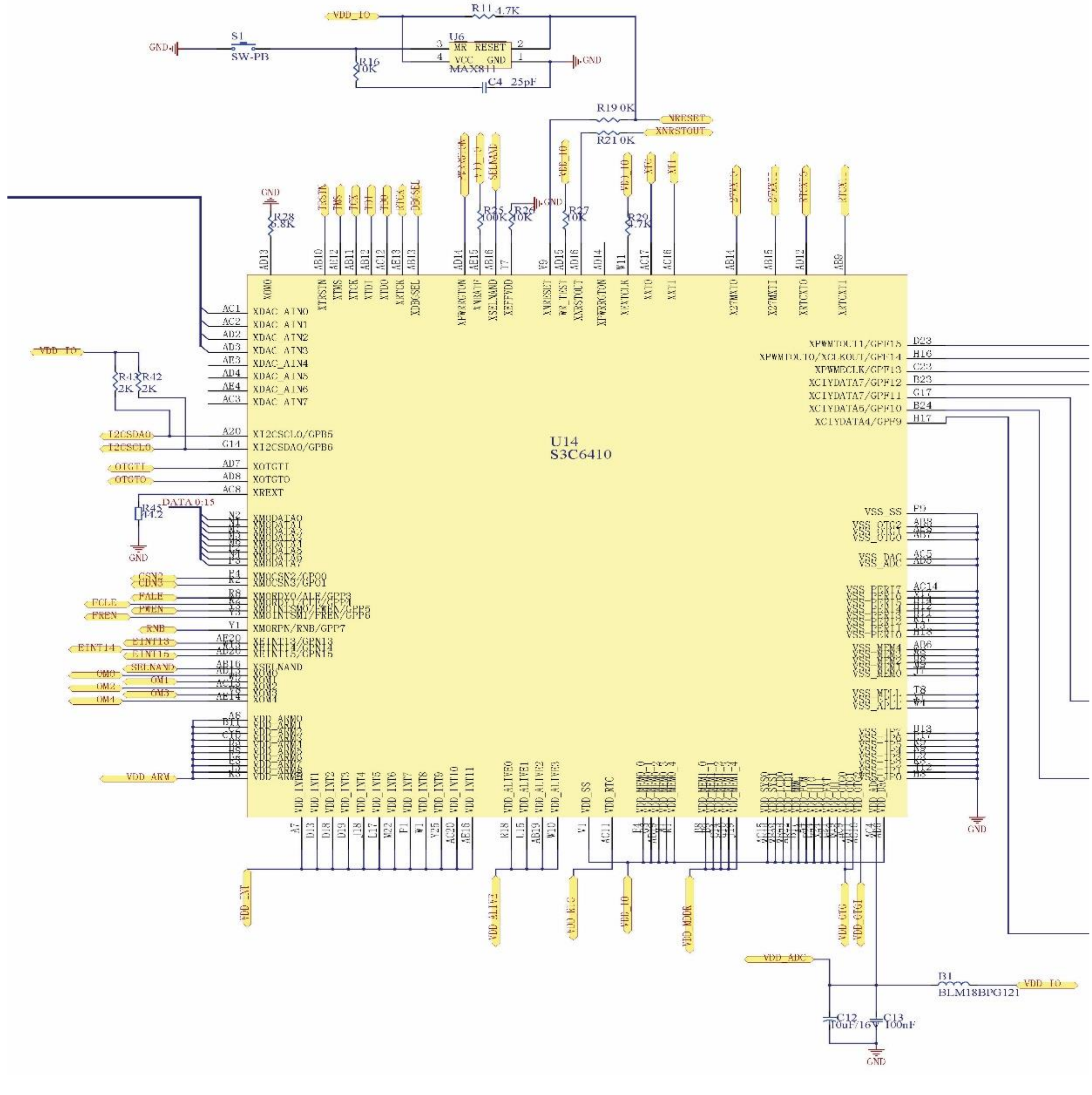

Fig.3 Core board circuit diagram

3. PWM Drive Design

After the signal is detected, the system initializes. After initialization, the AD converter changes the analog signal to a digital signal. The digital signal is stored in the ADCATO, and then the input frequency is obtained to see if the input frequency is equal to 66.7HZ, if equal to 66.7HZ. , the original PWMM signal is output normally. If it is not equal to 66.7HZ, set TCNTB0=310, set TCMPB0=155, then assign TCNTB0 to TCNT0 (reducer), when TCNT0=0, start interrupt, this is a PWM generation process, the generated PWM frequency It is 66.7HZ, at which time the microcontroller outputs a PWM signal.

4. Conclusion

The innovations of the paper are as follows:

(1) For the control system of the current magnetic levitation motor, new ideas have been proposed and a new ideology system has been established. The advantage of combining ARM is that the electronic control is more convenient, the reaction speed is faster, and the setting parameters are more convenient.

(2) The control of the magnetic levitation motor is more diversified and refined. The paper proposes to monitor the current of the 12 winding coils of the stator, which makes the operation more intuitive, more diverse and more precise control of the rotation speed and mode of the rotor. It provides a broader perspective for the application of magnetic levitation motors.

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