基于单片机控制的晶闸管可逆直流调速系统设计

摘 要：转速、电流双闭环直流可逆调速系统是性能优异、应用很广泛的中小功率直流调速系统。该系统是利用 AT89C52 单片机控制晶闸管来实现电能的变换，完成对直流电机的速度控制，实现电机速度的可逆运转。文中首先介绍了静止可控整流器的工作原理，以及双闭环直流可逆调速的系统结构。对基于单片机控制的晶闸管可逆直流调速系统进行设计。根据晶闸管的特性，通过单片机控制角 α 大小来调节电压。系统通过采样及运算，通过单片机控制晶闸管的导通，达到控制直流电机转速的效果。为实现转速、电流负反馈，系统设置了与之对应的转速和电流调节器，并将二者嵌套相连，使电流环在内，转速环在外，这就形成了转速、电流双闭环调速系统。设计确定系统的结构形式和各元部件，包括了转速调节器、电流调节器、检测电路、触发电路的参数与电路构成。并使用 MATLAB 仿真软件对整个电路进行了仿真，构成了基于单片机控制的晶闸管可逆直流调速系统。仿真结果表明直流电动机转速的响应速度较快且增长过程平稳，没有出现较大的超调，最高转速能达到 1500 r/min，满足任务书的要求。

关键词：直流调速系统；晶闸管；PI 调节；单片机

Design of thyristor reversible DC speed control system based on single chip microcomputer

Abstract: The speed and current double closed-loop DC reversible speed regulation system is a medium and small power DC speed regulation system with excellent performance and wide application. The system uses AT89C52 single chip microcomputer to control the thyristor to realize the transformation of electric energy, complete the speed control of DC motor, and realize the reversible operation of motor speed. Firstly, this paper introduces the working principle of static controllable rectifier and the system structure of double closed-loop DC reversible speed regulation. The design of thyristor reversible DC speed regulation system based on single chip microcomputer is presented. According to the characteristics of thyristor, the voltage can be adjusted by controlling the angle of single chip microcomputer. The system can control the speed of DC motor by sampling and calculating, controlling the conduction of thyristor by single chip microcomputer. In order to realize the negative feedback of speed and current, the system sets the corresponding speed and current regulators, and nest them together to make the current loop inside and the speed loop outside, which forms a double closed-loop speed regulation system of speed and current. Design and determine the structure and components of the system, including the parameters and circuit structure of speed regulator, current regulator, detection circuit, trigger circuit. The simulation software MATLAB is used to simulate the whole circuit, and a thyristor reversible DC speed regulation system based on single chip microcomputer control is constructed. The simulation results show that the response speed of DC motor speed is fast and the growth process is stable, there is no large overshoot, and the maximum speed can reach 1500 R / min, which meets the requirements of the task book.

Key Words: DC speed control system; thyristor; PI regulation;Single chip microcomputer

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