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Abstract
A motion control system for an articulated robot arm using System On a Programmable Chip (SOPC) technology is presented in this thesis. The development environment of SOPC technology includes a Field Programmable Gate Array (FPGA) and a Nios II processor which can be embedded into FPGA. In the proposed motion control system, there are two modules. One Module is implemented by software using Nios II embedded processor, and it performs the functions of the sequential control, point to point motion control and the continuous motion trajectory control. The other module is implemented by hardware using FPGA, and it performs the inverse kinematics of the Robot arm, the function of position control of the articulated robot arm driven by five dc servo motors. In the latter module, it concludes a position/speed controller circuit, five Quadrature Encoder Pulse (QEP) capture circuits and five Pulse Width Modulation (PWM) circuits. Programs in Nios II processor are coded in C language and digital hardware circuits are designed by VHDL language.
The FPGA chip adopts Altera Stratix II EP2S60F672C5ES, which has 48,352ALUTs, maximum 492 user I/O pins, 36 DSP blocks and total 2,544,192 RAM bits, and a Nios II processor can be embedded into this FPGA chip. Therefore, under this SOPC environment, it is very suitable for developing the motion control system like the robot arm. At last, an experimental system which includes a FPGA-based experimental board, five set of inverters, five set of rectifiers and an articulated robot arm has been set up and some experimental results have been provided and demonstrated the effectiveness and correctness of the proposed motion control system of the robot arm
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