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Abstract
A servo control IC for vertical articulated robot arm using SoPC technology is presented in this thesis. The development environment of SoPC technology includes a field programmable gate array (FPGA) and a Nios processor which can be embedded into FPGA. In the proposed servo control IC, there are two modules. One Module is implemented by software using Nios embedded processor, and it performs the Ethernet communication with remote PC, the functions of the sequential control, the inverse kinematics of the Robot arm, point to point motion control and the continuous motion trajectory control. The other module is implemented by hardware using FPGA, and it performs 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 QEP (Quadrature Encoder Pulse) capture circuits and five PWM (Pulse Width Modulation) circuits. Programs in Nios processor are coded in C language and digital hardware circuits are designed by VHDL language. The FPGA chip adopts ALTERA Stratix EP1S10F780C6ES, which has 10,570 LEs, maximum 426 user I/O pins, 6 DSP blocks and total 920,448 RAM bits, and a Nios processor can be embedded into this FPGA chip. Therefore, under this SoPC environment, it is very suitable for developing the servo control IC 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 servo control IC of the robot arm.
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