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Abstract
In this thesis, a design and implementation of a servo control IC for permanent magnet synchronous motor (PMSM) is presented. The function needed for controlling PMSM, such as a detection of quadrature encoder pulse (QEP)、coordinate transformation, indirect field-orientation control, space vector PWM, current loop PI controller, speed loop fuzzy controller, are all implemented in this servo control IC. The IC used in this thesis is adopted by Altera FLEX10K100A complex programmable logic device (CPLD) and the circuits are designed by VHDL. To simplify the design and increase the precision realization, a modular design approach is proposed and a 12-bit data length with Q11 and signed 2’s complement computation is utilized. In order to increase the control performances of PMSM drive, a fuzzy controller in speed control loop and a PI controller in current control loop are employed and the derivation of the fuzzy control rules according to the dynamic signal analysis is proposed. The completed servo control IC is connected to the TMS320F24x DSP through a bus communication .It can receive the speed command from the DSP to control the PMSM and transmit the running status of PMSM back to the DSP chip for analyzing the dynamic response. At last, an experimental system which includes a CPLD_based servo design board, a TMS320F24x DSK, inverter, rectifier, a PMSM and a set of PC has been set up and some experimental results provided for demonstrating the effectiveness of the proposed servo control IC.
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