

基于调制波周期归一化的片上SPWM 控制器设计与实现

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Design and Implementation of SPWM Controller Based on Modulation Wave Cycle Normalization

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摘要 设计了一款片上正弦脉冲宽度调制(sinusoidal pulse width modulation, SPWM) 控制器, 提出一种基于调制波周期归一化的 SPWM 实现方法. 以正弦调制波周期 T 为基准, 三角载波的周期为 T/n (取 $n=10$), 考虑到通用性, 所给出的设计方案是在对正弦调制波周期 T 作归一化的条件下, 离线解一组三角载波与正弦调制波的联立方程组, 计算出它们的交点(即SPWM 脉宽开关点) 相对时点值, 通过移位寄存器、加法器及相关算法实现输出波形在交点相对时点值处翻转, 得到一定载波比下的SPWM 波; 同时此控制器也通过捕获外部信号的周期, 输出经过变频后的SPWM 波; 对已嵌入此SPWM 模块的SHU-MV08a 进行验证, 并在ModelSim 上通过了寄存器传输级(register-transfer level, RTL) 功能的仿真验证; 最后, 在FPGA 开发板及所搭建的测试系统上进一步验证了其功能. 实验结果表明, 该设计具有实际可操作性, 且可用于任意调制波.

关键词: 调制波周期归一化 正弦脉冲宽度调制 捕获变频

Abstract: A sinusoidal pulse width modulation (SPWM) controller based on modulation wave cycle normalization is designed. The controller can operate in two modes: user defined and captured frequency scaling. Let T be the period of sinusoidal modulation wave, and T/n ($n=10$) the cycle of triangular carrier. The relative time value of SPWM wave on-off switching points are first calculated off-line. A shift register and adder are used to translate these data to control the level trigger moment of the SPWM wave. The scaling frequency SPWM signal for external signal can be realized with the SPWM module used. With the SPWM controller integrated in SHU-MV08a, register-transfer level (RTL) function simulation verification by ModelSim, and testing for printed circuit board (PCB) testing system have been achieved. The results show that the proposed SPWM controller is reliable, with practical significance. The modulation wave cycle normalization based on sinusoidal wave can also be used for any modulation wave.

Keywords: modulation wave cycle normalization, sinusoidal pulse width modulation (SPWM), captured frequency scaling

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[1] Hidekazu M, Michinobu K, Kohta T, et al. A PWM motor speed control system based on the dual-loop PLL [C]// ICROS-SICE International Joint Conference. 2009: 418-423.

[2] 沈锐, 卢刚, 李声晋, 等. 基于步进电动机SPWM 驱动的发电机调速控制[J]. 微特电机, 2011(12): 43-44.

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- [3] 李发启, 沈艳霞. 基于FPGA 的SPWM 控制器设计[C]// 2007 中国控制与决策学术年会. 2007: 1067-1070.
- [4] 张大为, 刘迪, 高艳丽. SPWM 变频调速在交流异步电动机控制中的应用[J]. 船电技术, 2012, 32(2): 30-32.
- [5] 韩静静. PWM 逆变器供电对异步电机铁芯损耗影响的研究[D]. 北京: 北京交通大学, 2011.
- [6] 张静. 基于FPGA的SPWM逆变电源控制器研究[D]. 西安: 西安科技大学, 2010: 9-12.
- [7] 王孟. 基于SoPC的变频控制器IP核的研究[D]. 武汉: 武汉科技大学, 2008: 7-14.
- [8] 罗宏浩, 刘少克. 新型SPWM 调制技术[J]. 微特电机, 2004(3): 19-20.
- [9] Zou C Q, Cai J L. A new method of solving SPWM switch point based on natural sampling [C]// 2nd IEEE International Conference on Information Management and Engineering. 2010: 325-329.
- [10] 丁卫东, 郭前岗, 周西峰. 一种基于FPGA 的SPWM波的实时生成方法[J]. 计算机技术与发展, 2011, 21(2): 211-214.
- [11] He D H, Huang W Q, Pan S, et al. Reserch on ultrasonic motor driver based on SPWM technology [C]// International Conference on Electrical Machines and Systems. 2008: 213-216.
- [12] Lin F, Li K, Liu Y. A design and implementation of edge controller for SPWM waves [C]// IEEE International Conference on Information and Automation. 2011: 764-767.
- [13] 黄云, 杨尊先. 基于FPGA 的SPWM 变频系统设计[J]. 现代电子技术, 2010, 33(1): 80-82.
- [14] Hu Y L, Zhou C. Integration and verification case of IP-core based system on chip design [J]. Journal of Shanghai University: English Edition, 2010, 14(5): 349-353. 
- [15] 郭腊梅, 胡越黎. 一种微控制器总线结构的设计[J]. 计算机测量与控制, 2005, 13(7): 715-717. 

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