

基于 FPGA 的 FIR 滤波器设计

摘 要

随着科技的发展和时代的变迁,现代电子技术这门学科在滤波方面的问题上也产生了飞跃,产生了数字滤波器,而对于 FIR 数字滤波器来说,它凭借着它优良的线性特性和可以进行快速傅立叶变换的优势而被广泛使用, FIR 数字滤波器已经成为了数字信号处理部分不可缺少的基本模块之一。在对大量国内外文献分析的基础上,总结了国内外现阶段 FIR 数字滤波器的发展水平和发展现状,认真的学习了 FIR 数字滤波器的基本原理,并且分析了 FIR 数字滤波器的基本结构。本文设计了一个基于 FPGA 的 FIR 低通滤波器,使用 MATLAB 进行仿真并使用 Modelsim 对其进行验证,验证过程中说明了应用 VerilogHDL 的设计流程,对其验证结果进行了详细的讨论。首先要掌握 FIR 滤波器的基本结构和特点,然后依据速度快和硬件规模小作为设计指导思想,利用 MATLAB 设计 FIR 滤波器,对整个 FPGA 元件计划采用模块化、层次化设计思想,最后使用 Quartus II 进行仿真,并将仿真结果与 MATLAB 的仿真结果进行对比,结果显示,设计的 FIR 低通滤波器已达到预期要求。

关键词: FPGA; 数字滤波器; VerilogHDL 语言; MATLAB

ABSTRACT

With the modern electronic technology in the filter on the leap, produced a digital filter, and the FIR digital filter with its good linear characteristics is widely used, is one of the basic modules of digital signal processing. On the basis of a large number of domestic and foreign literature analysis, summarizes the FIR digital filter development level and current situation, seriously analyzed the basic structure and design principle of FIR digital filter. This paper designed an 8-order FIR low-pass filter based on FPGA, using the distributed algorithm as the filter's hardware implementation algorithm, explained the application of VHDL EDA design process, and with the help of MATLAB simulation, it was discussed in detail. Must first master the basic structure and characteristics of FIR filter, and then on the basis of fast speed and small hardware design as the guiding ideology, using MATLAB to design FIR filter, for the whole of the FPGA component plan adopts modular, hierarchical design thought, finally the simulation using the Quartus II and compare the simulation results of the simulation results in MATLAB, the result shows that the design of FIR low-pass filter has reached the expected requirement.

Keywords: FPGA; Digital filter; VerilogHDL language; MATLAB

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