基于**FPGA**的数字超声内窥镜接收系统设计

作　者：温世杰，鲁冬杰，陈晓冬，郁道银

单　位：天津大学精密仪器与光电子工程学院，教育部光电信息技术科学重点实验室

基金项目：

摘　要：

根据数字超声成像的要求和超声信号的特点，设计了由高速采样电路和FPGA正交解调电路组成的数字超声内窥镜接收系统。采样电路由AD8138和AD9235实现
放大后的超声回波信号直接进行模数转换；FPGA利用内部RAM、乘法器、IP核和宏模块构建数字正交解调电路，提取超声回波信号的幅度；获取的幅度信息经
B2.0接口电路送入计算机显示。对玻璃杯进行的静止扫描成像实验，验证了接收系统的小信号检测能力，可以检测到信噪比约为4dB的回波信号；对玻璃杯进行
旋转扫描成像实验，表明接收系统可用于数字超声内窥镜成像。

关键词：内窥镜；超声信号；正交解调；FPGA

Design of Receiving System of Digital Ultrasonic Endoscope Based on FPGA

Author's Name: WEN Shijie, LU Dongjie, CHEN Xiaodong, YU Daoyin

Institution: College of Precision Instrument & Opto-electronic Engineering, Tianjin University, Opto-electronic Information Science and Technology Laboratory，Minist
Education

Abstract:

According to the requirement of digital ultrasonic imaging, a receiving system is designed for digital ultrasonic endoscope which is composed of a high-speed ADC and
quadrature demodulation circuit based on FPGA. The ADC directly samples the amplified echo using AD8138 and AD9235; FPGA extracts the envelope of digital echo b
internal digital quadrature demodulation circuit which is implemented by RAM, multiplier, IP core and megafunctions in FPGA; amplitude of echo is transferred to compu
for imaging through USB2.0 interface. The experiment of stationary scanning glass proves the detecting ability of the receiving system, which can obtain the amplitude o
signals whose SNR is 4dB. The experiment of rotating scanning glass proves that the receiving system can be utilized in digital ultrasonic endoscope.

Keywords: endoscope; ultrasonic signal; quadrature demodulation; FPGA