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Digital High Frequency Coded Imaging System

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Coded transmission is an approach to solve the inherent compromise between penetration and resolution required in ultrasound imaging. It is universally acknowledged that this technique gives major improvement in SNR. A novel high frequency (20-35 MHz) ultrasound real-time imaging system for research and evaluation was developed. The digital programmable coder-digitizer module based on the field programmable gate array (FPGA) supports arbitrary waveform coded transmission and RF echoes sampling up to 200 MSPS, as well as real-time streaming of digitized RF data via a high speed USB interface to the PC. All RF and image data processing were implemented in the software. A novel balanced software architecture using CPU and GPU processing supports real-time processing and display at rates up to 30 frames/sec. The system was used to acquire data for sine burst and 16-bit Golay code excitation using a single element scanning head with thick film focused spherical transducer 25 MHz center frequency and 56% system bandwidth. SNR gain for the Golay codes (referenced to single burst) of 15 dB for 20 MHz and 16 dB for 35 MHz were obtained. In water the axial resolution for both single burst and the Golay codes was the same FWMH=20 ns at 20 MHz and FWMH=15 ns at 35 MHz.