

**Post-Beamforming Volterra Filters for Contrast-Assisted Ultrasonic Imaging: In-Vivo Results**

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**Abstract:** We present the first verification of the contrast enhancement achieved by the post-beamforming second-order Volterra filter based on P. Phukpattaranont and E.S. Ebbini (2003) in vivo. Images of the kidney of a juvenile pig were obtained before and after infusion of contrast agent (Sono Vue, Bracco, Geneva, Switzerland) at various concentrations. For example, at a concentration of 0.01ml/kg, B-mode images (3 cycles at 1.56 MHz transmit frequency) show no quantifiable change due to the presence of the contrast agent. Pulse inversion (PI) images without second harmonic (SH) filtering showed 10 dB enhancement and evidence of residual tissue components due to motion. SH imaging on PI data produced 14 dB enhancements with some loss in resolution. On the other hand, quadratic filtering produced 23 dB enhancements at twice the frame rate. This performance was achieved with quadratic filters derived using a new algorithm leading to a computationally efficient separable implementation of the quadratic kernel. This implementation should allow for real-time implementation of quadratic filtering on commercial ultrasound scanners.