Adaptive Multi-Bit Sigma-Delta Modulation Digitizer for Pulsed Waveforms

Title: Adaptive Multi-Bit Sigma-Delta Modulation Digitizer For Pulsed Waveforms

Invention: Researchers at the University of Arizona have designed, built, and tested a digital-to-analogue circuit (DAC) that utilizes a multi-bit, sigma-delta modulation technique in a novel manner. The DAC captures the transient information as well as the pulse shape and displays it with high resolution even over an extremely short duration. The circuity minimizes the number of bits required and greatly reduces the circuitry footprint and computational requirements compared to a standard multi-bit sigma delta DAC or a 12-bit conventional DAC.

Background: For signals that have rapid transients or discontinuities, such as the pulses associated with the sudden deposition of energy when an x-ray or gamma-ray photon interacts in a detector material, 1-bit digitization is not able to keep up with the analog waveform. Although some information can be retrieved, but the pulse shape is typically lost. There is a need to recover the pulse shape of such rapidly transient signals without requiring huge amounts of circuitry and computation.

Applications:

- Medical Imaging
- Musical recordings
- Astronomy
- Homeland Security

Advantages:

- Cost-effective
- High-resolution
- Improved accuracy
- Compact
• Low computational requirements
• Reduced circuitry footprint

Licensing Manager:
Amy Phillips
AmyP@tla.arizona.edu
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Inventors
Maria Ruiz-Gonzalez
Graduate Research Associate, Optical Science

Lars Furenlid
Professor, Radiology