Time-Encoding Sub-Nyquist ADC

(No. T4-2258)

Principal investigator

Yonina Eldar

Faculty of Mathematics and Computer Science
Department of Computer Science and Applied Mathematics

Overview

Modern ADCs must reduce cost and power consumption without compromising signal quality, particularly in power-sensitive systems such as wearables, IoT, and security devices. This technology introduces the first sub-Nyquist ADC based on an integrate-and-fire time encoding machine (IF-TEM). By combining low power, reduced complexity, and scalable performance, it enables high-resolution signal acquisition at significantly lower sampling rates without requiring a clock, making it an ideal solution for next-generation energy-efficient computing systems.

Applications

- Wearable and IoT devices
- Remote and industrial sensors
- Homeland security systems
- Neuromorphic computing systems

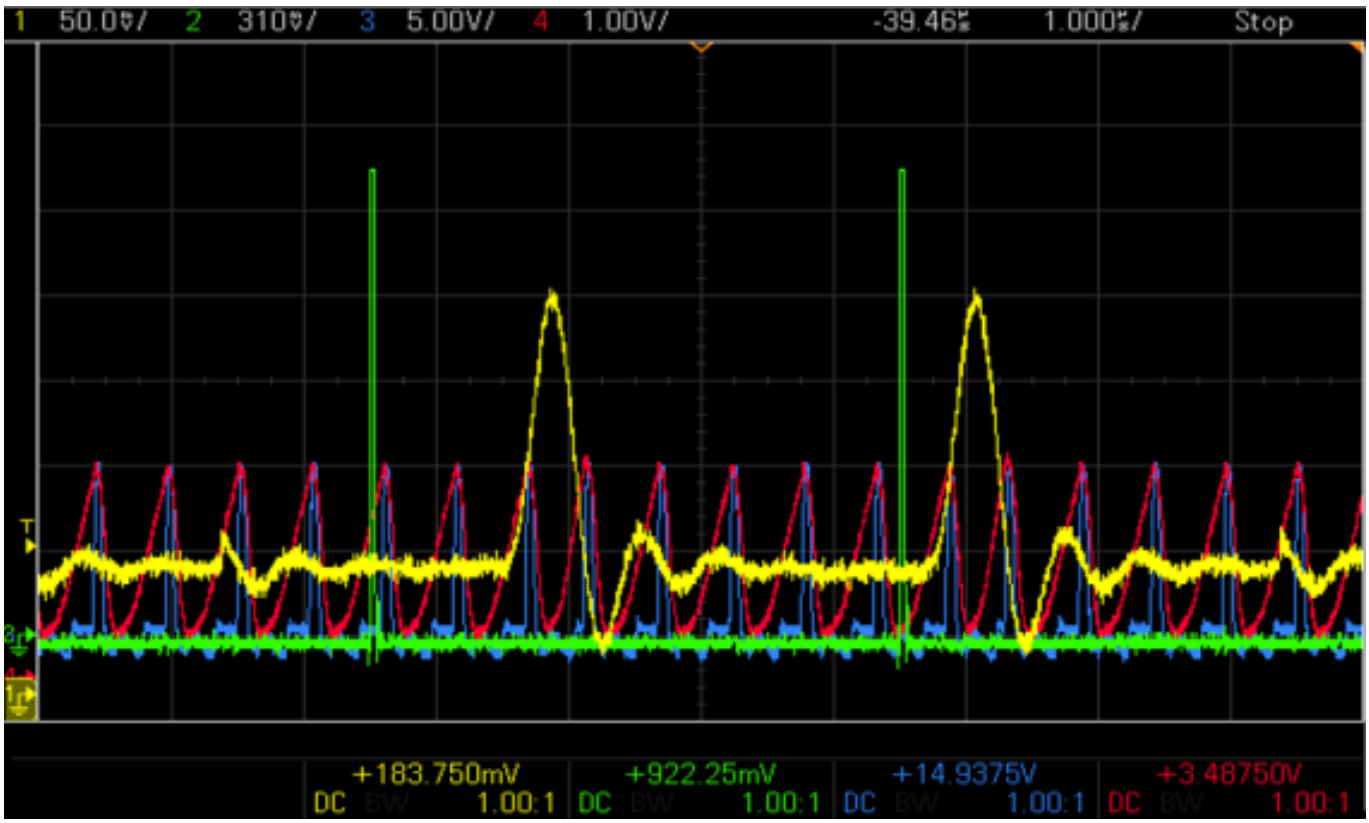
Differentiation

- Scalable and Cost-Effective
- Lower engineering costs
- High resolution
- Very low power consumption

Development Stage

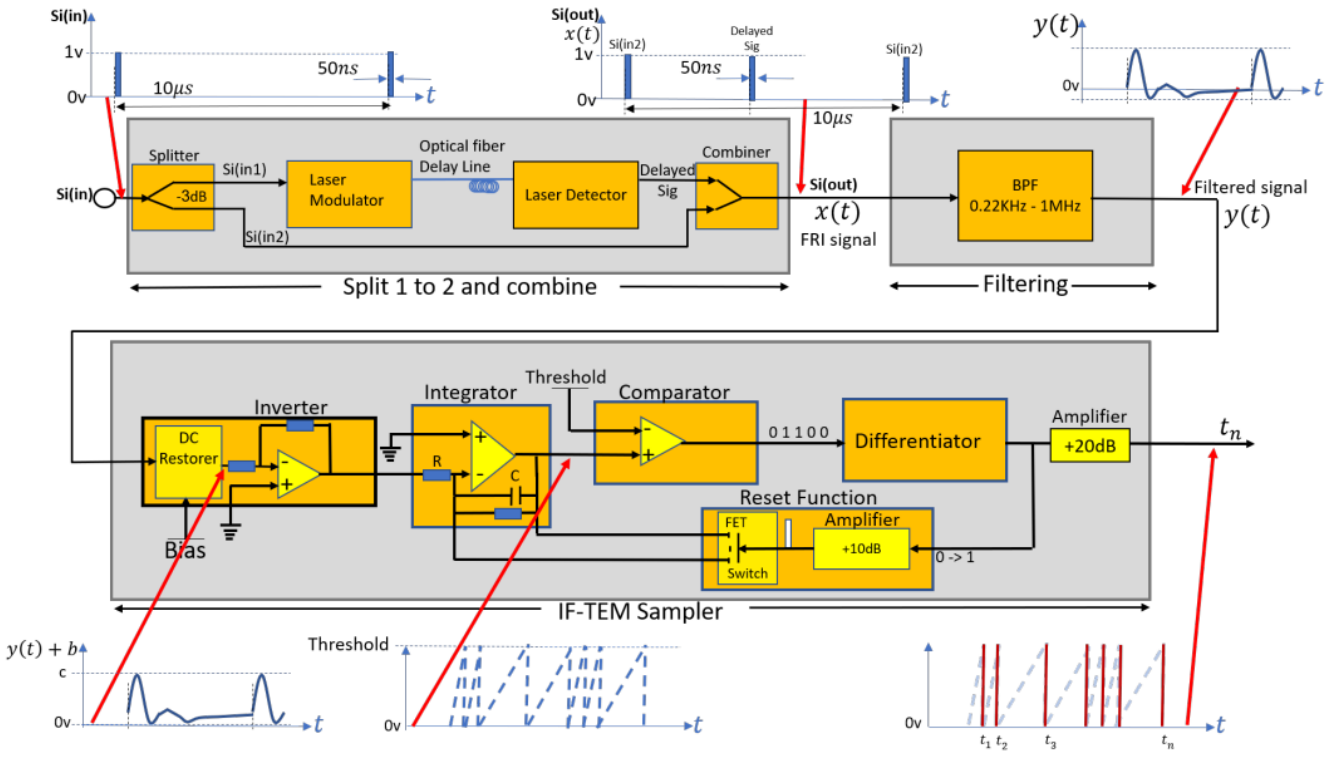
A hardware prototype was developed, demonstrating the applicability of efficiently emulating an integrate-and-fire (IF) neuron.Â The proposed hardware and the reconstruction method operated at a sampling rate 10-12 times lower than Nyquist with a signal-to-noise (SNR) ratio of up toÂ -25 dB.

Â



Â Block diagram of the analog board; Finite-rate-of-innovation (FRI) input signal x(t) (green), band-pass filter (BPF) output y(t) (yellow) and the IF-TEM output resulting in 19 samples (blue)

Â



Block diagram of the analog board

Â