Signal Time Decoding Algorithm for Analog-to-Digital Conversion

"Lead Inventor: Aurel A. Lazar, Ph.D.

Analog-to-Digital Signal Conversion Loses Accuracy with Low Power Supply Voltages:
Most signals in the natural world are analog. However, most computer systems used for processing these signals are binary digital systems. Generally, analog-to-digital (A/D) converters use synchronous circuits and sample the signal at precise moments in time. These analog signals are represented as a series of digital bits and the number of bits in the system defines the resolution of the conversion.

Applying traditional sampling theory, a band limited signal can be represented with a quantifiable error by sampling the analog signal at a sampling rate at or above what is commonly referred to as the Nyquist sampling rate. It is a continuing trend in electronic circuit design to reduce the available operating voltage provided to integrated circuit devices. In this regard, power supply voltages for circuits are constantly decreasing. While digital signals can be processed at the lower supply voltages, traditional synchronous sampling of the amplitude of a signal becomes difficult as the available power supply voltage is reduced and each bit in the A/D or D/A converter reflects a substantially lower voltage increment.

Signal Time Encoding Algorithm for Analog-to-Digital, Digital-to-Analog Conversion:
Time encoding is a real-time asynchronous mechanism of mapping the amplitude of a band-limited signal into an increasing time sequence. For time decoding, a large class of algorithms can achieve perfect recovery of the encoded signal if the rate of encoded time sequence satisfies Nyquist-type conditions for the bandwidth of the original analog signal. However, these decoding algorithms require solving typically ill-conditioned infinite-dimensional system of linear equations. This invention implements signal recovery decoding algorithm and investigates its performance. The algorithm uses an overlapping sequence of finite-dimension covering of the infinite-dimensional system.

Applications:
All applications that use analog-to-digital/digital-to-analog conversion including
• Encoding/decoding audio and video
• Network and wireless communications

Advantages:
• Highly stable and efficient
• Can be used in real time and implemented at the level of hardware


Inventors

Aurel Lazar