Exploring Aliasing and the Sampling Theorem

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April 2025

1 Introduction

In signal processing, ...

An analog signal refers to a signal that varies continuously over time. The complexity of analog signal processing, their susceptibility to noise and signal degradation over time, as well as their limited reproductibility and scalability makes them inconvenient to work with in practice. Therefore, digital signals are used – signals that vary discretely over time and can take only a finite number of distinct values.

Sampling refers to the process of converting an analog signal into a digital signal. If we let $x(t)$ be a continuous time signal, the sampled signal $x[n]$ is defined as

$$x[n] = x(nT_s)$$

where n represents discrete time sampling points and T_s represents the sampling period, such that the sampling frequency $f_s = \frac{1}{T_s}$. Sampling essentially allows us to discretize a continuous input.

In practice, sampling continuous time signals facilitates handling and working with them. After sampling is done, it is natural that the signal must be reconstructed in order to recover the original (time continuous) signal. However, recovery is not always perfect – the Shannon-Nyquist condition must be met. aaa

2 Implementation

3 Discussion

4 Conclusion