

Sampling in time domain = periodicity in frequency domain N1AL 6/9/2009

Sampling a signal in the time domain causes that signal to be repeated in the frequency domain. These alias products appear at frequencies equal to each harmonic of the sample rate plus and minus the frequency of the original signal. Here we show how one set of samples corresponds to sine waves of three different frequencies.

SamplePeriod := 100 100 display points in the graph per sample

SampleRate := $\frac{1}{\text{SamplePeriod}}$ Sample rate (samples per second) = 1 / period (seconds per sample)

OffsetFreq := 0.2 · SampleRate Frequency difference between a harmonic of the sample rate and an alias frequency

N := 400 i := 0..N

Freq₀ := 0 · SampleRate + OffsetFreq Sig_{0,i} := sin(2 · π · Freq₀ · i)

Freq₁ := 1 · SampleRate + OffsetFreq Sig_{1,i} := sin(2 · π · Freq₁ · i)

Freq₂ := 2 · SampleRate + OffsetFreq Sig_{2,i} := sin(2 · π · Freq₂ · i)

All three of these signals have exactly the same sampled sequence.
The same sampled sequence corresponds to many different frequencies.

SampleNumber_i := $\frac{i}{\text{SamplePeriod}}$



