ECOMMS Lab 1

Aidan Sharpe, Elise Heim, John Leahy

I. Introduction

II. Generating Arbitrary Waveforms with Specified SNRs

We were provided with sample code to assist our programming. The code produced a one second long A♯ signal, which is a sinusoidal signal with frequency $f_{\text{A}\sharp} = 433.16[\text{Hz}]$. This signal was sampled at 8 kHz, and altered to plot the waveform as shown in 1.

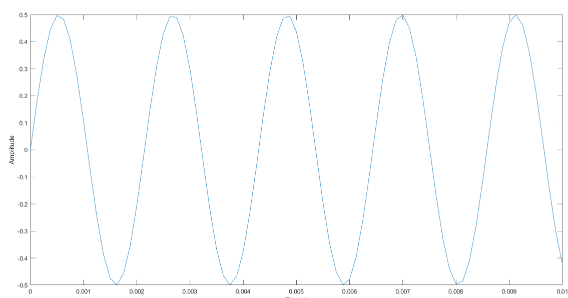

Fig. 1. Time domain representation of a pure A♯ tone with amplitude $\frac{1}{2}$.

In addition, the signal was corrupted with a Gaussian noise source to get a Signal to Noise Ratio (SNR) of 10 dB. This waveform sounded staticky and weak compared to the first signal. We then repeated the process with SNR values of 20 and 30 dB. As seen in 2, increasing the SNR increased the clarity of the signal.

Fig. 2. Time domain representation of the same signal with an SNR of 10db

III. Differences between the Continuous Fourier Transform (CFT) and the Discrete Fourier Transform (DFT)

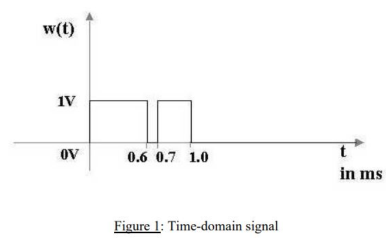

Fig. 3. Time domain plot of $w(t)$

We are given continuous time signal, $w(t) = u(t) - u(t - 0.6) + u(t + 0.7) - u(t - 1)$, seen in figure 3. Since it is a bounded, finite support aperiodic signal, it is absolutely integrable. Therefore, its Continuous Fourier transform (CFT) exists. The CFT of a signal is given by

$$\mathcal{F}\{w(t)\}(\omega) = \int_{-\infty}^{\infty} w(t)e^{-j\omega t}dt \tag{1}$$

where ω is angular frequency. Evaluating the integral gives

$$\mathcal{F}\{w(t)\}(\omega) = \frac{j\left(e^{-j\omega 0.6} + e^{-j\omega} - e^{-j\omega 0.7} - 1\right)}{\omega} \tag{2}$$

...where this sentence does not have a period at the end of it.

With this in mind, we can determine the maximum as well as minimum sampling frequency ”that would allow reconstruction of the CFT”.

IV. Synthesizing AM and FM Bandpass Signals and Analyzing Their Spectra

ooo part 3 here

V. Capturing and Analyzing the Spectra of One More Time

Our group selected a song called One More Time, and legally downloaded a portion of it.

Directions: Legally, download a segment of your favorite piece of music, import into Matlab and listen. Compute its spectrum in Matlab, observe.