ECE 215 Spring 2025

Objective 2.1: Fourier Transforms

UNITED STATES
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Objective 2.1

I can graph a given sinusoidal signal, including DC components, in both the time and frequency domains and determine its bandwidth.

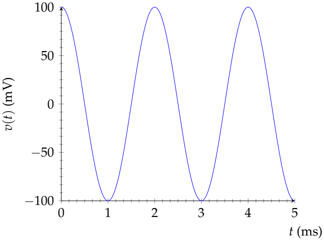
Time Domain vs. Frequency Domain

- So far we've only dealt with constant (DC) or sinusoidal signals - now we want to consider more complicated signals
- The domain of a function is the allowable, independent variable values along the horizontal axis (aka the x-axis)
- The frequency domain identifies the frequencies present in a signal (horizontal axis) and their corresponding amplitudes (vertical axis)

Time Domain vs. Frequency Domain

Start with a single sinusoid (or tone):

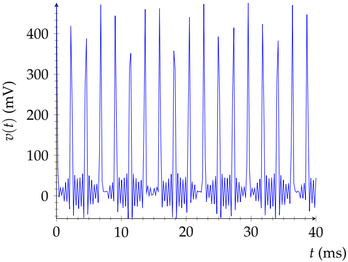
- What's the time domain equation?
- What does this look like in the frequency domain?



SIGNAL SPECTRUM FOR MULTIPLE FREQUENCIES

The advantage of plotting in the frequency domain becomes more apparent when we have a signal with multiple frequencies

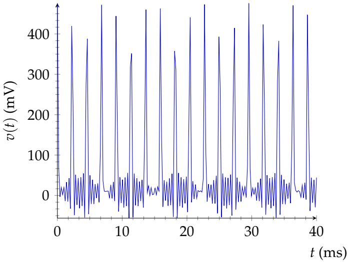
- What's the time domain equation?

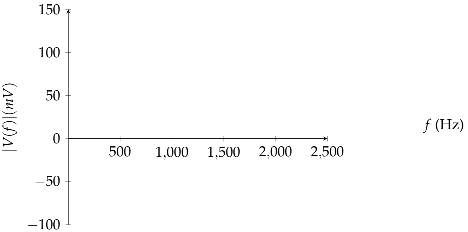


Signal Spectrum for Multiple Frequencies

If we know the time domain equation we can draw the signal in the frequency domain.

- $v(t) = 60 + 100\cos 360^\circ \cdot 440t + 91\cos 360^\circ \cdot 880t + 86\cos 360^\circ \cdot 1320t + 71\cos 360^\circ \cdot 1760t + 68\cos 360^\circ \cdot 2200t\,\mathrm{mV}$





Signal Spectrum for Multiple Frequencies

If we know what the signal looks like in the frequency domain, we can find the time domain equation *(but **no**, we will not draw it)*.