

Asynchronous Activity 1: Radio Waves and Radar

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Abstract

This activity contains exercises related to DSP, radio waves, and radar as part of our COSC360 course. Please watch Course Videos 1.1 and 1.2 before completing the exercises below.

1 Radio Waves and Octave Syntax

1. Write a script entitled `radioWave.m` for Octave that performs the following tasks:
 - Defines a sample time Δt in seconds
 - Defines a maximum time T_{max} in seconds
 - Defines a frequency f in Hz
 - Defines a signal amplitude A in Volts
 - Creates a vector of times running from 0 to T_{max} , with each time Δt seconds after the previous time. For example: `t = [0:dt:Tmax]`.
 - Creates a graph of $y1 = A \cos(2\pi f \cdot t)$, with labeled axes
2. Suppose this signal represents an observation of a radio wave on an antenna. Given what you know about radio waves, what is the wavelength λ ?
3. In Octave, type `help circshift`. Once you understand how the `circshift` function works, use it to make a copy of your $y1$ data above, but shifted in time, and add it to the graph. (Remember that the command `hold on` will allow you to keep adding to the graph without losing anything).
4. If the earlier wave represents the original signal, and the later wave represents a *radar echo*, how far away is the object that created the echo?
5. Finally, make a copy of $y2$ in a variable called $y3$, but change the amplitude to something lower by a factor of 100:

$$y3 = y2/100; \tag{1}$$

What is the ratio of the power of signal $y3$ to $y2$ in dB? (Refer to Video 1.2 for a demonstration).