Code Lab 2: Signal Combinations and Noise

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Abstract

In this activity, we compare sums of sinusoidal signals and other types of signals and noise. This connection will be further developed as the course proceeds. First, we will create a sum of sinusoidal signals at increasing frequencies. Second, we will plot that sum and compare it to a known type of signal: square pulses. Finally, we will add gaussian white noise to our signals.

1 Installing Packages in Octave

Use the following code to clear your workspace:

```
clear;
home;
close;
```

Run the following code to check if you have the `signal` package for octave:

```
pkg load signal;
```

If you do, the package will be loaded. If not, download the `control` and `signal` packages[1]. Use the `pkg install` command to install the files:

```
pkg install control-4.1.0.tar.gz
pkg install signal-1.4.6.tar.gz
```

These commands must be run in the folder into which the files downloaded.

[1] `https://gnu-octave.github.io/packages/`

2 Functions in Octave

Functions are written in octave like the following:

```
function retval = sinn_An(n,x)
    An = 2/pi/n;
    retval = An*sin(n.*x);
endfunction
```

The `function` keyword starts the function, and the return value(s) are are stored in a variable before an equals sign. In this case, they are called `retval`. This function computes a constant, $2/(n\pi)$ then multiplies it by a sine function with argument nx. In this case, x is a vector of sampled times. Define this code in octave. Next, define the following in octave:

```
function retval = fourier_square(n,x)
    retval = 0.5;
    for i=[0:n]
        retval = retval+sinn_An(2*i+1,x);
    endfor
endfunction
```

Notice this new function calls the previous function *for odd integers n.*

3 The Full Code

For the full code, download the Code Lab 2 file from the course Moodle page. The title of the code is `Fourier_Series_Square.m`. Run this code to create a graph of a *square wave*, compared to our sum of sine waves. Using the `randn` function, add noise to both the square wave and our sum of sine waves.