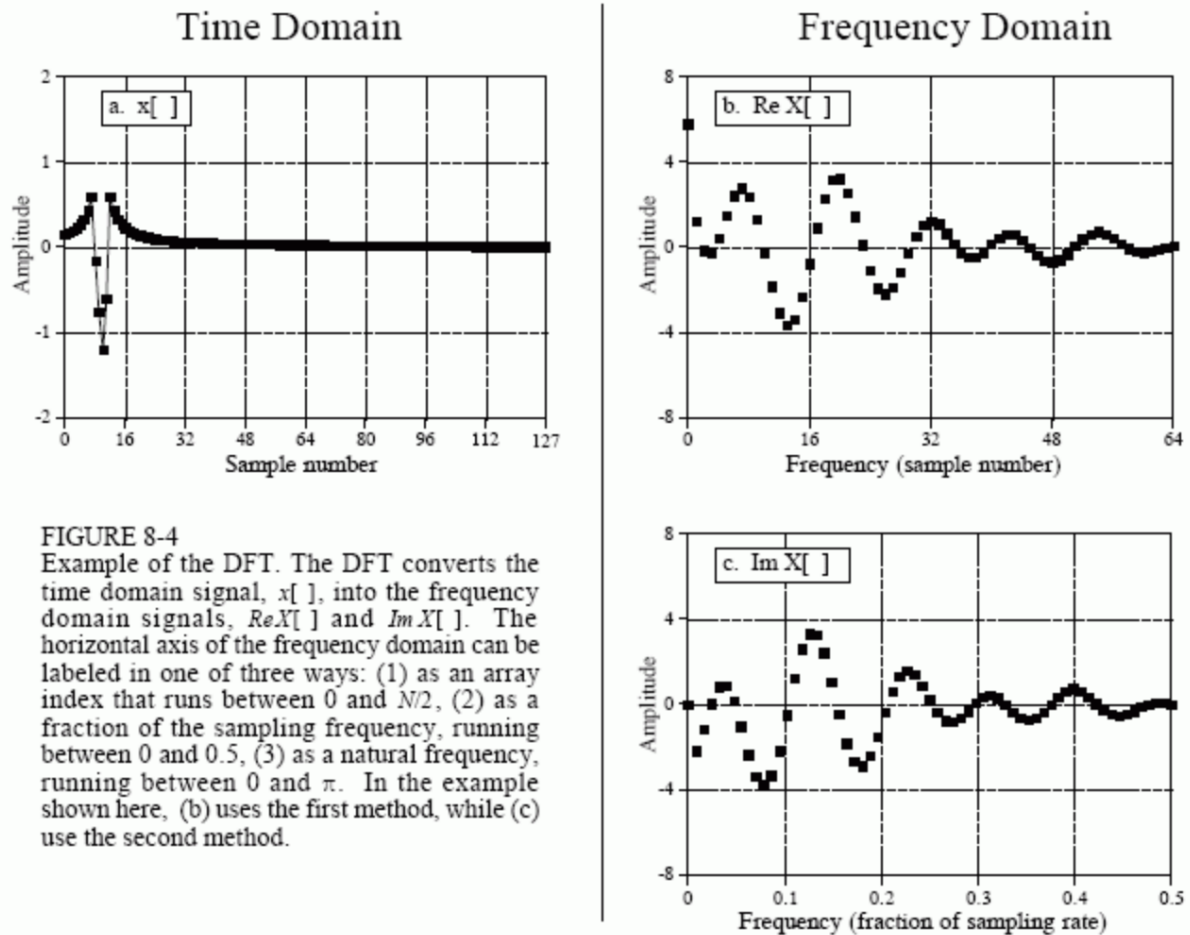


Images from “The Scientist and Engineer’s Guide to Digital Signal Processing”



EQUATION 8-4

The analysis equations for calculating the DFT. In these equations, $x[i]$ is the time domain signal being analyzed, and $Re X[k]$ & $Im X[k]$ are the frequency domain signals being calculated. The index i runs from 0 to $N-1$, while the index k runs from 0 to $N/2$.

$$Re X[k] = \sum_{i=0}^{N-1} x[i] \cos(2\pi k i / N)$$

$$Im X[k] = - \sum_{i=0}^{N-1} x[i] \sin(2\pi k i / N)$$

Discrete Fourier Transform

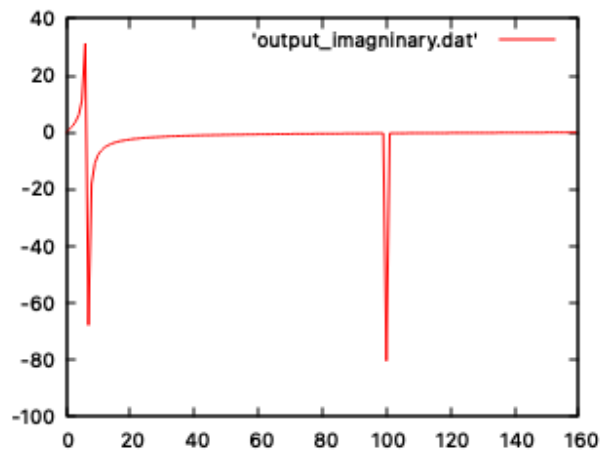
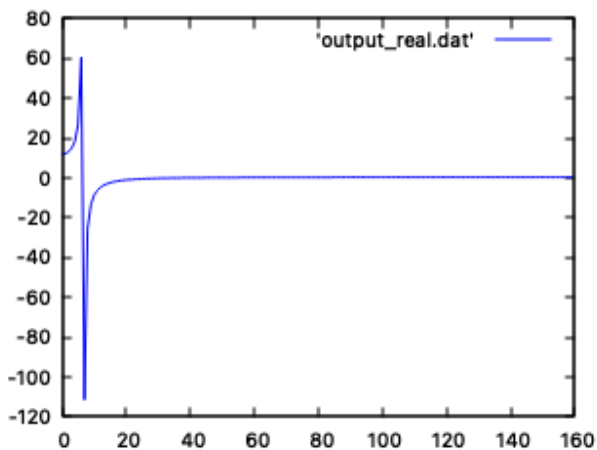
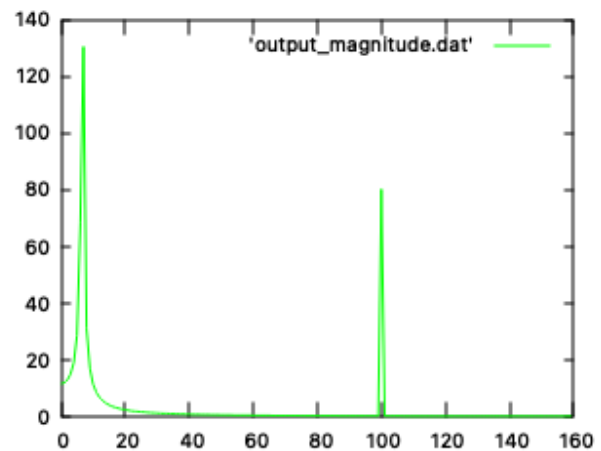
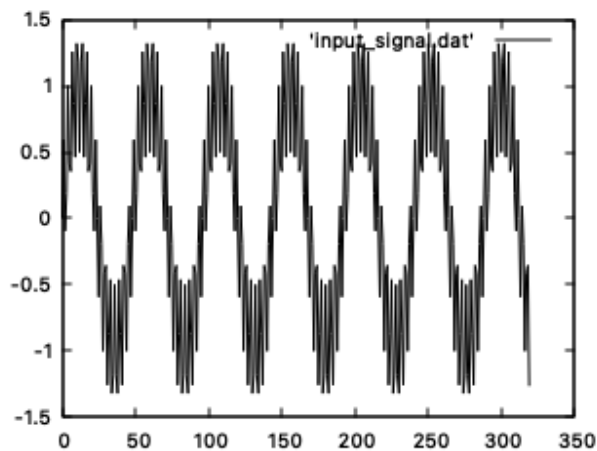
EQUATION 8-1

Equations for the DFT basis functions. In these equations, $c_k[i]$ and $s_k[i]$ are the cosine and sine waves, each N points in length, running from $i = 0$ to $N-1$. The parameter, k , determines the frequency of the wave. In an N point DFT, k takes on values between 0 and $N/2$.

$$c_k[i] = \cos(2\pi ki/N)$$

$$s_k[i] = \sin(2\pi ki/N)$$

Code



Here's the DFT is taking the input signal from the time domain to the frequency domain. We see the real and imaginary components broken down below as well.