6.3000: Signal Processing

FFT

April 03, 2025

Inverse FFT

Here is the lecture code for the FFT algorithm.

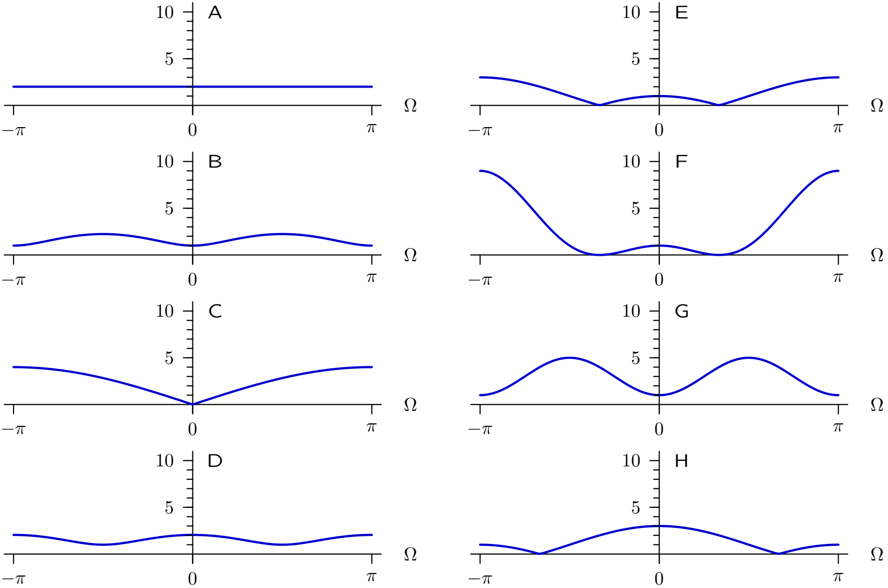
```
from math import e,pi
def FFT(x):
    N = len(x)
    if N != 2*N//2:
        print('N must be a power of 2')
        exit(1)
    if N==1:
        return x
    xe = x[::2]
    xo = x[1::2]
    Xe = FFT(xe)
    Xo = FFT(xo)
    X = []
    for k in range(N//2):
        X.append((Xe[k]+e**(-2j*pi*k/N)*Xo[k])/2)
    for k in range(N//2):
        X.append((Xe[k]-e**(-2j*pi*k/N)*Xo[k])/2)
    return X
```

How would you change the code to compute the inverse FFT?

Note: If `FFT(f)` returns `F`, then `iFFT(F)` should return `f`.

Quiz Review: Composite Systems

The following plots should the magnitudes of the frequency responses of eight discrete-time, linear, time-invariant systems.



Composite Systems

Which plot (if any) shows the magnitude of the frequency response of a system with each of the following unit-sample responses?

$$h_1[n] = g_1[n] = \delta[n] - \delta[n-1] + \delta[n-2]$$

$$h_2[n] = g_2[n] = \delta[n] + \delta[n-1] - \delta[n-2]$$

$$h_3[n] = g_1[n] + g_2[n]$$

$$h_4[n] = g_1[n] - g_2[n]$$

$$h_5[n] = g_1[n] \times g_1[n]$$

$$h_6[n] = g_1[n] \times g_2[n]$$

$$h_7[n] = (g1 * g1)[n]$$

$$h_8[n] = (g2 * g2)[n]$$