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Digital Signal processing

Exam 3 redo

1(a) 15/15 points

1(b)

The main key concept that makes an FFT faster form of DFT is its divide and conquer algorithm. So FFT computes smaller DFT signals and combines them to make a larger DFT signal. Furthermore the complexity of FFT is much less than that of DFT, specifically for larger calculations. Operational complexity of DFT is O(N^2) for a DFT compared to O(N\*log2(N)) for the FFT. So that means for large numbers of N, log2(N) is much less than N. Also the FFT algorithm takes advantage of the symmetric property of the DFT algorithm.

2(a) 15/15 points

2(b) 15/15 points

2(c) The width of the main lobe is important because it determines the resolution. So with narrow main lobe results in a very low side-lobe level, which causes no cross-talk between FFT channels. One particular example is in the Kaiser Window method. So depending on the main lobe width, its change can cause bias in the frequency domain.

3(a) hs[n] = (1+ h[n]) / h[n]

3(b) The frequency response of hs[n] shows that for symmetric or negative values of x[n], i.e., x[-n], the output is the same. This is similar to autocorrelation where the phase is lose and therefore for negative values like –n become n.

3(c) Yes these properties will hold even if h[n] is an IIR filter. This is true because the loss of phase make it such that the properties of an IIR filter are not violated due to the fact that h[n] values are always positive, i.e., loss of phase property. Moreover the poles and zeros will not be in the unstable region.