EEE5502 Foundations of Digital Signal Processing Code 4

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Question #3:

(a) The DFT of $x[n]$ is shown in the plot below:

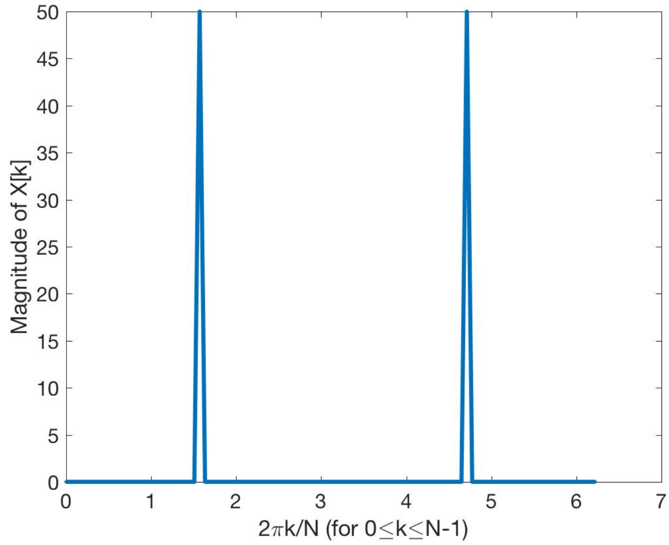

Figure 1: The DFT of signal $x[n]$

(b) The under-complete DFT of $x[n]$ for $K = 10$ is shown in the plot below:

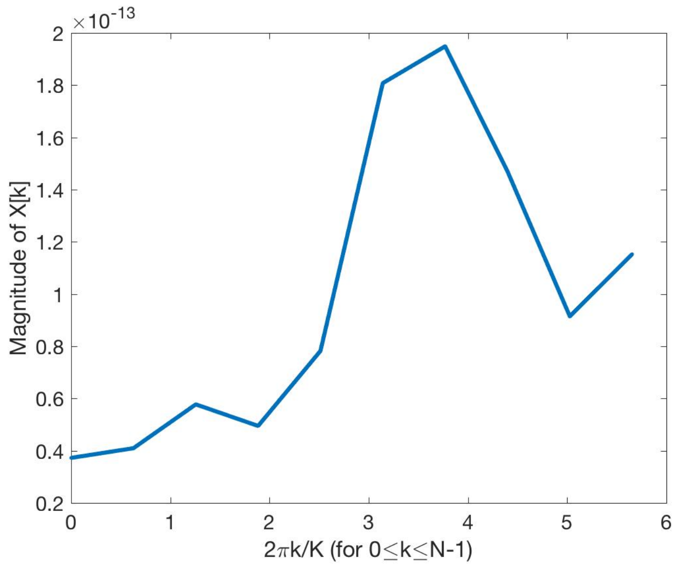

Figure 2: The under-complete DFT of signal $x[n]$

(c) The over-complete DFT of $x[n]$ for $K = 1000$ is shown in the plot below:

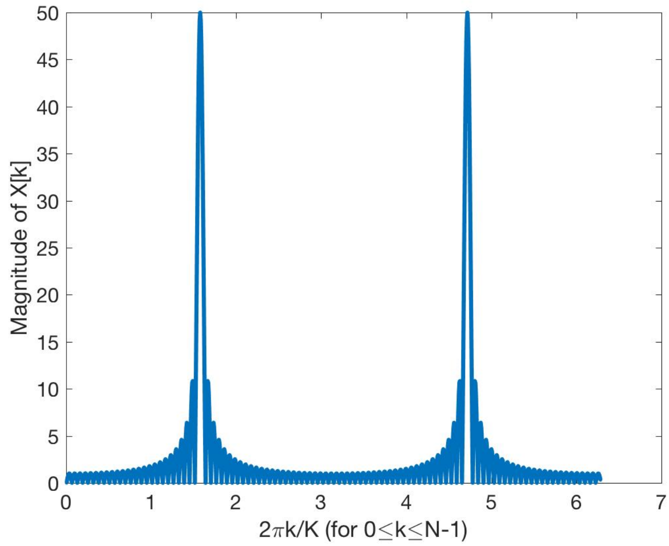

Figure 3: The over-complete DFT of signal $x[n]$

Compare to the result from part (b), with more samples, the over-complete DFT is able to be similar to the original DFT, though being redundant.

Also, based on part (f) of Question #2, we learned that only when $kx = k$, we got meaningful values, otherwise we would always get zero. For part b when $K < N$, kx cannot equal k, so we never get meaningful values; in part(c) K¿N, it is possible that $kx = k$, so we get meaningful values at those frequency.

Question #4:

The plots for $x[n]$, $h[n]$, and $y[n]$ is shown in the plots below:

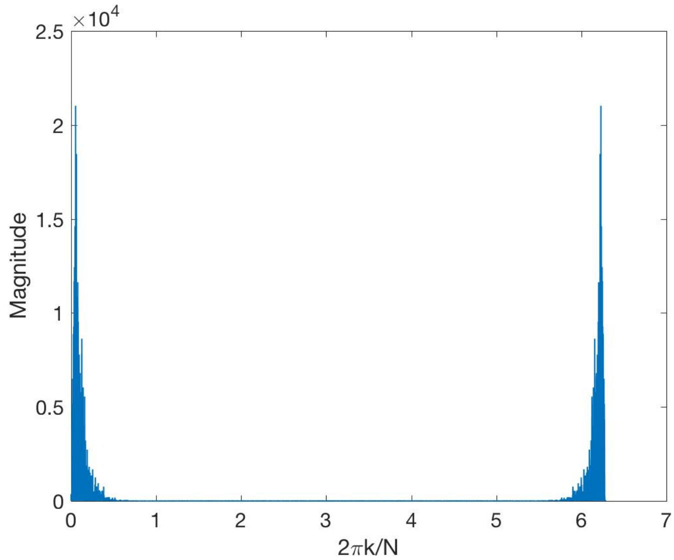

Figure 4: $x[n]$ in the frequency domain

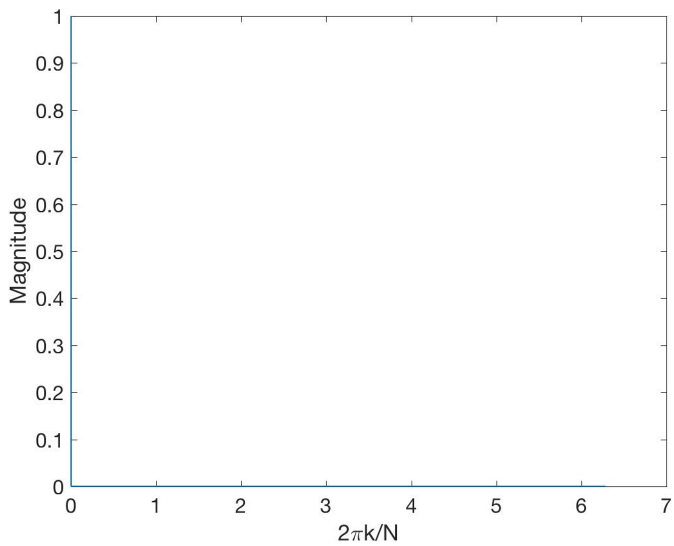

Figure 5: $h[n]$ in the frequency domain

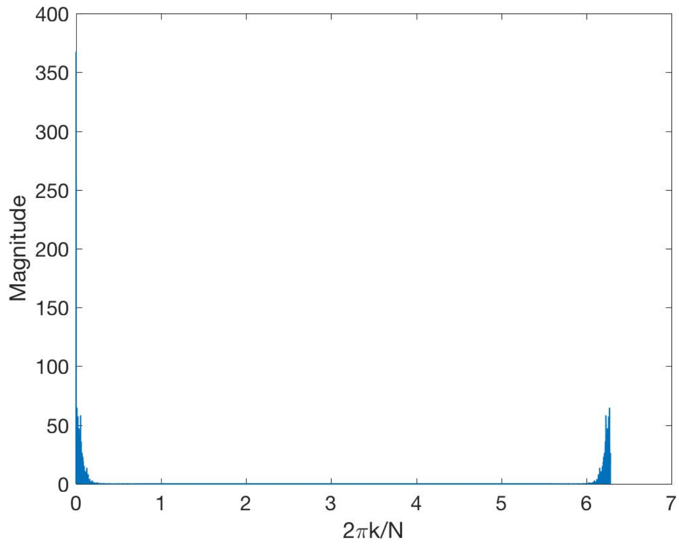

Figure 6: $y[n]$ in the frequency domain

It is obvious that in the frequency domain $H(\omega)$ acts as a low pass filter, so that only signal at low frequency of $X(\omega)$ is preserved in $Y(\omega)$ after the transform, with a weaken in magnitude, since when convolution, $H(\omega)$ also acts as an average filter.