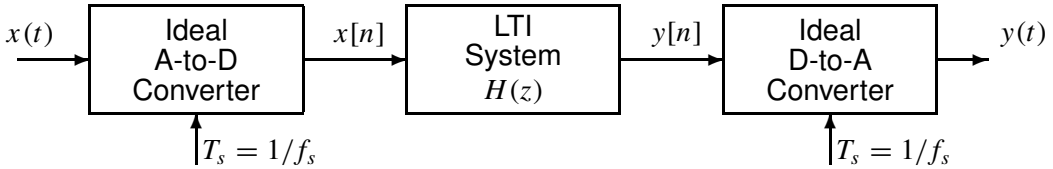
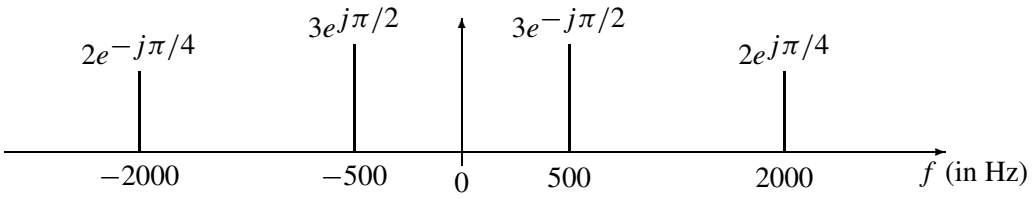
PROBLEM:

The input to the A-to-D converter in the figure below consists of sinusoids defined by a spectrum plot. The system function for the LTI system is a digital FIR filter. Since digital filters can be used to null out individual sinusoids, it should be possible to design $H(z)$ so that all the frequency components *will be zeroed out.*

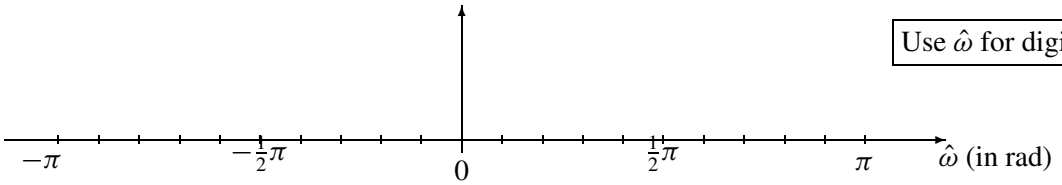


(a) If the input $x(t)$ is given by the two-sided spectrum representation shown below,



Determine the spectrum for $x[n]$ when $f_s = 2000$ samples/sec. Make a plot for your answer, but label the frequency, amplitude and phase of each spectral component.

Use $\hat{\omega}$ for digital freq.



(b) Now you must design the FIR filter: $H(z) = \sum_{k=0}^{M} b_k z^{-k}$. To avoid the all zero solution, set $b_0 = 1$. If the objective is to make the output zero by filtering $x[n]$, then the FIR filter $H(z)$ must be determined by specifying the locations of its zeros in *either* the z domain or the $\hat{\omega}$ domain. Draw the pole-zero diagram for $H(z)$.