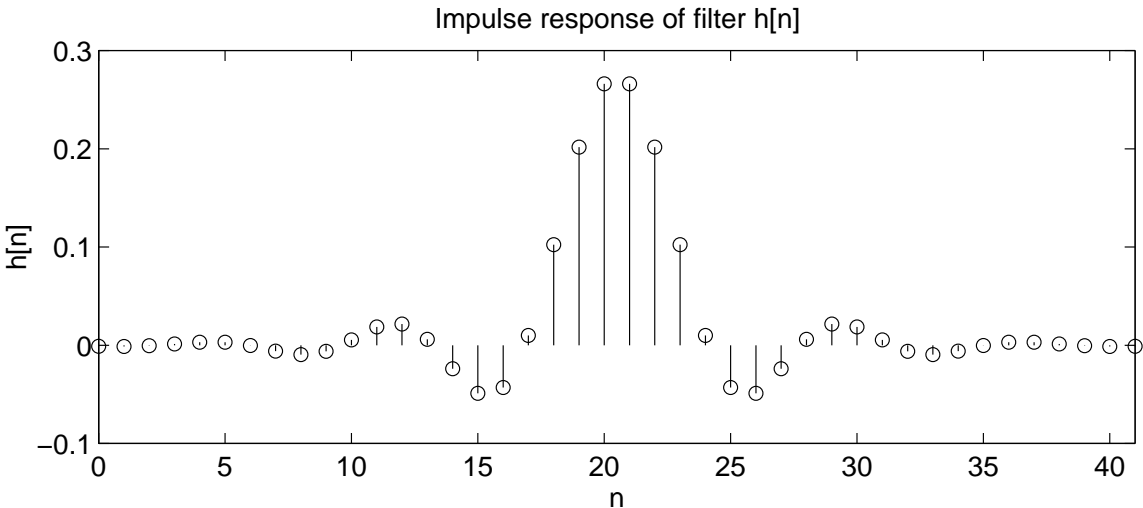


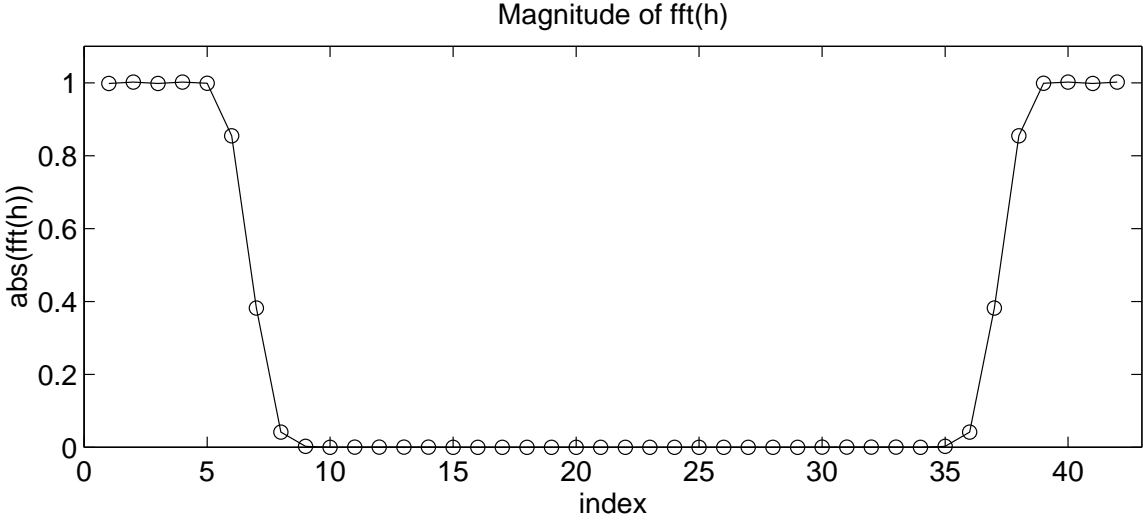
# ECE 410 warm-up problem: 10/24/2001

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Filter impulse response,  $h[n]$ :



FFT of filter impulse response:



## Warm-up questions

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- What frequency vector should be used for plotting the FFT results? i.e., what frequencies (in radians) are associated with each of the indices in the plot of `abs(fft(h))`?
- What kind of filter is this?
- If this filter were used to process a signal sampled at a rate of  $f_s = 1000$  Hz, what frequencies would be passed by the system?

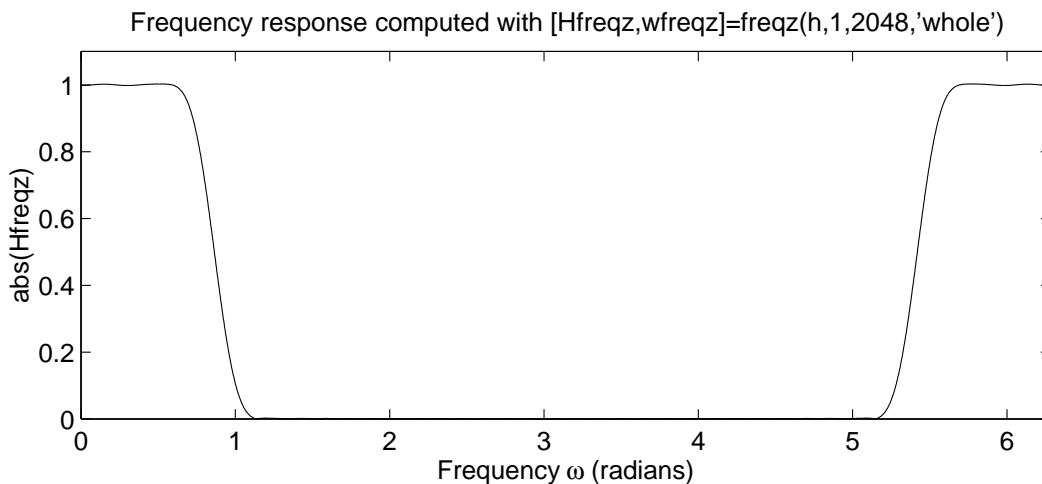
## Plotting frequency responses: `freqz`

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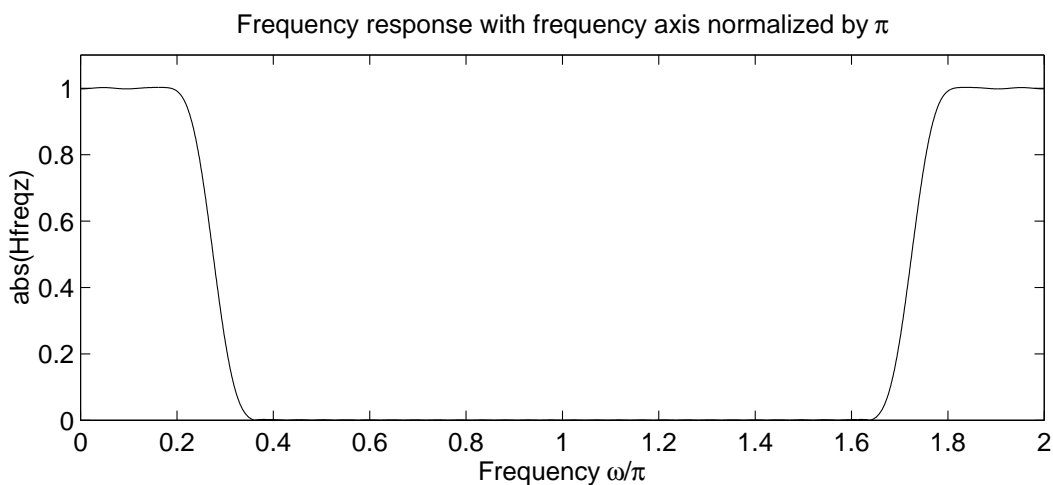
Matlab command `freqz` can be used to plot frequency responses:

Example: `[Hfreqz,w]=freqz(b,a,N,'whole')`

- `b` and `a` refer to filter coefficients; for FIR filters, `a=1`
- `'whole'` tells it to compute over interval  $0$  to  $2\pi$



Can normalize frequency axis:

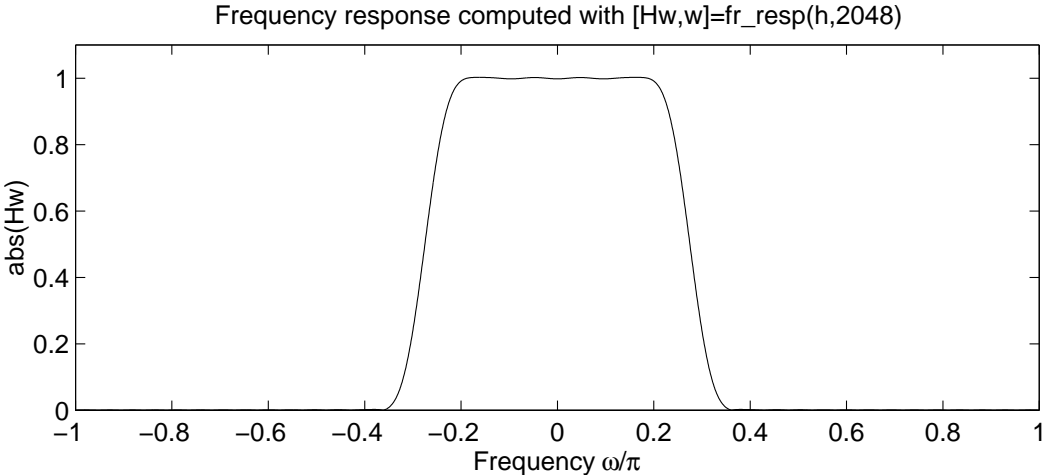


# Plotting frequency responses: `fr_resp`

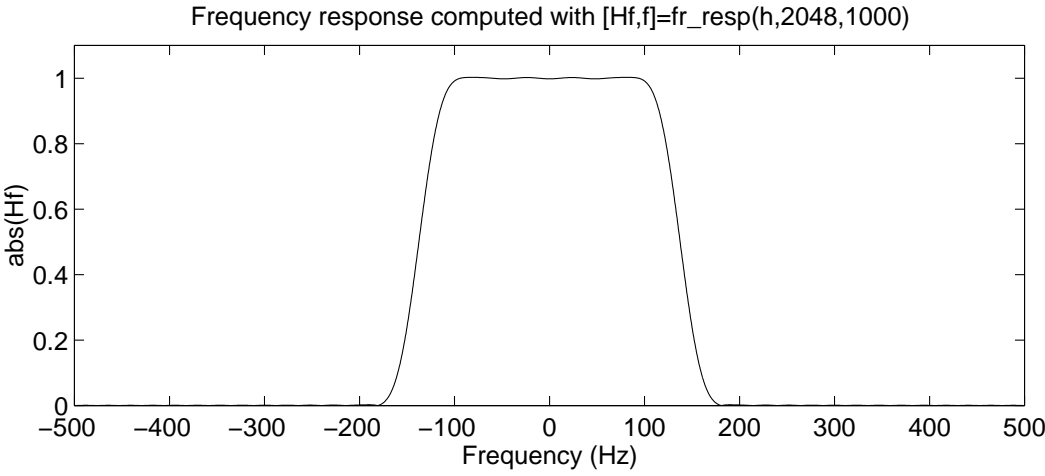
---

KEW's function to plot frequency responses: `fr_resp`

- uses `fftshift` to get response between  $-\pi$  to  $\pi$



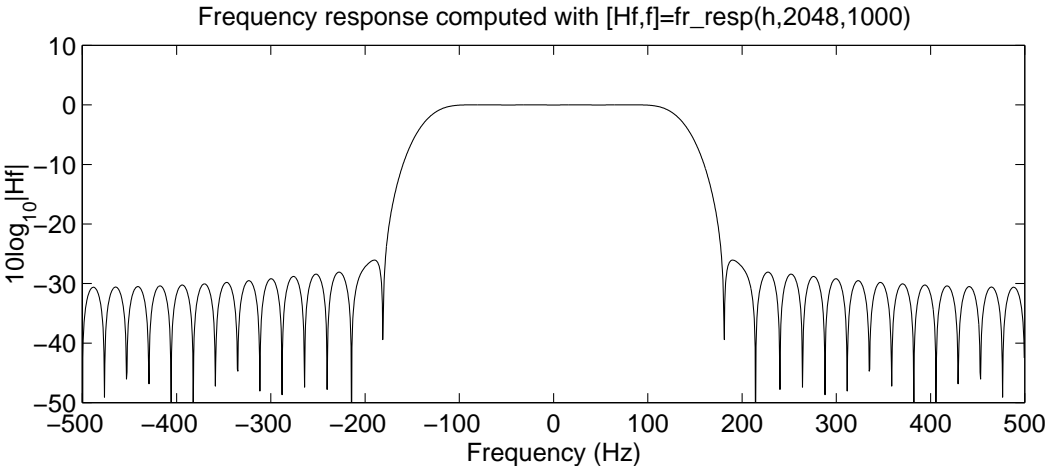
Can use an optional sampling frequency argument to plot vs. Hz



# Plotting frequency responses in dB

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Plot of magnitude response in dB:  $10 * \log_{10}(\text{abs}(Hf))$

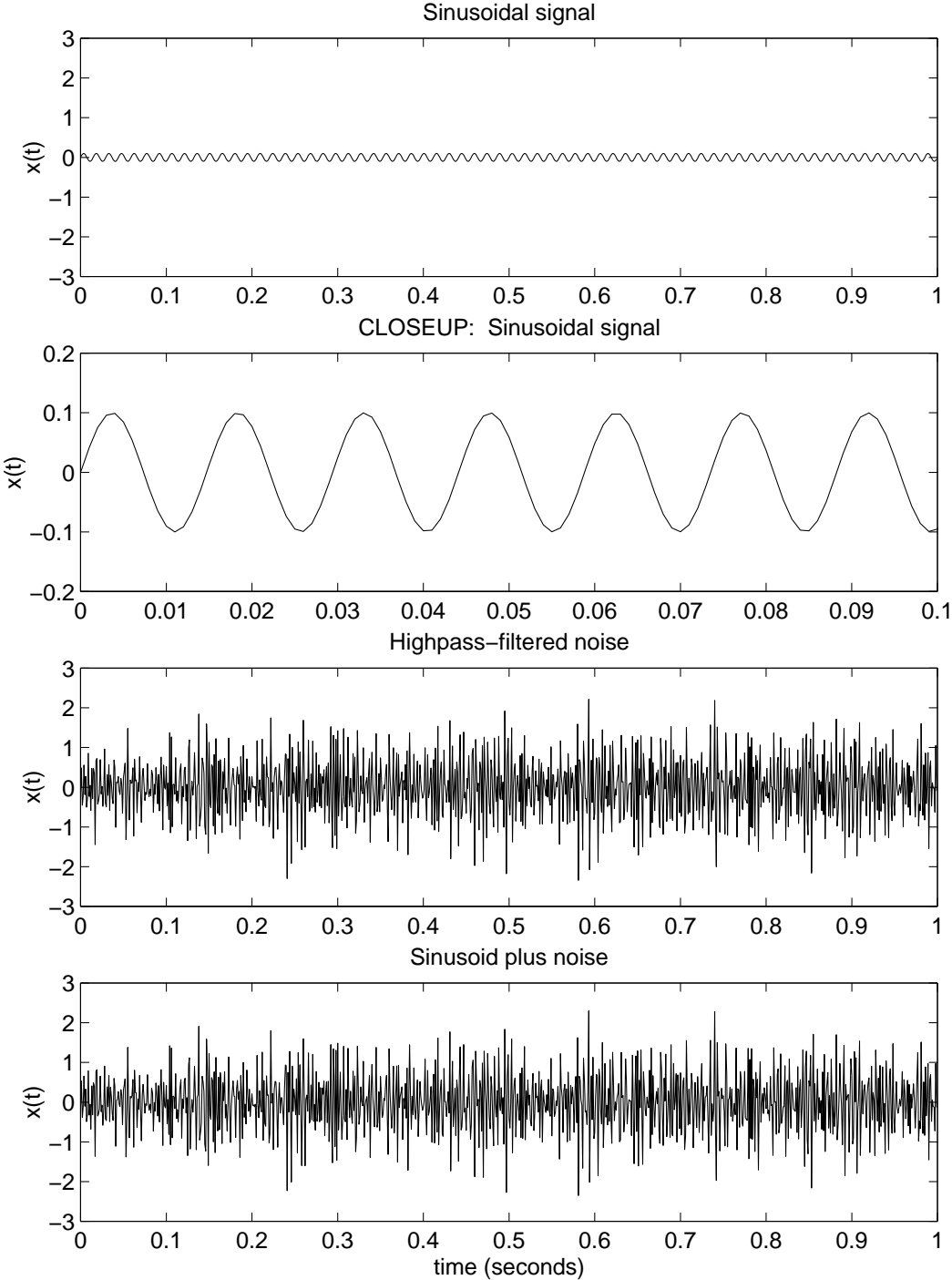


# Filtering example: creating the input signal

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Input signal consists of a sinusoid buried in highpass noise:

- $f_0 = 68 \text{ Hz}$ ;  $f_s = 1000 \text{ Hz}$



# Filtering example: output of lowpass filter

---

Filter using the `filter` command:

Example: `y=filter(h,1,x)`

