Tune-Up Tuesday #10 for November 21, 2017

Use a second-order LTI system with difference equation $y[n] = 2(\cos \hat{\omega}_0)y[n-1] - y[n-2] + (\sin \hat{\omega}_0)x[n-1]$ to generate a sinusoidal signal. (*Midterm 2.4 question*)

(a) For $\hat{\omega}_0 = 2\pi\frac{3}{20}$, determine the discrete-time period. See lecture slides 9-11 and 9-12.

(b) Generate an impulse signal that lasts 10000 periods.

(c) Use `filter` to compute the impulse response.

(d) Use `stem` to plot the impulse response for the first three periods. Describe it.

(e) Use `freqz` on the impulse response in (c). At what frequency does the peak magnitude response occur?

(f) Use `zplane` to plot poles and zero(s) from the transfer function. Describe the pole and zero(s).

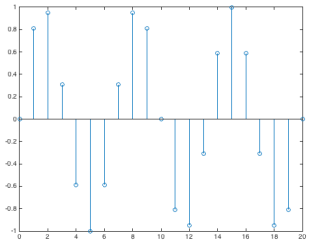
Transfer function

- In negative powers of z

$$H(z) = \frac{(\sin \hat{\omega}_0)z^{-1}}{1 - 2(\cos \hat{\omega}_0)z^{-1} + z^{-2}}$$

- In positive powers of z

$$H(z) = \frac{(\sin \hat{\omega}_0)z}{z^2 - 2(\cos \hat{\omega}_0)z + 1}$$



One period

Hint: zero crossings