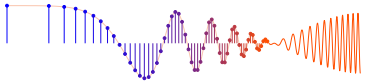
LaTeX ZIP PDF EPS PNG

4.1

Don't forget to get hw04b.pdf too!



PROBLEM:

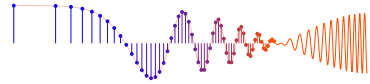
Factor the following polynomial and plot its roots in the complex plane.

$$P(z) = 1 + 2z^{-1} + 2z^{-2} + z^{-3}$$

In MATLAB see the functions called `roots` and `zplane`.

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION



PROBLEM:

The intention of the following MATLAB program is to filter a sinusoid via the `filter` function.

```
omeg = pi/6;
nn = [ 0:29 ];
xn = cos(omeg*nn - pi/4);
bb = [ 1  0  0  1 ];
aa = [ 1 ];
yn = filter( bb, aa, xn );      %<--- alternate form:   yn = conv( bb, xn )
```

(a) Determine $H(z)$ and also the zeros of the filter.

(b) Determine a formula for $y[n]$, the signal contained in the vector `yn`. Ignore the first few points, so your formula must be correct for $n \geq 3$. This formula should give numerical values for the amplitude, phase and frequency of $y[n]$.

(c) Give a value of `omeg` such that the output is guaranteed to be zero, for $n \geq 3$.

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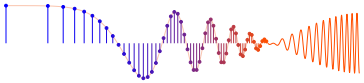
SOLUTION



PROBLEM:

A linear time-invariant system is described by the difference equation

$$y[n] = x[n] + x[n-4]$$

(a) Find its impulse response $h[n]$.

(b) Find its system function $H(z)$.

(c) Plot the poles and zeros of $H(z)$ in the z-plane.
(Recall that $-1 = e^{j\pi k}$ where k is an *odd* integer.)

(d) Find the frequency response $H(e^{j\hat{\omega}})$ and express it in polar form (magnitude and phase).

(e) Carefully sketch and label a plot of $|H(e^{j\hat{\omega}})|$ for $-\pi < \hat{\omega} < \pi$.

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SOLUTION