

Continuous-time signals

1. Design a simple real causal LTI discrete-time system that

- (a) annihilates the signal $\cos(\frac{\pi}{3}n)$
- (b) annihilates the signal $(-1)^n$
- (c) preserves the value of constant (dc) signals.

For the system you design:

- (a) Find and sketch the impulse response $h(n)$
- (b) Find the difference equation
- (c) Show the pole-zero diagram
- (d) Roughly sketch the frequency response magnitude $|H^f(\omega)|$.

2. Accurately sketch each of the three signals:

$$f(t) = u(t-1) - u(t-5)$$

$$g(t) = \sum_{k=0}^{\infty} (-1)^k \delta(t-2k)$$

and

$$x(t) = f(t)g(t)$$

3. For each of the following signals $x(t)$, sketch $x(t)$ and $y(t)$, where

$$y(t) = \int_{-\infty}^t x(\tau) d\tau.$$

- (a) $x(t) = u(t) - 2u(t-2) + u(t-3)$
- (b) $x(t) = e^{-t}(u(t) - u(t-1))$
- (c) $x(t) = 2\delta(t) - \delta(t-1) + u(t-2)$

4. Accurately sketch the derivative of $x(t)$ in parts (a) and (b) of the previous problem.