

EEE 5109 Digital Signal Processing.

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Today's Lecture

1. Convolution

LTI Systems

- ▶ The response of an LTI system to an input $x[n]$ is given by

$$y[n] = \sum_{k=-\infty}^{k=\infty} x[k]h[n-k]$$

Review

- ▶ A discrete time LTI system has an impulse response given by

$$h[n] = \begin{cases} 2 & n = -1 \\ 3 & n = 0 \\ 2 & n = 1 \\ -3 & n = 2 \\ 1 & n = 3 \\ 0 & \text{otherwise} \end{cases}$$

1. Sketch $h[n]$ in the interval $-5 \leq n \leq 5$.
2. Compute the output of the system $y[n]$ when the input to the system is $x[n] = 2\delta[n] - 5\delta[n - 3]$.

Convolution Example

- ▶ Consider an LTI system with impulse response $h[n] = u[n] - u[n - N]$ where $N = 5$. Find the output of the system in response to the input $x[n] = u[n] - u[n - N]$.

Examples

- ▶ Consider a linear time invariant system whose impulse response is given by $h[n] = a^n u[n]$ where $0 < a < 1$ and $u[n]$ is the unit step. Determine the response of the system to the unit step