

List of Topics (not necessary complete) for Midterm 1

- Complex numbers and complex variables
- Discrete-time (DT) signals and their representation
- Sinusoidal DT signals, periodicity, frequency
- System Properties: Linearity (LI), Time-Invariance (TI), Causality, BIBO Stability.
 - Determine system properties using their definitions for arbitrary systems
- LTI systems: relation between LTI property and convolution
- Impulse response
 - Determine the impulse response $h[n]$ of an LTI system described by LCCDE, by iteration
 - $H[z]$ - relation to stability and causality of LTI systems
- Convolution – computation
- The Bilateral z-Transform
 - Poles and zeros – finite and infinite
 - Properties: ROC determined by poles and by left or right sidedness of sequence, linearity, shift, convolution, modulation, derivative wrt z
 - Computation of forward transform
 - Computation of inverse transform
 - Partial fraction expansion (Single poles, repeated poles)
- Applications of the z-transform
 - Transfer function $H(z)$ of LTI systems
 - Relation between ROC of $H(z)$ and LTI system stability and causality
 - Eigenfunction property of LTI systems
 - Computation of convolution
 - Solving LCCDE
 - Converting between LTI system representations
 - LCCDE $\rightarrow H(z)$
 - LCCDE $\rightarrow h[n]$
 - $h[n] \rightarrow$ LCCDE
 - $H(z) \rightarrow$ LCCDE
 - Deconvolution: (i) determine input of LTI system given system and output; (ii) determine LTI system given input and output.
 - Connections (e.g., cascade, parallel) of LTI systems: determine complete system description and properties
 - Determine stability of LTI systems (described by $H(z)$, $h[n]$, or LCCDE)