

EECS 225A Spring 2005

Common themes

Complex variables

Real functions of a complex variable contains z^* , not analytic

Stationary points $\frac{\partial}{\partial z^*} = 0$

Gradient $\frac{\partial}{\partial z^*} = 0$

Linear time-invariant systems

Complex exponentials

Impulse response, transfer function

Rational transfer functions of a complex variable z

Poles and zeros

Minimum-phase

Real-valued unit-sample response

Real-valued on unit circle

Spectral factorization: non-negative on unit circle

Allpass: unit magnitude on unit circle

Structures

Direct form

Lattice

Matrices

Hermitian

Real-valued eigenvalues

Orthonormal eigenvectors

Spectral theorem

Toeplitz

Circulant

Eigenvalues = FFT

Eigenvectors = complex exponential

Linear equations

Result from quadratic criteria

No solutions, many solutions, unique solution

Time and ensemble averages

Wiener filters

- Non-causal vs causal

- FIR (matrix) vs IIR (transfer function)

- Predictor

- Joint process estimator

Estimation

- Linear vs. non-linear

Orthogonality principle applies to both

- Quadratic criteria, linear estimates

Model vs. non-parametric

Signals (sample functions) vs statistics

MA, AR, ARMA

- Polynomial coefficients

- Polynomial roots

- Reflection coefficients

Harmonic: sum of sinusoids

Non-stationary signals

Steepest descent, LMS

Recursive LS

Block processing

Time-frequency representations

- Time resolution vs frequency resolution

- Bandpass filters vs transforms