

EE513

Audio Signals and Systems

Digital Signal Processing (Analysis)

Kevin D. Donohue

Electrical and Computer Engineering

University of Kentucky

Spectra

The spectrum of the impulse response indicates the following filter/system properties:

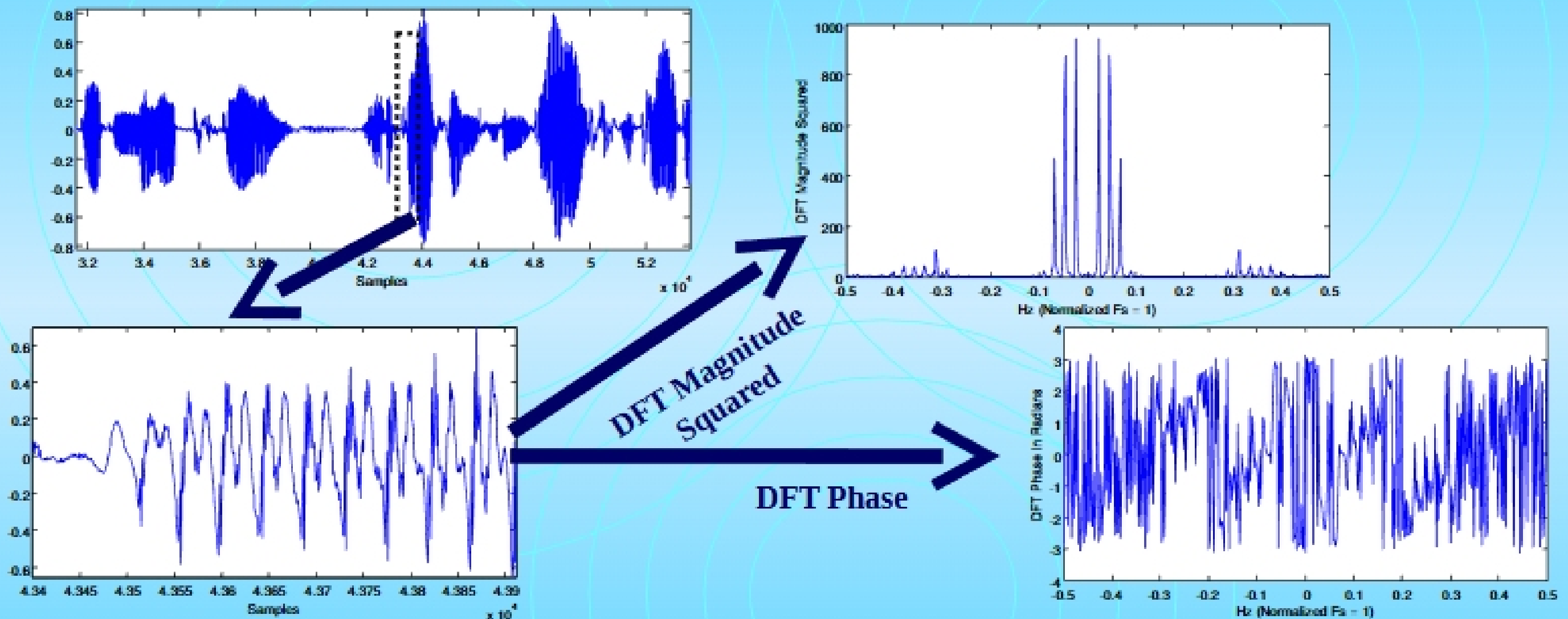
- resonance and frequency sensitivities through the magnitude spectrum
- delay and dispersive properties through the phase spectrum.

The discrete Fourier transform (DFT) computes complex samples of the spectrum.

- For deterministic signals both the phase and magnitude are important for characterizing the signal or response.
- For stationary noise processes the square of the DFT magnitudes can be averaged from independent segments to create a power spectral density.

Discrete Fourier Transform

In order to take a DFT of a signal, a finite window (time interval) must be extracted from the original sampled time signal:



The process can be repeated with overlapping windows covering entire signal.

- If the signal is deterministic and changes over time, the DFTs for small consecutive intervals must be displayed to show the changes in spectrum over time (Spectrogram).
- If the signal is random with statistics that do not change over time, the DFT magnitudes can be averaged (Power Spectral Density (PSD)).