EEE 321
Signals and Systems

Ankara University

Faculty of Engineering

Electrical and Electronics Engineering Department

The Discrete-Time Fourier Transform

EEE321 Signals and Systems

Lecture 12

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Agenda

- Discrete-Time Fourier Transform for Aperiodic Signals

- Convergence of Fourier Transform

- Discrete-Time Fourier Transform for Periodic Signals

DT Fourier Transform for Aperiodic Signals

- $x[n]$ is an aperiodic signal
- $x[n] = \frac{1}{2\pi} \int_0^{2\pi} X(e^{j\omega}) e^{j\omega n} d\omega$
- $X(e^{j\omega}) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\omega n}$
- $X(e^{j\omega})$ is a periodic signal with period 2π

Convergence of DT Fourier Transform

- Aperiodic signal must be absolutely summable.

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DT Fourier Transform for Periodic Signals

- Fourier series coefficients, a_k

- $x[n] = \sum_{k=0}^{N-1} a_k e^{jk\omega_0 n}$: periodic signal

- $X(e^{j\omega}) = \sum_{k=-\infty}^{\infty} 2\pi a_k \delta(\omega - k\omega_0)$
  - Train of impulses

References

- Signals and Systems, 2nd Edition, Oppenheim, Willsky, Nawab