ECE 457: Fourier Optics

IN

Linear Systems Analysis

- Understand Fourier transform
- Understand the impact of elementary transformations on the spectrum of a signal
- Understand linearity and time invariance
- Understand convolution and compute the response of an LTI system to an arbitray input
- Understand complex exponentials as eigenfunctions of LTI systems
- Understand the interplay between time domain and frequency domain analysis of LTI systems

Principles of Wave Optics

- Understand plane wave propagation
- Understand interference
- Understand basic concepts of wave diffraction

Numerical Simulation

- Use basic coding for technical computations

Pre-requisites

- ECE 311 with a minimum grade of C; ECE342 with a minimum grade of C

Concepts:

- Fourier transforms in optical systems
- Multidimensional Fourier transforms
- Angular (wavenumber) Spectrum analysis of optical systems and propagation
- Scalar diffraction theory
- Optical Coherence
- Light Scattering
- Speckle

Applications:

- MATLAB simulation of propagation in optical systems
- Application of Fourier and linear systems to optical systems
- Gain intuitive understanding of optics and propagation
- Coherent and incoherent imaging systems

Tools:

- Advanced numerical simulation Coding

OUT

Optical Systems Computation

- Compute diffraction of optical fields numerically and analyze with Rayleigh-Sommerfeld, Fresnel and Fraunhofer propagation
- Calculate imaging transfer functions for coherent and incoherent imaging system

Optical Systems Analysis

- Analyze and design optical Fourier processing and imaging systems

Optical Systems Design

- Design and numerically simulate a full complex optical system

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