Optical Information Science

Syllabus Number 4D305
Special Subjects
Elective 2 credit

KONDO, Naoki

1. Course Description

Students will learn the followings in this course,
(1) Fourier optics which is suited to treat light as waves with phase
(2) Basics of optical information processing founded upon Fourier optics
(3) Fundamental mechanics of holography.

2. Course Objectives

In this course we shall learn the basics of optical information processing and aim to reach the understanding of the mechanics of holography, which is one of the most powerful 3D imaging modality.

3. Grading Policy

You will be graded by the submitted reports (total 50%) and final examination marks (50%). Reports are returned with comments within 2 weeks after submission.

4. Textbook and Reference

Textbook
The textbook is "Light and Fourier Transform" by YATAGAI Toyohiko (Japanese).
Supplementary English materials are provided if necessary.

5. Requirements(Assignments)

Read the corresponding part of the text carefully (˜1 hour).
It is recommended to verify the mathematical expressions and programs in the text and supplied materials in the review process (˜2hours).

6. Note

None.

7. Schedule

[1] Light and wave 1 (Wave equation, plane waves, complex representation of waves)
[2] Light and wave 2 (Spherical waves, theory of superposition)
[3] Interference and diffraction 1 (Interference, coherence, Young's experiment, interferometer)
[4] Interference and diffraction 2 (Diffraction, Fresnel diffraction, Fraunhofer diffraction)
[5] Fourier transform and convolution 1 (Fourier series, optimal polynomial approximation, orthonormal functions)
[6] Fourier transform and convolution 2 (Fourier transform, properties of Fourier transform, delta function)
[7] Fourier transform and convolution 3 (Convolution and correlation function, special functions and their Fourier transforms, sampling theorem)
[8] Linear systems 1 (Systems and operators, linear systems, shift-invariant systems)
[9] Linear systems 2 (impulse responses, frequency response functions, eigenfunctions and eigenvalues)
[10] Fourier optics 1 (Fresnel diffraction, Fourier transform function of lenses)
[11] Fourier optics 2 (Coherent image formation, image formation by incoherent light source)
[12] Fourier optics 3 (Frequency response functions of optical systems, resolution)
[13] Optical computing 1 (Spatial frequency filtering, holography)
[14] Optical computing 2 (Computer holograms, digital holography)
[15] Summary and final examination