IPT 514300 Digital Optics Laboratory

Objectives: This Course will introduce classical optics in a graduate level. The theories of geometry optics, diffraction, liquid-crystal optics and Fourier Optics will be systematically present. With these basic understandings, students then will get hand-on experience on operating the spatial light modulators (SLM) and developing diverse digital optical systems.

Instructor: Chang-Hua Liu

Prerequisites: Optics, Electromagnetic theory or Graduate standing

Office hours: by appointment (send me an email: chliu@ee.nthu.edu.tw)

Textbook: None required. I will post the lecture notes.

Supplementary References:

E. Hecht, Optics (Addison Wesley)

A. Yariv, P. Yeh, Optical waves in Crystals (Wiley)

Grades:

Homework: 15%

Mid-term exam: 25%

Labs: 40%

Final exam: 20%

Course Outline:

Lectures will cover the following topics:

- Lenses and image formation
- ABCD matrices of optical elements and imaging systems
- Aberrations
- Optical waves in anisotropic dielectric medium (vector nature of waves, representations of a polarization state, Birefringence, Jones calculus and its applications)
- Fraunhofer diffraction (Rectangular & circular apertures, Arrays of apertures & diffraction gratings, Fresnel lens, Fourier transformation by a lens)

Laboratories (using SLM to realize the following experiments):

- Amplitude and phase modulation
- Wavefront modulation and control
- Diffraction and interference
- Fourier optics (dispersion and optical signal processing)
- Fourier optics (talbot image and phase shift digital holography)
- Field programmable lens