OPTI 512L
Mathematical Optics Laboratory

Instructor: Prof. Amit Ashok
Class Time: Tuesday 3:30pm - 4:45pm
Class Location: Meinel RM 307
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Teaching Assistant (TA):
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1 Course Description

The Optics 512L laboratory will facilitate your fundamental, mathematical understanding of optics and teach you how to apply your knowledge using computer models and simulations. This course will require a lot of one-on-one quality time with a computer running Matlab. Each week we will cover a new topic class. You will then be required to review the notes and complete the assignment by the following week. The lab report for this course need to be clear and understandable but they need not full reports with references. Each student must complete their own work. However group discussions of problems is encouraged.

2 Learning Outcomes

(a) Develop expertise in utilizing the discrete Fourier transform to simulate optical systems or solve mathematical problems.

(b) Develop an understanding of how to propagate scalar fields various distances. This understanding will include the difficulties and common pitfalls associated with implementing propagation methods.

(c) Develop an understanding of modeling linear systems using both Fourier analysis and singular value decomposition (SVD) as well as how to use these tools to improve image quality.

(d) Develop the skills necessary to model complex optical imaging systems including the noise.

(e) Develop an initial understanding of image reconstruction and restoration.

3 Reference Textbooks

All notes for this course will be available on the D2L website. There is no required textbook; however,"Foundation of Image Science," H. H. Barrett and K. J. Myers, 2004 is a useful reference for much of the material we cover.

4 Class Website

The course's online component will be conducted via the University of Arizona's D2L software system. The D2L can by accessed by this link: `www.d2l.arizona.edu`.

5 Assessment Categories and Percentage of final grade

Lab #1: Introduction to Matlab - 8.3%
Lab #2: The Discrete Fourier Transform I - 8.3%
Lab #3: The Discrete Fourier Transform II - 8.3%
Lab #4: Wave Propagation - 8.3%
Lab #5: Wave Propagation through an Ideal Lens - 8.3%
Lab #6: Image Processing and Deconvolution - 8.3%
Lab #7: Singular Value Decomposition (2 weeks) - 8.3%
Lab #8: Image Reconstruction - 8.3%
Lab #9: The Radon Transformation - 8.3%
Lab #10: The Wavelet Transform - 8.3%
Lab #11: Introduction to Statistics and Noise - 8.3%
Lab #12: Methods of Numerical Integration - 8.3%
Total: 100%

6 Grading Scale and Policies

The class grades will depend on the class score statistics. However, nominally the following scores ranges will be used to assign the class grade:

- 100% - 87%: perfect understanding. Nearly no mistakes.
- 86% - 75%: some minor mistakes, but good demonstrated understanding of material.
- 74% - 60%: significant conceptual problems.
- Below 60%: no demonstrated understanding of the material.

Students will be responsible for uploading a single laboratory report each week. Code should also be uploaded as a separate file. For the lab writeup, PDF is the preferred format but Word files will also be accepted. This report should contain the necessary code, graphs, and text to show that you understood the problems and the solutions. Please do not just upload your Matlab scripts; a writeup is required. You should label all axes when possible and comment your code so that the TA can accurately grade the assignments. Do not forget to discuss your results for each problem so that we know you understood the problems.

Each lab writeup will count equally towards your grade. There will be no final for this course. Lab due dates will be posted on each lab. Late labs will be penalized 10 points (1 grade)for each week late. Labs must be submitted to the D2L website.

7 Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor of this course.

8 Academic Integrity

Integrity and ethical behavior are expected of every student in all academic work. This Academic Integrity principle stands for honesty in all class work, and ethical conduct in all labs and clinical assignments. This principle is furthered by the student Code of conduct and disciplinary procedures established by **ABOR Policies 5-308 through 5-404**, all provisions of which apply to all University of Arizona students. The Code of Academic Integrity is intended to fulfill the requirement imposed by **ABOR Policy 5-403.A.4** and otherwise to supplement the Student Code of Conduct as permitted by **ABOR Policy 5-308.C.1**.

For more details please see:
`http://deanofstudents.arizona.edu/codeofacademicintegrity`

9 AI Policy

In this course, limited use of AI tools is permitted. The guiding principle of AI policy in this course is that AI is a tool to help further your understanding of writing and debugging your code, instead of using it to "write" the code.
More specifically you may use AI in following scenarios:

(a) Assist in understanding a particular implementation or various methods that may be available

(b) Assist in finding issues or bugs in your code/implementation

(c) After you complete your code and it is functional, you may use AI to comment on your code to improve it

You may NOT use AI: To write/generate any significant part of your code and/or lab report.

If you are in doubt as to whether you are misusing AI tools or want to discuss AI usage in this course, please contact me or the TA.

AI support must be acknowledged per assignment expectations so as not to violate the Code of Academic Integrity.

How to write an acknowledgement statement:
I acknowledge the use of [insert name of AI system(s)] to [describe specific use of generative artificial intelligence]. Prompts used included [share link or copy-and-paste prompt].