OPTI 521L: Introduction to optomechanical engineering laboratory

Updated 08/03/2023

Fall 2023

Lectures: Mondays 12pm – 12:50pm MST, Room 432.
Labs: Fridays 11am – 1:50pm MST, Room 436

Course Description

This course covers the basic principles of optomechanical engineering with laboratory exercises. This course introduces students to optomechanical measurement and testing tools and techniques that illustrate principles related to optics mounting, alignment, and thermo-mechanical disturbances.

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Office hours: By appointment

Learning outcomes

After taking this course, students should be able to:

- Accurately measure mechanical and optical components and their mounting attributes
- Test effects on optical quality of mounted optics
- Test optomechanical assemblies for thermo-mechanical stability

Acknowledgement

Course materials were adapted from those generously provided by Dr. James H. Burge and Dr. Jonathan D. Ellis.

Assessment

Grading will be based on 10 Lab Reports, which will be weighted as below.

Element	Due date	Fraction of grade
Report 1	9/6	10%
Report 2	9/20	10%
Report 3	9/27	10%
Report 4	10/4	10%
Report 5	10/11	10%
Report 6	10/25	10%
Report 7	11/1	10%
Report 8	11/8	10%
Report 9	11/20	10%
Report 10	12/6	10%

Your lab notebook will not be graded, but you are expected to record all relevant notes and data to complete the report.

Lab report contents

A lab report may contain multiple parts as outlined in the Lab Instructions. Each part should have a similar structure, as suggested below:

Purpose

What information did the experiment aim to provide?

Methods

What details would somebody need to replicate the experiment? The Lab Instructions may be referenced to avoid repeating text, but any deviations should be described in enough detail for somebody to follow.

Results, analysis, and discussion

What were the outcomes, and how are they related to the information the experiment aimed to provide? Ensure all questions raised in the Lab Instructions are answered in this section. This section may have multiple sub-sections.

Conclusion

Did the experiment provide the desired information? What additional experiments or measurements would improve the results?

Grading scale and policies

Grading will be on a regular scale: A (>=90%), B (>=80%), C (>=70%), D (>=60%), E (<60%)

Late assignments (without prior approval) will lose 25% per day, to a minimum value of 0.

All deadlines are 11:59pm MST. All assignments must be uploaded to D2L.

University policies

All university policies related to a syllabus are available at: https://academicaffairs.arizona.edu/syllabus-policies.

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.

Graduate student resources

University of Arizona's Basic Needs Resources page: http://basicneeds.arizona.edu/index.html

Accessibility and accommodations

At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu) to establish reasonable accommodations.

Tentative schedule

Description	Date
No lecture or lab	*8/21-8/25*
Lab 1: Basic measurement tools	
Lecture 1: Use of common measurement tools	8/28
Lab 1: Measurement of mechanical components	8/31, 9/1
Lab 1 report due	**9/6**
No class or lab	*9/4-9/8*
Lab 2: Autocollimator	
Lecture 2: Autocollimator design and function	9/11
Lab 2: Assembly and testing of an autocollimator	9/14, 9/15
Lab 2 report due	**9/20**
Lab 3: Mechanical errors	
Lecture 3: Common mechanical errors	9/18
Lab 3: Measurement of mechanical errors	9/21, 9/22
Lab 3 report due	**9/27**
Lab 4: Flexure stage	
Lecture 4: Flexure stiffness and error motions	9/25
Lab 4: Measurement of flexure stage stiffness and error motions	9/28,9/29
Lab 4 report due	**10/4**
Lab 5: Positioning repeatability	
Lecture 5: Mirror mounts and kinematic couplings	10/2
Lab 5: Measurement of mirror position repeatability	10/5, 10/6
Lab 5 report due	**10/11**
Lab 6: Lens centering	
Lecture 6a: Lens centering theory	10/9
Lab 6a: Lens centering procedure	10/12, 10/13
Lecture 6b: Lens mounting options	10/16
Lab 6b: Repeatability of lens mounting	10/19, 10/20
Lab 6 report due	**10/25**
Lab 7: Quality of mounted optics	
Lecture 7: Introduction to interferometry and optical component testing	10/23
Lab 7: Optical component testing	10/26, 10/27
Lab 7 report due	**11/1**
Lab 8: Retaining ring loss of contact	
Lecture 8: Retaining rings	10/30
Lab 8: Thermal loss of contact	11/2, 11/3
Lab 8 report due	**11/8**
Lab 9: Adhesive bonding	
Lecture 9: Adhesive bonding procedure	11/6
Lab 9: Bond preparation, lens alignment	11/9, 11/10 11/16, 11/17
Lab 9 report due	**11/20**
No lecture	*11/13, 11/20*
Lab 10: Adhesive failure	
Lecture 10: Adhesive failure modes	11/27
Lab 10: Mechanical, thermal loading of adhesive joints	11/30,12/1
Lab 10 report due	**12/6**