Reed Hollinger

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▶ Syllabu

ECE 503 -- Ultrafast Optics

Course Description

Ultrafast optical science has had a dramatic impact on a vast array of technological disciplines. An ultrafast laser is one that generates laser pulses shorter than 100 fs in duration. The theory and understanding of propagation of broad bandwidth optical signals is essential for the design of high throughput optical communications systems. However, the applicability of ultrashort pulse technology spans areas ranging from studying basic processes in semiconductors and devices, watching and controlling the formation and breaking of chemical bonds, nonlinear frequency conversion for new light sources that span three decades of the electromagnetic spectrum, medical imaging, among others. This course will introduce the principles of ultrafast optics, including the basic theory behind ultrashort pulse generation, amplification, propagation, shaping, and measurement. Some application areas from the recent literature will also be covered, partly in lecture. Our goal will be to start with an introductory knowledge of optics and bring you to a point where you can understand the current research literature on each subject.

Textbook

Ultrafast Optics

by Andrew Weiner, John Wiley & Sons, Inc.

First published:28 October 2008

Print ISBN:9780471415398 |Online ISBN:9780470473467 |DOI:10.1002/9780470473467

.**https://onlinelibrary.wiley.com/doi/book/10.1002/9780470473467** ⤷ **(https://onlinelibrary.wiley.com/doi/book/10.1002/9780470473467)**

Homework Policy
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The homework is an essential part of the course. You should attempt all problems yourself, but feel free to argue with your colleagues about them. (Simply copying each other's solutions is, however, counterproductive for all parties and is not acceptable.

By the way, a few of the problems will be numerical, not involving heavy computation, but more in the way of modeling pulse propagation through various dispersive elements, so you will need to use your favorite math package (e.g., Mathcad, Maple, Matlab, Mathematica, IDL, etc.)

A homework solution MUST include a full explanation of how the problem is set up, the motivation of steps in the analysis, and an interpretation of the results. The entire point of homework is to explore and think about the material presented in the class AND to be able to communicate your findings. The ability to communicate scientific ideas is of critical importance. Moreover, homework emphasizes analyzing each physical situation, interpreting that analysis, and communicating the meaning. As a result, the emphasis is NOT on algebraic manipulations. All solutions MUST be in a highly simplified form that YOU interpret correctly. Remember: each homework solution should be a short story that includes a reproduction of appropriate diagrams and may require plots of the final solutions you find to explain behaviors.

References

- Ultrashort Laser Pulse Phenomenon: Fundamentals, Techniques, and Applications on a Femtosecond Time Scale, 2nd edition, J. -C. Diels and W. Rudolph, Academic, 2006.

- Femtosecond Optical Frequency Comb: Principle, Operation, and Applications, Jun Ye and Steven T. Cundiff (Ed.), Kluwer Academic Publishers / Springer, 2004.

- Optics of Femtosecond Laser Pulses, S.A. Akhmanov, V.A. Vysloukh, and A.S. Chirkin, American Institute of Physics, 1992.

- Lasers, A.E. Siegman, University Science Books, Mill Valley, 1986.

- Nonlinear Fiber Optics, G.P. Agrawal, Academic, 1995.

- Frequency Resolved Optical Gating: The measurement of ultrashort laser pulses, R. Trebino, Kluwer Academic Publishers, 2002.

- Few-Cycle Laser Pulse Generation and Its Applications, F.X. Kartner (ed.), Springer, 2004.

- Ultrafast Lasers Technology and Applications, M.E. Fermann, A. Galvanauskas, and G. Sucha (eds.), Marcel Dekker, 2003.

- Compact Sources of Ultrashort Laser Pulses, I.N. Duling (ed.), Cambridge, 1995.

- Femtosecond Laser Pulses , C. Rulliere (ed.), Springer, 2002.

- Ultrashort Laser Pulses and Applications, W. Kaiser (ed.), Springer, 1993.

Course Summary:

Date	Details	Due
Fri May 15, 2020	🚀 **Midterm Exam** **(https://colostate.instructure.com/courses/179943/assignments/2386710)**	due by 10pm
	📝 **Final Project** **(https://colostate.instructure.com/courses/179943/assignments/2386711)**	
	📝 **Homework 1** **(https://colostate.instructure.com/courses/179943/assignments/2386712)**	
	📝 **Homework 2** **(https://colostate.instructure.com/courses/179943/assignments/2386713)**	
	📝 **Homework 3** **(https://colostate.instructure.com/courses/179943/assignments/2386714)**	
	📝 **Homework 4** **(https://colostate.instructure.com/courses/179943/assignments/2386715)**	
	📝 **Homework 5** **(https://colostate.instructure.com/courses/179943/assignments/2386716)**	
	📝 **Homework 6** **(https://colostate.instructure.com/courses/179943/assignments/2386717)**	
	📝 **Homework 7** **(https://colostate.instructure.com/courses/179943/assignments/2386718)**	
	📝 **Homework 8** **(https://colostate.instructure.com/courses/179943/assignments/2386719)**	