

ECE/ME 853 - Spring 2019

OPTIMAL CONTROL

Instructor: Zhaojian Li;

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Schedule: MWF 10:20 – 11:10, Room 118 Farrall Ag Eng Hall

Office Hours: Monday, 2:00 – 3:00 pm at 3260 EB (or by appointment)

Prerequisite: ECE/ME 851 or equivalent course on linear control systems

Recommended Textbooks:

- Athans and P.L. Falb, “Optimal Control: An Introduction to the Theory and Its Applications,” Dover Publications, 2007. ISBN 0-486-45328-6.
(It’s a paper back and can be purchased from amazon.com)
- H.P. Geering, “Optimal Control with Engineering Applications,” Springer, 2007.
(It’s available in the MSU Library Electronic Resources)
- L.C. Evans, “An Introduction to Mathematical Optimal Control Theory,” Version 0.2, 2008.
(These notes can be downloaded from <http://math.berkeley.edu/~evans/control.course.pdf>)

Recommended References (on reserve in the Engineering Library):

- Desineni Subbaram Naidu, “Optimal Control Systems,” CRC Press, 2003 (Call number TJ213 .N2655)
- A. E. Bryson and Y. C. Ho, “Applied Optimal Control: Optimization, Estimation, and Control,” Halsted Press, 1975 (Call number QA402.3.B78).
- D. E. Kirk, “Optimal Control Theory: An Introduction,” Prentice-Hall, 1970 (Call number QA402.3 .K52).
- J. C. Hsu and A. U. Meyer, “Modern Control Principles and Applications,” McGraw-Hill, 1968, (Call number QA402.3 .H75)
- F. L. Lewis and V. L. Syrmos, “Optimal Control,” 2nd edition, Wiley, 1995 (Call number QA402.3.L487)

Tentative Outline:

- Introduction and Mathematical preliminaries
- Finite dimensional optimization
- Discrete-time optimal control
- Optimal control in continuous time
- Dynamic Programming and the Hamilton-Jacobi-Bellman Equation
- Numerical methods for optimal control

Class Communication on D2L (SS19-ECE-853-001 - Optimal Control):

- Course syllabus and lecture slides
- 9 homework assignments (assigned every Wednesday and due in a week)
- Take-home Exams (available on D2L 24 hours before the due time)

Exams:

- Two Term Exams and one term paper with final presentation

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Schedule of Take-home Exams & Term Paper Due Date	Due time		Due Place
Exam 1 (take home)	Friday, 2/21 ~ 2/22	10:20 AM	Class
Term Paper Proposal	Friday, March 20	10:20 AM	Class
Exam 2 (in class)	Friday, April 12	10:20 AM	Class
Term Paper and presentation Due	April 24	10:20AM	Class
Term Paper Presentation	April 26	TBD	

Take-home Exams:

- The exam is written to be worked out in two hours. You are given 24 hours to conveniently fit it in your schedule.
- From the moment the exam is posted on D2L until the due time, you are **NOT allowed** to discuss the contents of the exam in particular or the course in general with anyone other than the instructor.
- You must not reference any source consulted in solving the exam (book, paper, online site, etc.), with the exception of the class notes.
- If you cannot submit the exam at the due time and place, you must make prior arrangements with the instructor.

Term Paper and Presentation:

- The title shall cover an optimal control application in engineering, economics, management, biology, medicine, or any other fields.
- A **one-page** proposal is due on March 20 and should contain a description of the problem, references, and the additional work (work plan) to be performed by the student in the form of analysis and/or simulation.
- The proposal will be returned within one week with approval or suggestions for changes. If needed, a 15 minutes meeting will be scheduled with each student to discuss your term paper proposal.
- The term paper is limited to **10 pages** (12 point font size), including figures, tables, and references. It is due on April 24.
- A ten minute presentation of the term paper will be scheduled for each student on April 26 (8 minute presentation and 2 minute discussion). The location and time will be announced later to accommodate student schedule.

Class Grading

Homework (20%), Term Exams (25% each → 50%), and Term paper (20%) and presentation (10%)

Homework: You can discuss homework problems with other students, but you must complete and submit your own work.

Grading

Score	90-100%	80-89%	70-79%	60-69%	50-59%
Grade	4.0	3.5	3.0	2.5	2.0