AA/EE/ME 548
Linear Multivariable Control
Department of Aeronautics & Astronautics
Winter 2014; Syllabus[1]

Instructor: Mehran Mesbahi
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Instructor's Office Hours: TBD
Class website: From instructor's website: **Teaching** $\longrightarrow$ **Linear Multivariable Control**
Class Room: Loew 206
Class Time: T/Th: 1:30-2:50 pm

Textbook:
F. L. Lewis, D. Vrabie, and V. L. Syrmos, *Optimal Control* , Wiley, 2012.

Recommended References:
B. D. O. Anderson and J. B. Moore, *Optimal Control: Linear Quadratic Methods*, Dover, 2007.
D. P. Bertsekas, *Dynamic Programming and Optimal Control* (vol. 1), Athena Scientific, 2007.
A. E. Bryson and Y-C. Ho, *Applied Optimal Control*, Taylor and Francis, 1975.
P. Dorato, C. Abdallah, and V. Cerone, *Linear Quadratic Control: An Introduction*, Krieger, 2000.
H. Kwakernaak and R. Sivan, *Linear Optimal Control Systems*, Wiley-Interscience, 1972.

Prerequisite: Linear Systems Theory at the level of AA/EE/ME 547.

Theme: The course is on linear multivariable control with a particular emphasis on controller synthesis using linear quadratic (LQ) methods. The LQ methodology is one of the cornerstones of system and control theory from various point of views, including its historical significance, practical relevance, computational tractability, as well as its mathematically beauty. In this course we will aim to touch upon some of the facets of LQ methods in order to gain a better understanding of the theoretical, computational, and practical challenges of dynamic system analysis and control synthesis.

Topics: The topics to be covered include: relevant material on linear system theory (e.g., controllability, observability), followed by calculus of variations, dynamic programming, Hamilton-Jacobi-Bellman equation, Riccati equation, Lyapunov theory, computational issues, disturbance rejection, Linear Quadratic Gaussian (LQG) framework, robustness issues, H_2 problem, reinforcement learning, LQ games, and applications of the theory.

Website: The class website is a living document. **Check it regularly** as I plan to update it often. I will post the schedule, homework assignments, thoughts, notes, references, etc., on it.

Homework: We will have weekly homework assignments, assigned every Thursday; the assignments are also due on Thursdays at the end of the class. The contribution of the homework toward the final grade is 25%.

Midterm: We will have two midterms approximately during the fourth and eight weeks into the quarter. The midterms will each contribute 30% to the final grade.

Project: We will have a project for the class, details of which will be discussed during the lecture. The project will contribute 15% to the final grade.

[1] Rev. 0.1; January 3, 2014