Term: 2023 Fall / Full Term

Instructor: [Heng (Hank) Yang](#)

Teaching Fellow: [Weiyu Li](#)

Meeting Time: Monday / Wednesday 2:15PM - 3:30PM

Classroom: SEC 1.413

Enrollment Limit: N/A

Course Description:

This course teaches the fundamentals of optimal control and estimation for dynamical systems. The goal of this course is twofold: to teach how to use optimization to formulate, analyze, and solve control and estimation problems, and to prepare students for control and robotics research by introducing some of the most fundamental topics. Key themes include dynamic programming and its approximation, reinforcement learning, model predictive control, Lyapunov analysis, output feedback (control from cameras), nonlinear filtering, geometric computer vision and estimation, data-driven control, as well as convex optimization and semidefinite programming. This course will cover both the theoretical and practical aspects of the topics with running examples mostly motivated by robotics applications.

Syllabus:

https://docs.google.com/document/d/1q8_jB5dLx9jHOBi3DQ48Vv2E243ocGCGm_H0mJuOojM/edit?usp=sharing

Lecture Notes:

https://hankyang.seas.harvard.edu/OptimalControlEstimation/

Prerequisites:

Familiarity with linear algebra, probabilistics, calculus, and basic programming (Matlab, Python etc). It is recommended to have basic knowledge about control theory (ES 155) and optimization (AM/ES 121), though this is not strictly necessary.

Cross-listing:

Engineering Sciences 158 is also offered as Applied Mathematics 158. Students may not take both for credit.

This course counts towards a [Computer Science concentration with the tag "core CS"](#).

Undergraduate Engineering Students should enroll in Engineering Sciences 158.

Contact:

Please email Heng Yang (hankyang@seas.harvard.edu) for questions and comments related to the course.