

ENPM 667 Syllabus (Fall 2023)

Course: ENPM 667 - Control of Robotic Systems

Semester: Fall 2023

Time: Mon 7:00-9:40pm (0101), Mon 4:00-6:40pm (0201), Thu 7:00-9:40pm (0301)

Location: JMP 2121 (0101), JMP 2116 (0201), JMP 2222 (0301), or Online (DE01)

Instructor: Dr. Waseem A. Malik

Office Hours: TBD

TAs: Vignesh Radhakrishnan, Yashveer Jain

Grader: TBD

TA Office Hours: TBD

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Course Description:

This is a basic course on the design of controllers for robotic systems. The course starts with mainstay principles of linear control, including a review of elementary concepts of systems, and discusses applications to independent joint control. The second part of the course introduces optimization principles to tackle the design of controllers. Selected topics from Optimal Control, Non-Linear Control, and Classical Control are also discussed in detail.

Textbook (Required)

Mark Spong, Seth Hutchinson, and M. Vidyasagar, ***Robot Modeling and Control***, Wiley; 1st edition, 2005 (ISBN: 0471649902)

References:

Karl Astrom and Richard Murray, ***Feedback Systems: An Introduction for Scientists and Engineers***, Princeton University Press, 2008

Joao P. Hesphanha, ***Linear Systems Theory***, Princeton University Press, 2009

Wilson Rugh, ***Linear System Theory***, Pearson, 2nd Ed, 1995

Serge Lang, ***Linear Algebra***, Springer, 3rd Ed, 2000

Course Outline:

An overview of robotic systems and control systems

- Basic concepts of linear system theory, with applications and numerical methods
- Modeling and design of linear controllers using state-space methods (application to independent joint control)
- Controllability, observability and realization of dynamic feedback controllers
- Basic concepts of Lyapunov stability theory
- Analysis and design of feedback systems using frequency domain methods
- Basic concepts of optimal control (LQR, LQG, ...)
- Non-Linear Control
- Model Predictive Control (if time permits)

Grading System:

HW Assignments - 25%

Project(s) - 40%

Final Exam - 35%

Code of Academic Integrity:

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity of the Student Honor Council, please visit <http://shc.umd.edu/SHC/HonorPledgeInformation.aspx>.