ME/AER 676 Robot Modeling & Control
Spring 2023

Overview

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Syllabus

- **Lecture:** Tue & Thur 11:00am - 12:15pm, RMB 309.
- **Office Hours:** TBD
- **Text:** Notes +*Modern Robotics*+ *Robot Modeling and Control*
- **Workload:** 2.5 hours of lecture, 8 hours of reading notes, papers, and writing simulation code.
- **Course announcements:** I use canvas to send information, but don't read inbox messages. Contacting me by email with **[ME 676 RMC]:** or **[AER 699 RMC]:** makes it easy for me to track and respond to your emails.
- **Course website:** All course material will be available on the website, which will be updated as the course proceeds.

Syllabus

- **Academic Integrity**
- **Accommodations due to disability**
- **Attendance Policy**
- **Classroom Conduct**
- **Excused Absences & Verification of Absences**
- **Exams:** None.
- **Homework:** Weekly assignments, must adhere to rules in syllabus
- **Grading:** See Syllabus. Subject to change.

More Information

Read The Syllabus!

About me

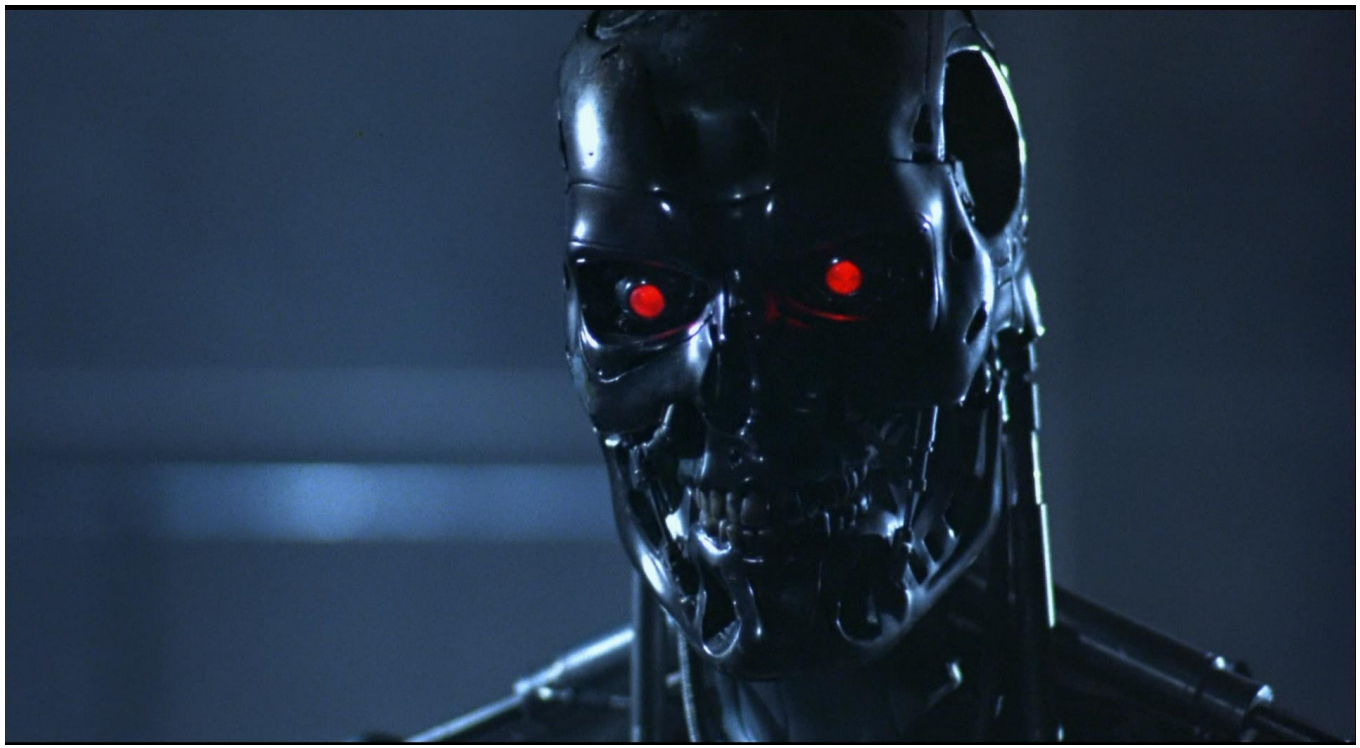
- Grew up in UK and India
- Undergraduate degree in Mech. Engg. in India
- Masters in Mech. Engg from U. Michigan
- Ph.D in Electrical Engg. from UT Dallas
- PostDoc at UT Austin in Computational Control

Research

Goal: Get mechanical robots to control themselves.

Day-to-day: Theory from dynamics and control systems, simulations/experiments involving machine learning and robots.

Motivation



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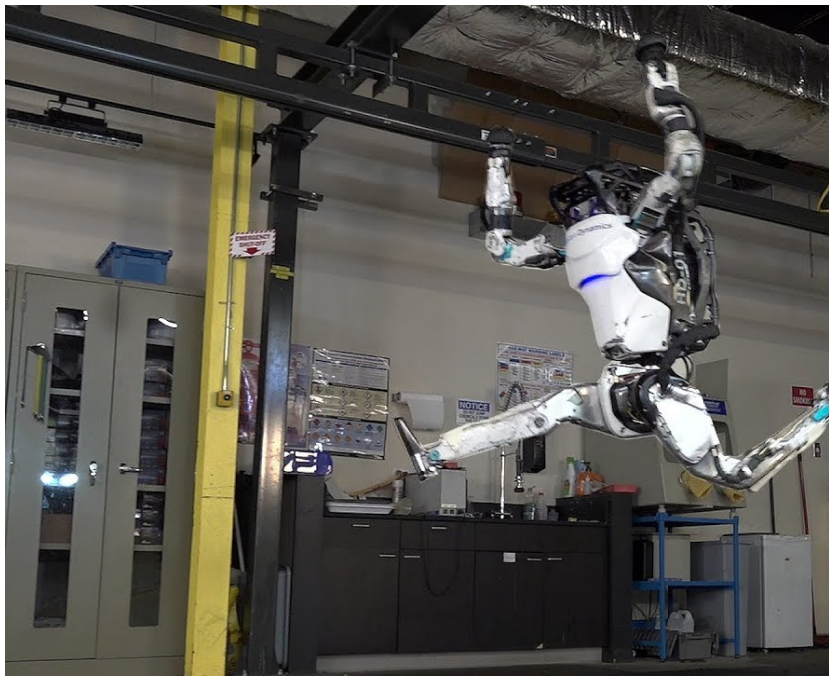

Tasks For Robots

- What kinds of tasks requires a physical robot?
  (Or, what can't your phone do?)

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- How would you describe the motion you want to a robot?
- How would you, as a robot, convert that description into action?

Course Overview

Learning Goal

For you to be able to read and assimilate both recent papers and early foundational papers on robotics. Furthermore, develop programming skills that enable you to implement and try (possibly new) methods in simulation.

Course Overview

Learning Goals:

1. Understand coordinates and robot configurations.
2. Understand how to transform the robot configuration into task coordinates and *vice versa*, along with the challenges in these processes.
3. Learn approaches to planning motions in both task coordinates and robot configurations.
4. Learn approaches to achieving planned motions using feedback control.
5. Understand the challenges of state estimation.
6. Learn optimization-based approaches to planning and control.
7. Simulate robotic systems and test control algorithms.

Course Overview

Approaches for achieving goals:

- Lecture/Discussion on
  1. Coordinates
  2. Dynamical Systems: single and articulated rigid bodies
  3. Planning Trajectories
  4. Sensing and State Estimation
  5. Feedback Control
- Paper readings
- Practice through assignments (code and question) and **Course Project**

Expectations

- Read notes ahead of time. Classroom activities ASSUME YOU ARE DOING THE READING.
- Comfort with mathematics:
  - Abstract definitions.
  - Imagining concrete examples to which they apply.
  - Applying definitions to complete derivations and proofs.
- Comfort with code:
  - How to use documentation describing installation and use of packages.
  - Awareness of the need to test code frequently, and that your tests will need testing.
- Study groups. Don't go this one alone.

About You

On an index card / sheet of paper, write down:

1. Name
2. First robot you were aware of and/or Favorite robot
3. Motivation for taking this course
4. Concerns about the course
5. Topics you wish were on the syllabus
6. Topics you have already studied
7. Learning/teaching styles that you feel work well for you