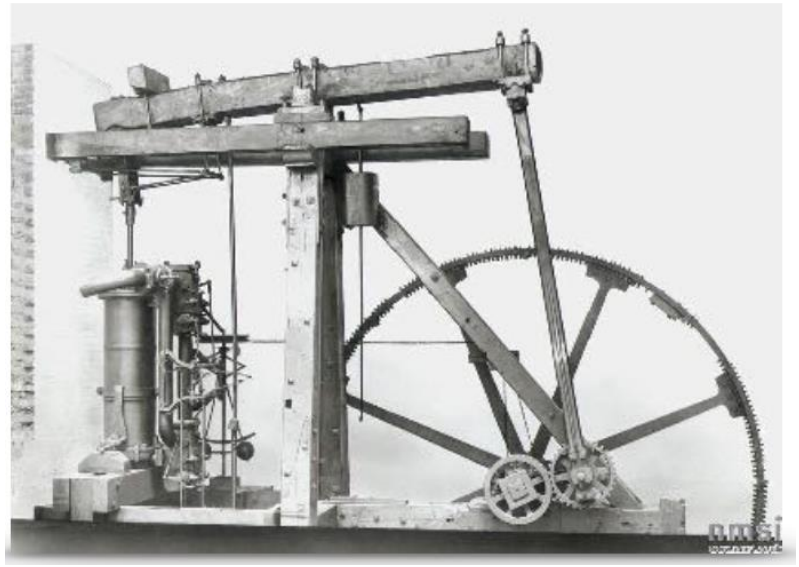
6.3100 Dynamical System Modeling and Control Design

Spring 2023 – Lecture 1

History of control

- Control engineering was first developed in the industrial revolution for controlling the steam engine (1788)



- “Centrifugal governor” controls the speed of the engine

History of control

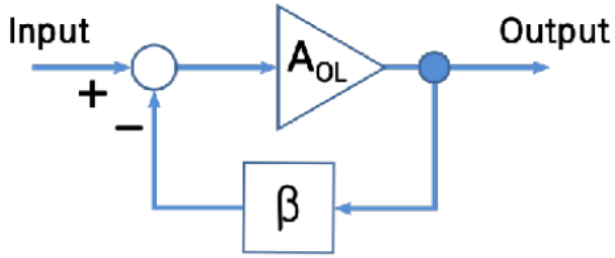
- Signals through telephone wires (1888)

Manhattan

Problem: signal attenuation / noise over a long distance

The Bell Telephone Company

Solution: feedback control



Engineering projects involving control

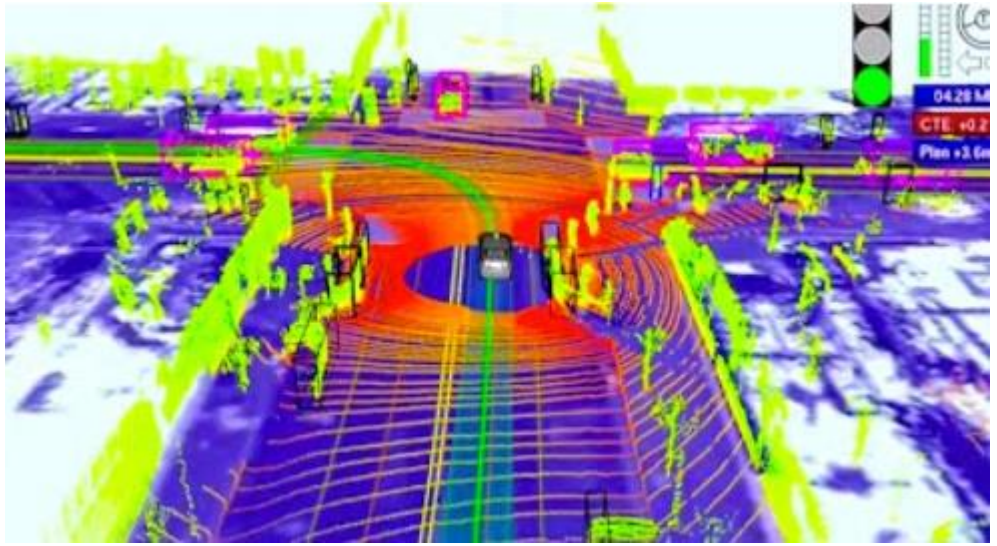
Perseverance Rover (2020)

Ingenuity (2020)

Engineering projects involving control

Self-driving car

Sensing and planning

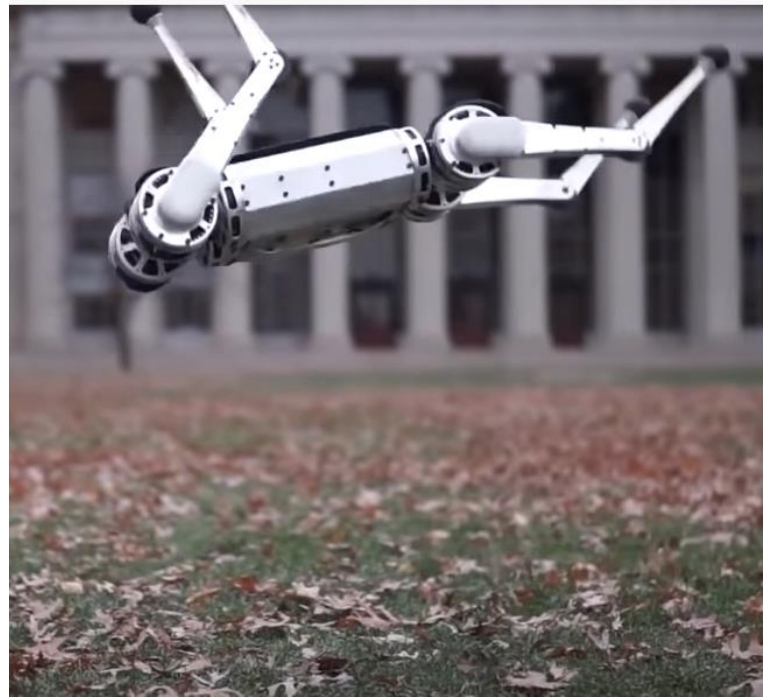


Control research at MIT

MIT Cheetah Mini

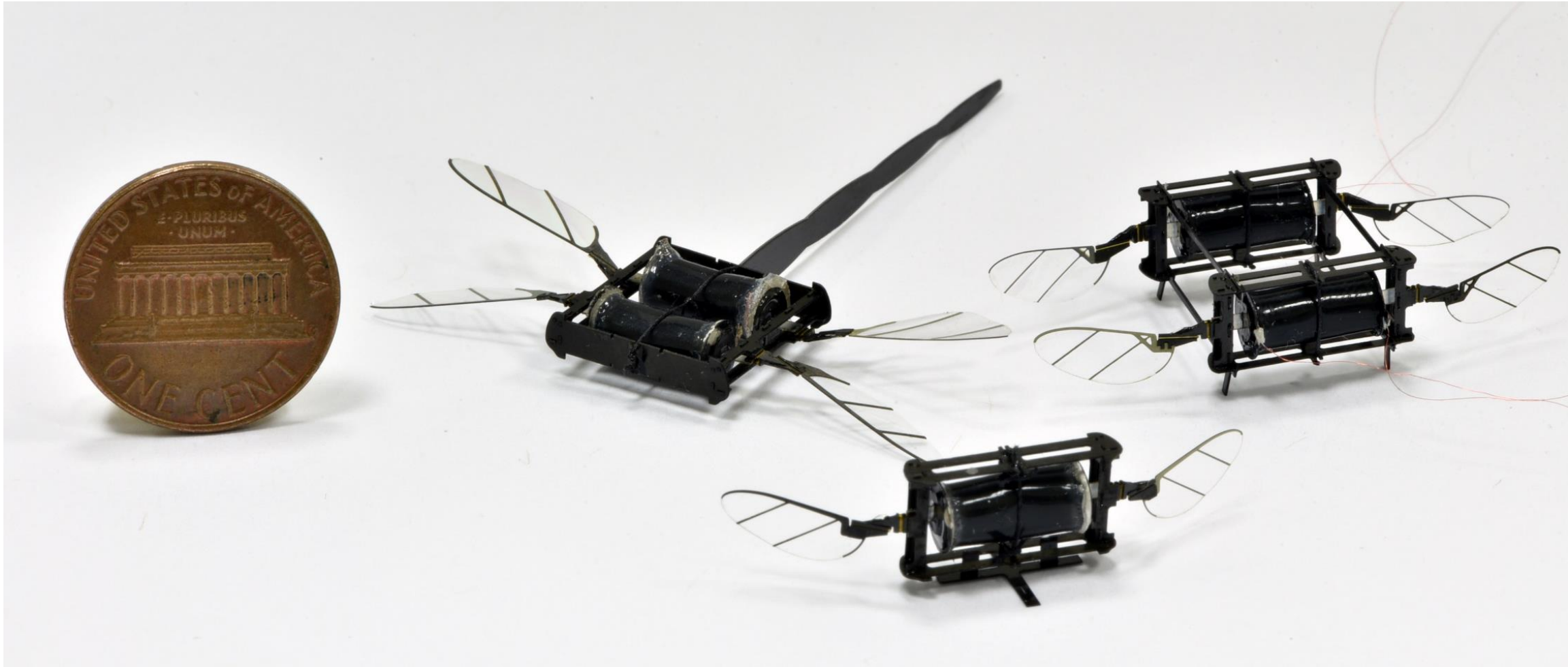
Collision recovery

Body flip



Control research at MIT

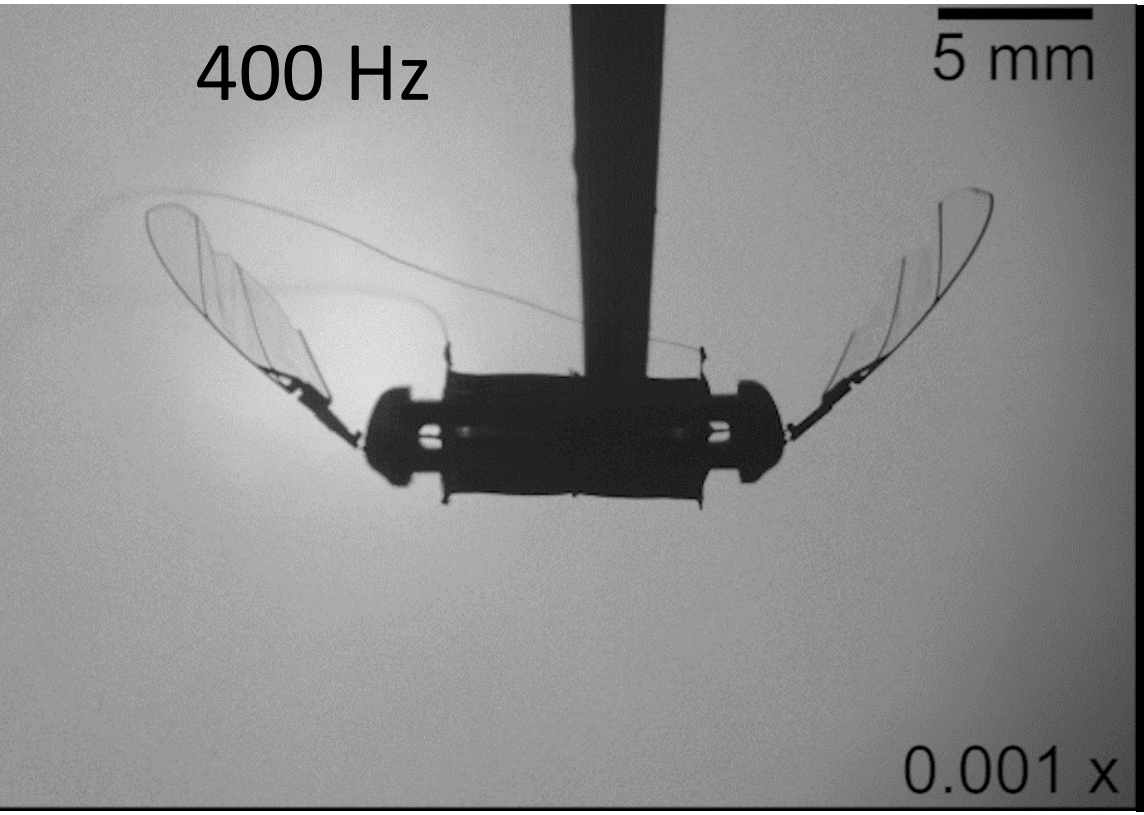
MIT SoftFly



Control research at MIT

MIT SoftFly

High frequency actuation



Feedback controlled flight

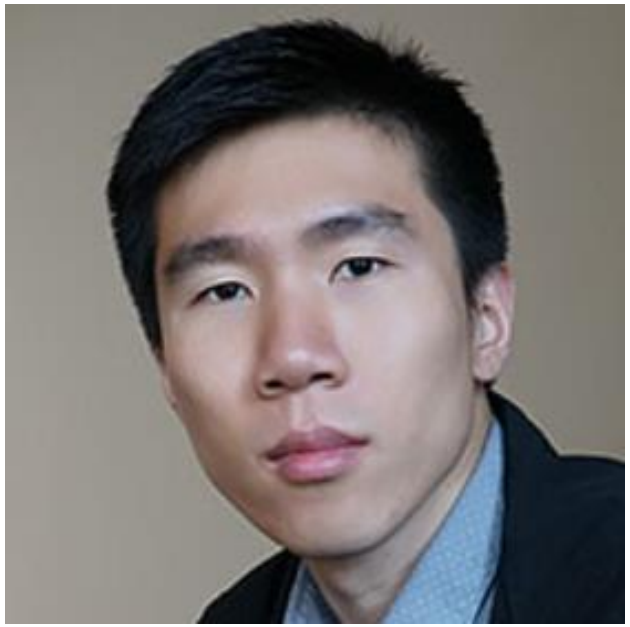
Course logistics

Lecture staff

Lecturers

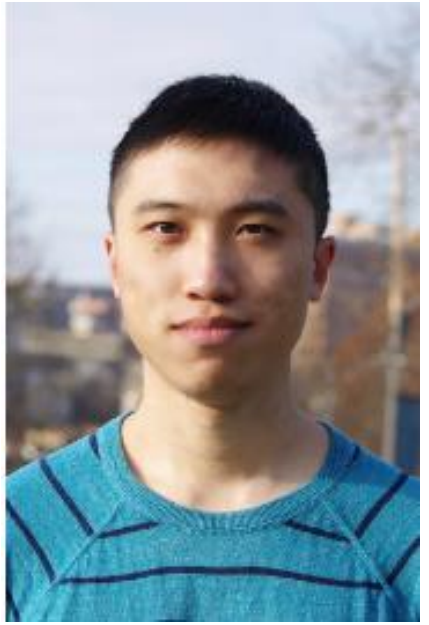
Prof. Dennis Freeman

Prof. Kevin Chen



Teaching assistants

Zhijian Ren



Nemo Hsiao

Course logistics

Meeting time

Lectures: MW 3:00 – 4:00 pm, 4-163

Labs: Friday 10 – 1pm or 2 – 5pm, 38-545

Office hours: all in 38-545 (starting next week)
Monday: 7-10 pm
Thursday: 7-10 pm
Sunday: 2-5 pm, 7-10 pm
Please sign up on piazza

Course logistics

https://introcontrol.mit.edu/spring23

Course content:

Part 1: classical control

- Discrete time (steady state error, stability)
- Continuous time (sinusoidal steady state)

Part 2: introduction to modern control

- State space representation
- Pole placement, LQR
- Observers

Pre-requisite:

18.03 or 18.06:

Differential equation,

Linear algebra,

Complex numbers

Course logistics

Course components:

6 labs (2 weeks per lab) 70%

- Based on in-person checkoffs
- Need to complete a lab before the next lab (Friday midnight)
- Must complete late labs in OH (except cases supported by S^3)

Written postlab problems 20% -- graded by the TAs

- Solution is posted immediately after the deadline
- Please contact the teaching staff for each late submission

Online prelab problems 10% -- no late penalty