# ME132 Dynamic Systems and Feedback Spring 2016

**Website** All announcements, homework, solutions, notes will be posted on
*https://bcourses.berkeley.edu/*
Make sure you have access to this site!

**Instructor** Kameshwar Poolla, *poolla@berkeley.edu*, 5141 Etcheverry
Office hours: Friday, 3:00-4:30 pm; begins the 2nd week, Jan.29
Location: 6153 Etcheverry

**Assistants** Office hours (Location: 1171 Etcheverry, begins the 2nd week, Jan.25)

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|---|---|
| Yujia Wu, *yujia.wu@berkeley.edu* | Mon 3:00-4:30pm |
| Minghui Zheng, *minghuizheng@berkeley.edu* | Tu 4:00-5:30pm |
| Thomas Georgiou, *tgeorgiou@berkeley.edu* | Wed 5:00-6:30pm |

**Prerequisites** Math 1A, 1B, E7. Exposure to MatLab.
Some previous exposure to Matrix Algebra will be valuable.
ME 104 or equivalent can be taken concurrently.

**Lectures** MWF 2-3 pm, 105 Northgate.

**Discussions** Discussions begin the 1st week (Jan. 19th, Tu, 9:00-10:00 am).
The HW Help sec begins the 2nd week (Jan. 28).

You can attend any discussion section.

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| Dis Sec 1: Tu 9:00-10:00 am | 10 Jacobs | Yujia Wu |
| Dis Sec 2: Wed 4:00-5:00 pm | 1171 Etcheverry | Tomas Georgiou |
| Dis Sec 3: Th 10:00-11:00 am | 1171 Etcheverry | Tomas Georgiou |
| Dis Sec 4: Th 1:00-2:00 pm | 10 Jacobs | Minghui Zheng |
| HW Help Sec: Th 2:00-3:30 pm | 1165 Etcheverry | Katrina Jiang |

**Grading** (tentative plan)
2 midterms [25% each] + homework [15%] + final [35%]
I may decide to offer a project, in which case the weights will change.

**Text** None is required. Notes will be provided for *most* of the topics covered.
I strongly suggest you attend lecture and take good notes.

**Reference** K. Astrom and R. Murray,
*Feedback Systems: An Introduction for Scientists and Engineers*,
Princeton University Press, Princeton, NJ, 2008.
Available at the Student Store and online (free).
On 2-hour reserve at the Engineering Library.

I will suggest other reading material during the course.

**Exam Dates** (midterm dates are tentative)
Midterm 1: Wednesday, March 02, 5:30-7pm
Midterm 2: Friday, April 08, 5:30-7pm
Final: Tuesday, May 10, 11:30 am-1:30 pm

#### Announcements, Resources, etc

Announcements, homework assignments, solutions, and course material will be posted on bspace. The class email list is also controlled through bcourses, so please be sure you have access to b-courses and your current email address is up to date in Bearfacts. Please check the course website frequently for updates.

#### Homework

Homework will be posted on bcourses on Fridays and due at *4:45 pm sharp the following Friday.*
Turn in your homework at the Drop Box (labeled *ME 132*) on the 3rd floor of Etcheverry Hall.
You must attach the Homework Cover Sheet.
(so we can return the homework in the correct discussion section)
The cover sheet is available on bcourses.
*No late homework will be accepted. No exceptions.*
I understand that sometimes you may not be able to submit the homework on time.
So, I will give you two free passes: your two lowest homework grades will be dropped.
Homework solutions will be posted on bcourses after 5:00 pm on the due date.
Homework will be returned in discussion.

#### Matlab proficiency

We assume everyone has taken E7 or a comparable Matlab class.
If you are unfamiliar with the basics of Matlab, make an appointment to meet with a teaching assistant as soon as possible.

#### Introduction to Simulink sessions

Introduction to Simulink sessions will be offered during the second week of instruction during regular discussion times. You must attend at least one session if you have not used Simulink.

#### Tentative Schedule

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| Week 1 | The power of feedback; terminology, structure of control systems, block diagrams, major concepts. |
| Week 2 | Cruise control example; signals, systems, models, controllers. |
| Week 3 | First order systems; free response, step response, frequency response, transfer functions; control. |
| Week 4 | Second order systems; PID control; anti-wind-up strategies. |
| Week 5 | General LTI systems; transfer functions; stability; frequency response; |
| Week 6 | Interconnected systems; root-locus; Nyquist theorem; delays. |
| Week 7 | Stability robustness and robustness margins |
| Week 8 | Linear algebra review; introduction to state-space |
| Week 9 | Realizations; general solution |
| Week 10 | State-feedback; pole-placement; observers; separation principle. |
| Week 11 | Nonlinear systems; equilibrium points; linearization. |
| Week 12 | Feedback linearization; Gain-scheduling. |
| Week 13 | System identification; estimation; model predictive control; adaptation. |
| Week 14 | New frontiers. |