Automatic Control
ECE441A/541

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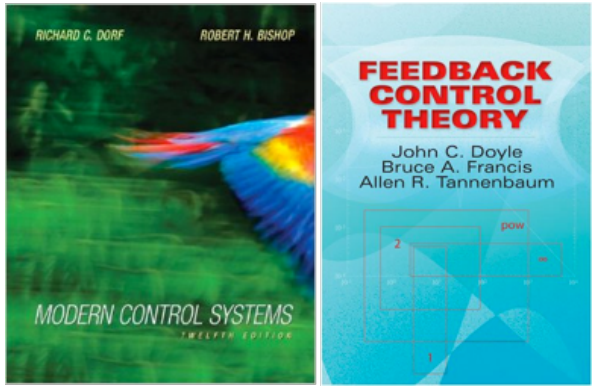
Overview of the Course



Text Book
ugrad + grad ($$), grad ($)

About me

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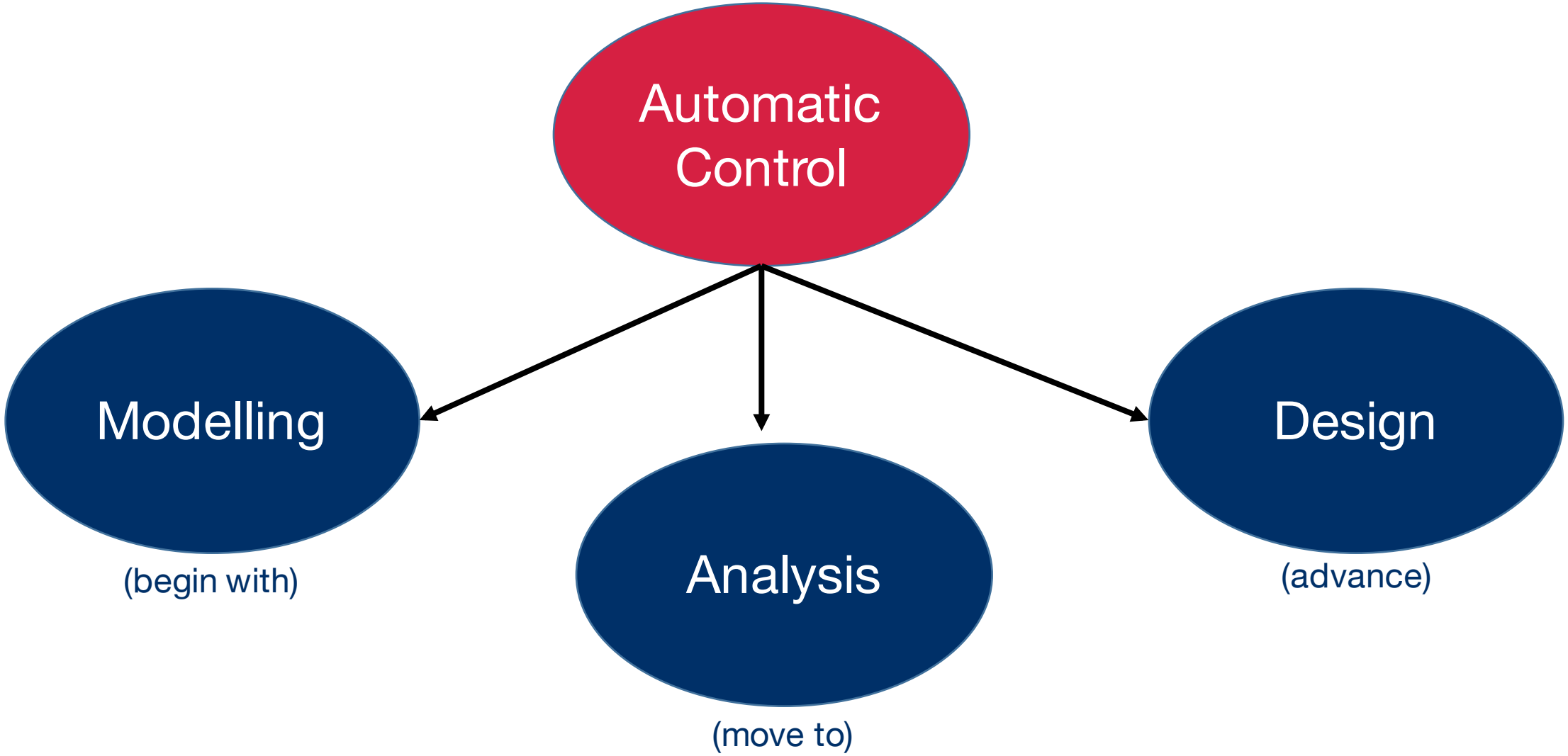
About Automatic Control

- Undergraduate and graduate level control systems course with an online section
- We will cover the basics of control systems and their relationships to real world problems. Matlab will be used as a companion.
- Stuff to talk about: grading, project, integrity, and disabilities
- Course materials: http://d2l.arizona.edu

Chapter 2 Outcomes

- Recognize that differential equations can describe the dynamical behavior of physical systems
- Understand the application of Laplace transforms and their role in obtaining transfer functions
- Be aware of block and signal flow diagrams, and their role in analyzing control systems
- Understand the important role of modeling in the control system design process

Automatic Control



Modelling

“”

A Modelling Approach

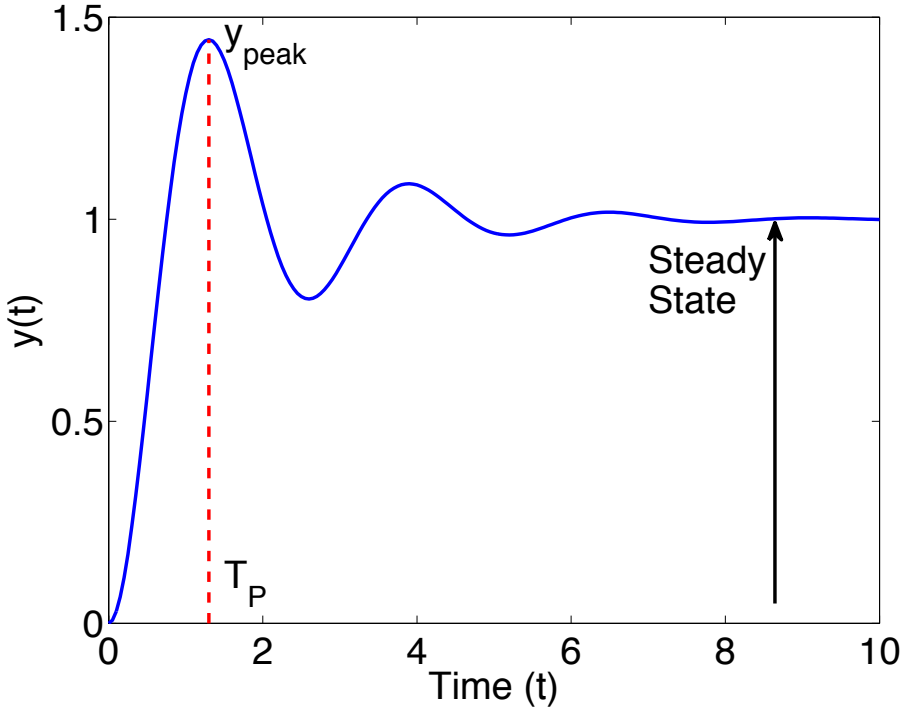
1. Define system and its boundaries
2. Identify variables
   - through variables
   - across variables
3. Write equilibrium and/or compatibility equations
4. Write physical relationship between variables
5. Substitute (2) & (4) into (3)

System Identification

“”

System Identification

- Define system and its boundaries




```
tau = .4; zeta = .25; t = 0:0.05:10;
y = 1 - exp(-zeta*t/tau) .* (cos(t*sqrt(1-
zeta^2)/tau) + zeta/sqrt(1-zeta^2)*sin(t*sqrt(1-
zeta^2)/tau));
[~,tmax] = max(y);
figure; hold on;box on;
plot(t, y, 'LineWidth', 2);
plot([t(tmax),t(tmax)], [0,y(tmax)], 'r--',
'LineWidth', 2)
text(t(tmax)+.2, y(tmax),'y_{peak}', 'FontSize', 22)
text(t(tmax)+.2, .1,'T_{P}', 'FontSize', 22)
annotation('arrow', [.8,.8], [.14, .65],
'LineWidth', 2)
text(7, .9, 'Steady', 'FontSize', 22)
text(7, .8, 'State', 'FontSize', 22)
xlabel('Time (t)', 'FontSize', 22)
ylabel('y(t)', 'FontSize', 22)
set(gca, 'fontsize', 22)
```

$$y(t) = 1 - e^{-\frac{\zeta t}{\tau}}\left\{\cos\left(t\frac{\sqrt{1-\zeta^2}}{\tau}\right) + \frac{\zeta}{\sqrt{1-\zeta^2}}\sin\left(t\frac{\sqrt{1-\zeta^2}}{\tau}\right)\right\}$$

Laplace Transforms

“What we know is not much. What we do not know is immense.”

-Pierre-Simon Laplace (allegedly his last words)

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