EECS192 Lecture 10
Mar. 21, 2017

Notes:
1. Check off 3/24: 3 laps 1 m/s ave with varying illumination. Turn in both the step response and sensor mechanical response plots digitally on bCourses.
2. HW 2 due Fri Mar. 24, 6 pm in bcourses
3. Progress Report due Tues 4/4 in class
4. Check off 4/7: practice course, 5 min
5. Mon. 4/10: (5 pm) round 1
6. CalDay Sat. April 22 @ UCB,
7. Quiz 4: SI timing, not CLK timing as long as >= 129 clocks

Topics
• Software notes for embedded control
• Steering step response
• Discrete time control
Quiz 4 comments TSL 1401 line sensor

**Figure 1. Timing Waveforms**
Software Notes

Read sensors ➔ process ➔ output ..... Idle ....... Read sensors ➔ process ➔ output

Interrupt-
highest priority

idle

User IO Blocking IO

Printf

Interrupt-
highest priority

idle
Bicycle Steering Model

Proportional control:

$$\delta(t) = k_p y_a(t)$$

$$\ddot{y}_a + V k_p \dot{y}_a(t) + \frac{V^2}{L} k_p y_a(t) = 0.$$  

Eigenvalues:

$$\lambda_{1,2} = \frac{V}{2} \left( -k_p \pm \sqrt{k_p^2 - \frac{4k_p}{L}} \right)$$
Bicycle Steering Control - recap

Proportional control:
\[ r = 0 \quad \text{(to be on straight track)} \]
\[ \delta = u = kp \cdot e \]

Proportional+derivative

\[ P + I + D \]

Note steady state error: car follows larger radius

On board
Discrete Time Control

\[ u[n] = kp^*(r[n]-y[n]) \]

Time Series Plot: unnamed

On board