

Physics 37100 Advanced Physics Laboratory I

Lab #5

(PART II: PID---The Controller)

- 1) Make a sketch using getPhoto() to control the LED using proportional control. Here is an outline:
 - a. Set out=0;
 - b. Loop for k=1 to 100
 - c. Set analogWrite() to out
 - d. Wait 100ms.
 - e. Measure V using getPhoto
 - f. Serial.println V
 - g. Define err ie $e=V_{set}-V$;
 - h. Define $out=P*e$;
 - i. Make sure out is between [0 255].
 - j. Serial.println e and out
 - k. End loop
- 2) Find the largest value of $P=P_{max}$ that does not causes the V to oscillate. How does it compare to your estimate from part I?
- 3) What is the value of the error for the largest P that will not oscillate?
- 4) Plot V and out verses step k from above for P_{max} , $P_{max}/2$, and $P_{max}/10$.
- 5) Add Integral control. Initialize e_s to 0 before the loop and after line g above add $e_s=e_s+e$; Then change line h to $out=P*e+I*e_s$.
- 6) Find values of $P=P_0$ and $I=I_0$ that give good control.
- 7) Plot V and out verses step k for (P_0,I_0) , $(P_0,I_0/10)$, $(P_0/10,I_0)$, and $(P_0/10,I_0/10)$. You may have to lengthen the k loop to see the full effects. Give a brief explanation of the plots.