Ch. 28: Basic Closed-Loop Control

28.1)
Which PID term(s) contribute(s) instability to the system when the gain is too large? Which one(s) contribute(s) stability?

28.2)
Write pseudo-code for a function to implement a bang-bang control law as described in Section 28.4.

28.3)
Explain, in your own words, why proportional-only control can never reach the set-point.

28.4)
A system that implements PI control exhibits a step response like that shown in Figure 28.19.
a) How would you modify the gains to eliminate the oscillatory behavior while preserving as much of the rise time as possible?
b) If you were simply to add a derivative term (with some nonzero gain) to this system (keeping the other gains the same) how would you expect the response to change?

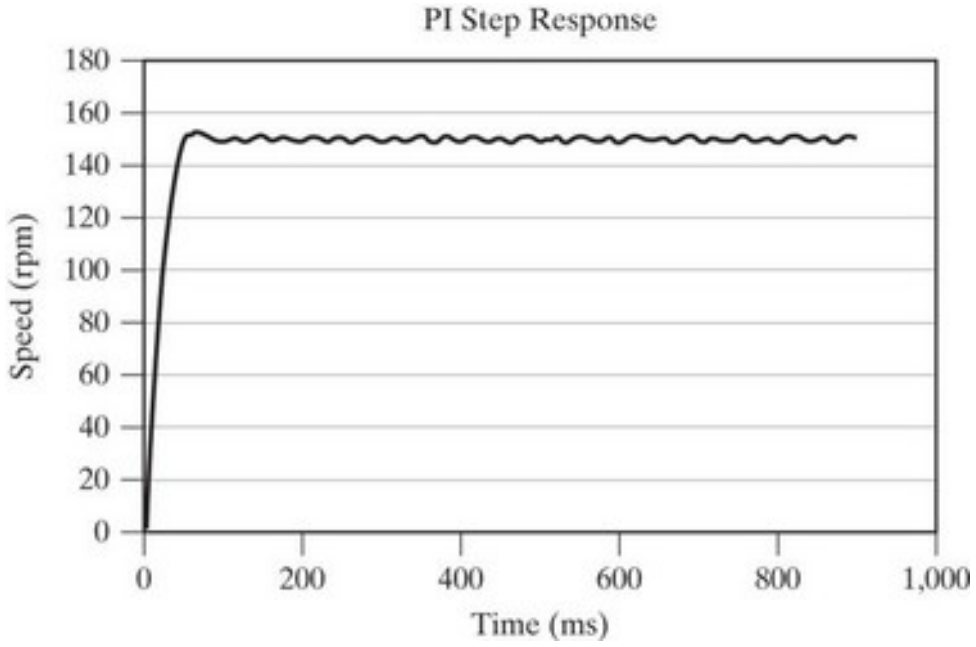

Figure 28.19: System response for Problem 28.4.

28.5)
Lab-mates have collected some step response data from a system that they are trying to control using a PI controller. The plots of rpm and duty cycle are shown in Figure 28.20. They have asked you whether or not you think that they can increase the gains to improve the response of this system, and if so, which gain should they try increasing first?

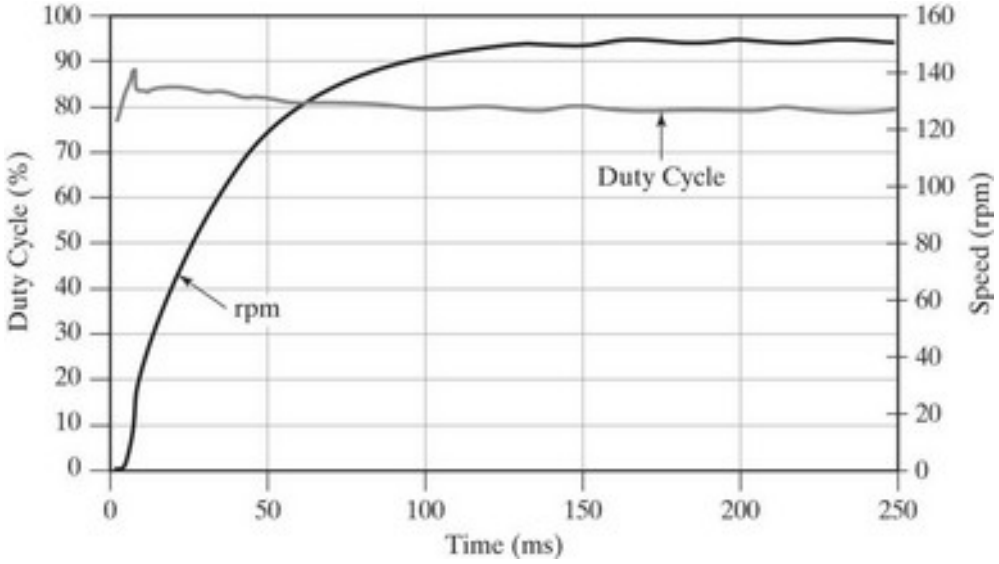

Figure 28.20: System response for Problem 28.5.

28.10)
A particular actuator driven mechanical system is found to have a time constant of 30 ms from actuation to stable response. Suggest a reasonable control loop rate to use in controlling this system. Explain your reasoning.

28.11)
Only certain systems are good candidates for bang-bang control. What is the prime characteristic to consider when evaluating whether or not a system is suitable for use with bang-bang control?