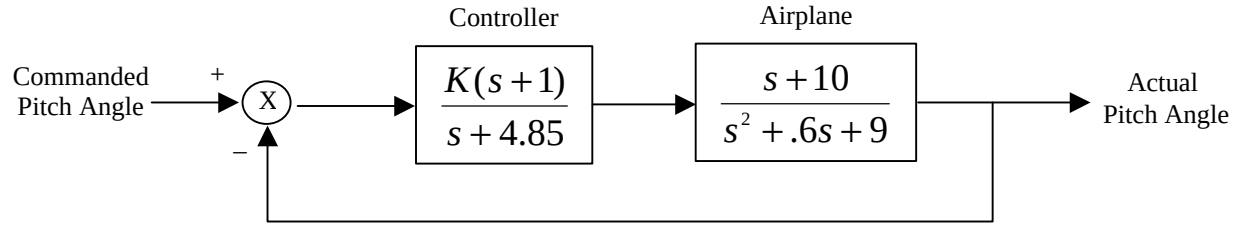
ECE 460 – Project 1 (35 Points) Due April 4, 2001

*This is an individual project. There is to be **no** collarboration between students on any aspect, including code, theory or report writing. Any evidence of work sharing will be dealt with in the strictest possible manner.*

Consider the following control system that models a jet fighter.



(a) What is the range of K for stability?

(b) In general, the pilot would like the actual pitch angle to be very close to his commanded pitch angle. How should one choose K to make this happen, and why?

(c) [Use MatLab] It is a well known fact that humans pilots cannot handle dramatic changes in pitch angle over a short time duration. Assume that the maximum velocity that the human can handle is 20 degrees/second and the commanded angle is 40 degrees. What is the lowest SSE achievable for this scenario?

(d) What is wrong with the design in (c)? Use physical considerations in your answer.

Project 1 write-up guidelines.

A short (2 – 3 page) write-up is expected. Include an introduction, answers to all questions, and a conclusion.

Include your work, with explanations. A significant amount of the credit will be given for the explanations you provide in answering the questions.

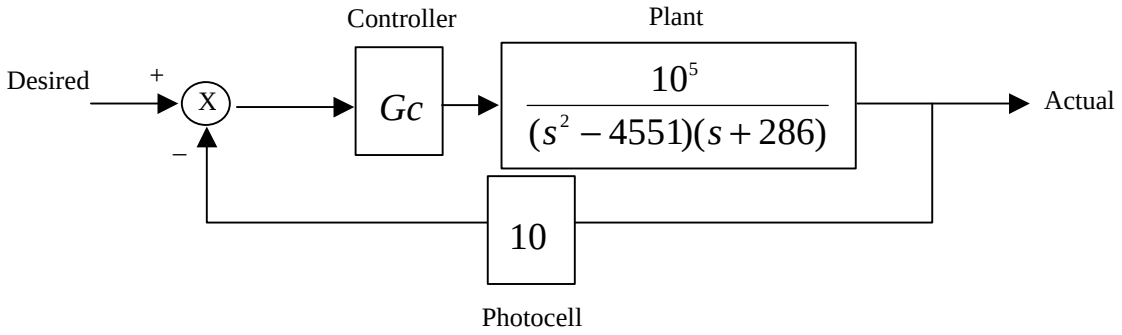
Equations and diagrams *may* be handwritten if and only if you can do so neatly.

Write in complete sentences. Use proper grammar.

ECE 460 – Project 2 (65 Points) Due April 23, 2001

*This is an individual project. There is to be **no** collarboration between students on any aspect, including code, theory or report writing. Any evidence of work sharing will be dealt with in the strictest possible manner.*

The transfer function for a magnetic levitation (maglev) train system is given by the plant below.



(a) What is the step response when there is no compensator, (i.e. $Gc = 1$)?
Include Matlab plots and all measurements made from the simulation (Ts, Os, Tp, ...)

(b) Design a compensator, *Gc*, to yield a settling time of 0.1s or less if the step response is to have no more that 1% overshoot. Hint: First rewrite as a unity feedback system.
Include a complete explanation of the design process. This will be a significant portion of your grade. Include Matlab plots of the compensated system and the measured values of Ts, OS, etc. Highlight your design (Gc), including the pole(s), zero(s) and gain.

(c) Design a second compensator, to be placed in series with that of (b), to minimize SSE to to a step input and have a total settling time < 0.5s. This compensator should not appreciably effect the OS achieved in (b).
Include a complete explanation of the design process. This will be a significant portion of your grade. Include Matlab plots of the compensated system and the measured values of Ts and OS. Highlight your design including the pole(s), zero(s) and gain.

Project 2 write-up guidelines.

An extensive write-up is expected. Include an introduction, solutions to each part, and a conclusion.

Include your work, MatLab figures, and diagrams with explanations. A significant amount of the credit will be given for the explanations you provide in answering the questions.

Equations and diagrams *may* be handwritten if and only if you can do so neatly.

Write in complete sentences. Use proper grammar.