

## Mechatronics Engineering and Automation Program

CSE488: Computational Intelligence

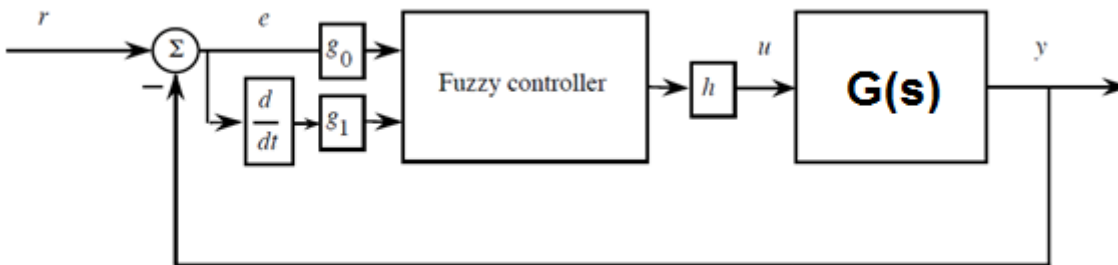
Project #03: Fuzzy Control Systems

Due Date: Midnight of the final exam day.

**Students are encouraged to form groups of at most 3 students.**



1. Simulate the following fuzzy controller system with the vehicle model,  $G(s) = 6/(s^3+10s^2+15s+0.725)$ . Your system must have the following block diagram with the scaling gains  $g_0$ ,  $g_1$ , and  $h$ :-



You need to show the effect of changing the scaling gains on the system performance. Write a source code to estimate the best scaling parameters that will minimize the integral of square error of the closed loop system. Discuss and analyze the results. You may use the fuzzy control rules explained in the course lectures. You need to show the following:-

- a- The system response when  $g_0=g_1=h=1$ ;
- b- The system integral of square error for different values of  $g_0$ ,  $g_1$ , and  $h$ .
- c- The best parameters when using the genetic algorithm optimization. You must show different runs of the algorithm associated with the corresponding system response.
- d- The best parameters when using the PSO. You must show different runs of the algorithm associated with the corresponding system response.

**You may use PSO and GA MATLAB ready-made toolbox functions.**

**Important:** You need to write a neat report with the following contents:

- Problem definition and importance (1 Page).
- Methods and Algorithms (2 Pages).
- Experimental Results and discussions.
- Appendix with codes.

**Warning:** Plagiarism is prohibited. Assignments with no reports will not be graded.