Homework 4   Intelligent Control

Note: Details explanation and code (.m; .py; or .c should be attached)

1. (Optimization algorithm for NN's training) As the statement in class, the single-layer perceptron cannot treat the XOR logic problem. Please use the genetic algorithm (GA) or particle swarm optimization (PSO) to train a neural network with at least one hidden layer for solving the XOR logic (two-input) problem. Hint: input/output of NN are (A, B)/output, respectively.

2. (Optimization algorithm for controller design) The most commonly used model to describe the dynamics of chemical processes is the *First-Order Plus Time Delay Model*. By proper choice of τ_{DT} and τ, this model can be made to represent the dynamics of many industrial processes. Consider the **PID controller** design problem for the plant with transfer function

$G(s) = \frac{Ke^{-\tau_{DT}s}}{\tau s+1} = \frac{e^{-s}}{10s+1}$ and $C(s) = (k_p + k_d s + k_i/s)$, this means that select the suitable

parameters to optimize performance index. In addition, the usually utilized time response performance indices are rise time, setting time, overshoot, sum of square error, etc and gain margin/phase margin for time response and frequency response, respectively. (a) Please formulate an optimization problem by performance indices introduced above. (b) Use the PSO or GA to treat it and demonstrate your results.

3. (Fuzzy control) Continue the above controller design problem, the utilized controller is replaced by fuzzy control. That is the *First-Order Plus Time Delay Model* is controlled by a fuzzy controller, please give your design and implementation results using simulation.

4. (Final Project planning) Please describe the **implementation plan for your final project**, includes problem, plant, datasets,…