KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

PROJECT # 4

It is required to develop Differential Evolution (DE) code to solve the following optimization problems.

Part 1- It is aimed to minimize the below function.

$$f(x_1, x_2, x_3) = {x_1}^2 + 2{x_2}^2 + 3{x_3}^2 + x_1x_2 + x_2x_3 - 8x_1 - 16x_2 - 32x_3 + 110$$

The bounds are $0 \leq x_1, x_2, x_3 \leq 10$

Part 2- For the control system given in the class notes, Consider the followings.

1. The objective function is to *maximize* (min. ζ).
2. The optimized parameter constraints are

$$1.0 \leq K \leq 100$$
$$0.1 \leq T_1 \leq 1.0$$
$$0.1 \leq T_2 \leq 0.1$$

The following steps should be carried out.

a. Run the code 10 times with different initial populations, mutation factor, and crossover factor. Draw the objective function variation of the best solution in all cases in one graph.
b. Find the optimal design of the controller, i.e., optimal parameters and objective function in each run and tabulate them for comparison. Calculate max., min, and average values over the number of runs.
c. Select the optimal design and carry out the eigenvalue analysis of the system with the optimal controller.

Discuss the results thoroughly and assume any missing data you may need.

Submission: Due Tuesday March 15, 2022

A softcopy of all materials (report + Matlab code) must be submitted.