INDIAN INSTITUTE OF TECHNOLOGY MADRAS

Department of Chemical Engineering

Simulation lab (CH2082)

Assignment 5 – (02/04/2014)

Wednesday Batch

Instructions

1. Attempt all problems on your own.
2. You may discuss with the TAs for assistance.
3. All variables should be declared or initialized within your program
4. Name each program using the following convention using a combination of your roll number, assignment number and question number. i.e., if your roll number is CH12B001, name the program in the first question of the first assignment as follows:CH12B001_A1_Q1.m
5. Submit a single zipped folder (named accordingly e.g. CH12B001_A2) in moodle which contain matlab codes (m files) for each question and one pdf file (after publishing)
6. Comment wherever required

Note: All submissions are to be made by 5pm on the same day.

Questions

1. Find the minima of the following function. Use the initial guess as x = y = z = 1. (Use fminunc). $F = (x^2+y^2)^2-x^2-y+z^2$
2. Consider the following two equations in two unknowns

   $f(x) = x^3 - 0.165*x^2 + 3.993*10^{-4}$

   Use x = 0.05 as the starting point. Solve using Newton Raphson method and compare with the true solution.

3. A) A golf ball of mass 46 gm, radius of 21 mm is propelled into the air with an initial speed of 35.5 m/s making an angle with the ground. Assume the ground is perfectly flat and neglecting air resistance, determine the range (horizontal distance travelled) of the ball.

   B) The ball also experiences drag friction, the magnitude of which is approximately given by the following formula: $F_{drag} = 0.5\rho r^2 v^2$

where ρ is the density of air, and v is the instantaneous speed of the ball. Assume ρ = 1.3kg/m3.

In each of the above cases, determine the angle such that horizontal range is maximized. (Hint: Write a function that takes in the angle of launch and returns the range that is calculated using an ode solver (You already have this in your 4^{th} assignment). Use this function in fminuncon)