Assignment 1

Due Date

Create a matlab script and change the filename to F7xxxxxx_hw1.m. Link all the programs to solve following problems to this script. Make sure once type the filename' F7xxxxxx_hw1', the results of the following problems will pop-up automatically in order. Remember not to type any 'clear all ', 'close all' command in any of the codes.

Problems

Prob1. [F7xxxxxx_hw1_prob1.m]

Prepare two functions "NumToSngBin.m" and "SngBinToNum.m" for floating point number conversion.

◆ "NumToSngBin" converts a given number to the binary representation corresponding to the single precision floating point number using truncation/round-down mode. The output of the function should be a 1x32 array containing only 0 and 1 corresponding to IEEE754 standard. The left-most bit of each section is the most significant bit.

◆ "SngBinToNum" converts a 1x32 binary array of a single precision floating point number back to its decimal representation.

◆ MainScript/MainFunction: Write a script "F74xxxxxx_hw1_prob1.m" and choose three numbers to demonstrate how the two functions work. The output of the script displays following information in the Matlab command window.

The binary representation of　A.B　is [0 110…0 0….0];
The decimal representation of [0 110…0 0….0] is A.B;
The binary representation of　C.D　is [0111001….01];
The decimal representation of [0111001….01] is C.D;
The binary representation of　-E.F　is [1111000….01];
The decimal representation of [1111000….01] is -E.F;

Prob2. [F7xxxxxxx_hw1_prob2.m]

Suppose that a unit charge Q = 1C is placed at the origin (0,0,0).

(a) Plot the ELECTRIC FIELD for grid the points (格子點) on the x-y plane (z=0) using "quiver" function or your own function to draw an arrow to demonstrate the electric field at the designated grid point. The length of the arrow should reflect the magnitude.

Electrical Field
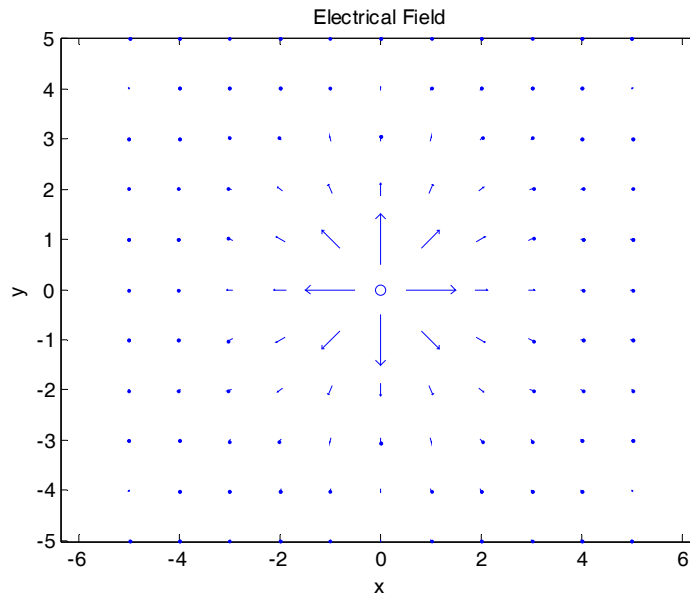
(b) Given the following configuration, the two charges have +1C and -1C respectively.
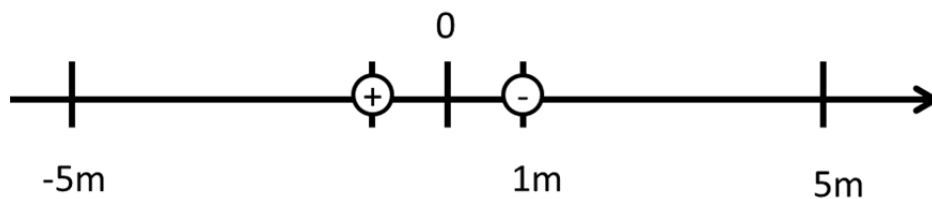
Generate a plot ,V(x)-x to demonstrate the electric potential from -5m to 5m.

(c) Generate a plot E(x)-x by using finite difference to approximate E(x) from the points in (b). Note: the precision should contain at least 6 significant digits.

Prob3. [F7xxxxxxx_hw1_prob3.m]

A 5-kg brick undergoes a damped oscillation. The velocity of the brick can be expressed by

$$\vec{v}(t) = -20e^{-0.01t^2} \sin\left(20\pi t + \frac{2\pi}{5}\right) \frac{m}{s} \, \hat{x} \quad \text{for} \quad t \geq 0$$

   (a) Draw the v-t plot of the object. (put on appropriate axis label on the figure)
   (b) Plot the temporal changes of the net force on the object, an F-t plot.
       (put on appropriate axis label on the figure)
   (c) Find $\vec{F}(8)$. The precision should be up to 6 significant digits and print the result on the console window

Contents to submit

1. All the m-files you compose for the assignment.
2. All the m-files should include proper COMMENTS.
   (No comment, no score)
3. A PDF [F7xxxxxxx_hw1.pdf] includes Your Name, Your Student ID Number, Introduction to your program, such as What your program can do, How do you finish this homework, and the test result that convinced you that your program is correct.

Notice

1. DO NOT PLAGIARIZE. You are encouraged to ask and to discuss the homework content with your fellow classmates, the TAs and the instructor. But identical core program wording is NEVER ACCEPTABLE.
2. Upload all the files without archiving(Do Not ZIP or RAR). Do not upload files that don't work well. Any missing file or function that leads to fail of the execution will be regarded as a program that never works.