

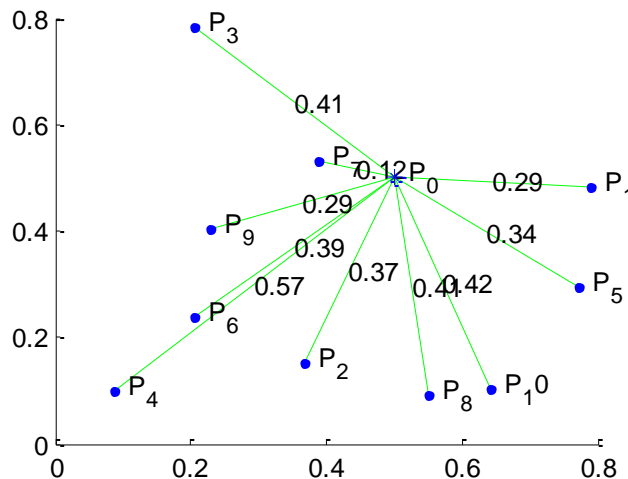


Numerical Methods for Engineering – Graduate Course 019003

Homework 1- introduction to Matlab

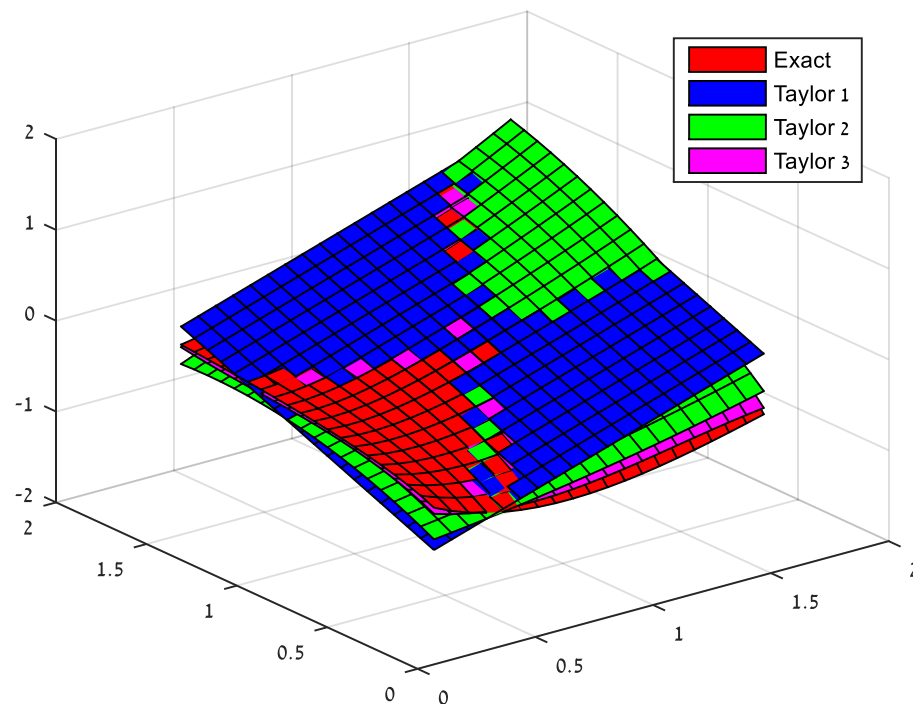
Due date: January 30th, 2024 through Moodle

1. You are given an array of points on the plane: $P = \text{rand}(10,2)$, and a single point $P_0 = [0.5 \ 0.5]$.
 - a. Write a function $R = \text{MyDist_a}(P, P_0)$ that takes inputs P and P_0 and returns the vector R containing the distances from point P_0 to the points in P . **Use only one Matlab line of code.** (don't use the *pdist* command).
 - b. Write a function $R = \text{MyDist_b}(P, P_0)$ that takes inputs P and P_0 and returns the vector R containing the distances from point P_0 to the points in P . **Use a for-loop.**
 - c. Compare the two functions runtimes using *tic toc* commands.
 - d. Write a function $[] = \text{MyPlot}(P, P_0)$ that plots a graph of the array P , the point P_0 , and lines connecting the origin P_0 to the points. Write the point number next to each point and the distances next to the line connecting them as in this figure below. Use *MyDist_a* or *MyDist_b* as subfunction.



2. Write a formula to calculate $f = \sin(x) \ln(xy)$ using a 2-D Talyor series around the point (1,1) in the 3rd order (polynomial of order 3).
 - a. Find the Taylor polynomial of order 1, 2, and 3 using Matlab's symbolic calculations. Do NOT use *taylor* command. Explicitly write the approximations in your submission.
 - b. On a single graph, plot the given function f and on top of it the approximate functions which you calculated in 2.a. Each function should be in a different color. Draw the graph with the center in (1,1) , plot the result in the range [0.5,1.5] . **Similar** to the following figure

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3. Use the file given in HW1_3.m and fix it. In the file, we have used an algorithm to solve this set of non-linear equations using the Newton Method:

$$\begin{cases} x^2 + y^2 = 4 \\ e^x + y = 1 \end{cases}$$

(As a reminder, here is link to a summary of the method:

<http://www.ohiouniversityfaculty.com/youngt/IntNumMeth/lecture13.pdf>

4. Exercise given in first lecture. Write the pseudocode described by this next flow-chart

