Universidad Ana G. Méndez -Recinto de Gurabo
Electrical and Computer Engineering Program
Numerical Methods with Programming
COMP 411

Final Project
Due: Monday, December 12, 2022, at 11:59PM

Source Code

Problem 1: Write separate MATLAB functions for Newton's, the Secant method, the modified secant method. The functions should be written so that they can be called in MATLAB by typing.

1. [X, NumIters]=Newton(@f, @df, x0, TOL, MaxIters)
2. [X, NumIters]=Secant(@f, x0, x1, TOL, MaxIters)
3. [[X, NumIters]=ModifiedSecant(@f, δ, x0,TOL, MaxIters)

Application Problems

Problem 2: Figure 1 shows a circuit with a resistor, an inductor, and a capacitor in parallel. Kirchhoff's rules can be used to express the impedance of the system as

$$\frac{1}{Z} = \sqrt{\frac{1}{R^2} + (wC - \frac{1}{wL})^2}$$

Where Z =impedance (Ω) and w=the angular frequency. Find the w that result in an impedance of 75 Ω using the implemented methods in problem 1.

1. Newton x0=1
2. Secant method with x0=1, x1=100
3. Modified Secant method with x0=1

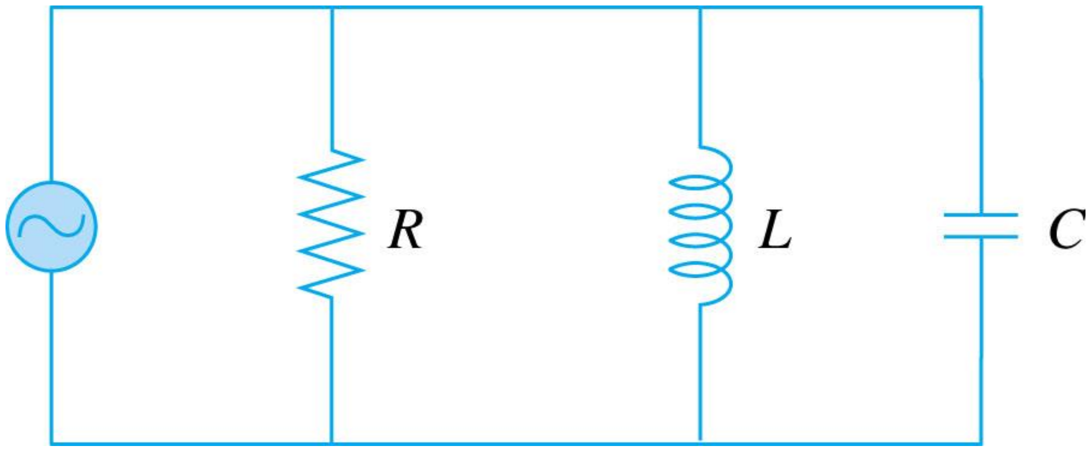

Figure 1. RLC Circuit.

Use the following parameters: R=225 Ω, $C = 0.6x10^{-6} F$ and $L = 0.5H$. Determine how many iterations of each method are necessary to determine the answer to $\varepsilon_s = 0.1\%$.
If any difficulties arise, please use the graphical method to explain them.

Problem 3: Given the following data points,

x	1.6	2	2.5	3.2	4	4.5
y	2	8	14	15	8	2

1. Construct the divided difference table for this table
2. Find the Newton's interpolating polynomial using the divided difference technique (1^{st}, 2^{nd} order) find f(2.8).
3. Repeat the previous step using Lagrange interpolation
4. Repeat 1 and 2 by running the given code for each technique in the handouts
5. Write a MATLAB code that plot the polynomials found in 2 and 3 on the same scale.

Problem 4: Use nonlinear regression to estimate α and β of the following model

$$y = \alpha_4 x e^{\beta_4 x}$$

Based on the following data. Develop a plot of your fitting model along with the data.

X	0.1	0.2	0.4	0.6	0.9	1.3	1.5	1.7	1.8
Y	0.75	1.25	1.45	1.25	0.85	0.55	0.35	0.28	0.18

Problem 5: The function $f(x) = 2e^{-1.5x}$ can be used to generate the following table of unequally spaced data:

x	0	0.05	0.15	0.25	0.35	0.475	0.6
$f(x)$	2	1.8555	1.5970	1.3746	1.1831	0.9808	0.8131

Evaluate the integral from a 5 0 to b 5 0.6 using (a) analytical means, (b) the trapezoidal rule, and (c) a combination of the trapezoidal and Simpson's rules; employ Simpson's rules wherever possible to obtain the highest accuracy. For (b) and (c), compute the percent relative error (ε_t)

Problem 6: The logistic model is used to simulate population as in

$$\frac{dp}{dt} = k_{gm}\left(1 - \frac{p}{p_{max}}\right)p$$

Where p=population, k_{gm}=the maximum growth rate under unlimited conditions, and p_{max}= the carrying capacity. Simulate the world's population from 1950 to 2000 using one of the numerical methods discussed in the course. Employ the following initial conditions and parameter values for your simulation: p_0 (in 1950) =2555 million people, k_{gm}=0.026/yr, and p_{max}= 12,000 million people. Have the function generate output corresponding to the dates for the following measured population data. Develop a plot of your simulation along with the data.

t	1950	1960	1970	1980	1990	2000
p	2555	3040	3708	4454	5276	6079

Good Luck!