ECE 8630 Fall 2024
Power System Dynamics and Stability

Assignment 2

Due: Friday Sept. 27, 2024 at 11:59 pm Instructor: R.Hadidi

Use Matlab/Python for this assignment.

1. Numerically solve the swing equation of a SMIB system for a 1.5 rad step disturbance at t=1 s for t=[0-4]s (for three second) with the following parameters. Plot the results for each case.

   H=4, P_m=1pu, P_e=2*sin(δ) pu, f=60 Hz

   a. Use Matlab ode45 command.
   b. Use Forward Euler's method.
   c. Use Backward Euler's method.
   d. Use Trapezoidal Rule method.
   e. Use Euler's full-step modification method.
   f. Use Euler's half-step modification method.
   g. Use Adam-Bashforth second-order method

   Explain your observations about each method and its pros and cons. You can start with time step of 0.005s and vary time-step to better investigate.

   Matlab ode45 method: https://www.mathworks.com/help/matlab/ref/ode45.html

2. Repeat question 1 by including damping in your swing equation using D=1 pu power/pu speed. Refer to the swing equation with damping in your notes.

3. Show the following expressions are valid for very small angles. No mathematical derivation is needed. Matlab plots showing the validity region of these expressions are sufficient. In addition, show the calculation error associated with these assumptions.

$$\sin(\delta) \approx \delta \ \ (rad)$$
$$\cos(\delta) \approx 1$$

Please submit a report detailing your results and comparisons. Upload your code/codes for problem 1 and 2.