HW 3

1. Explain whether the following linear multistep formula is A stable. Draw the region of the stability if the formula is not A stable. Formula: $x_n - x_{n-2} - 2hx'_{n-1} = 0$.
2. Prove that the error of the midpoint method in Bulirsch-Stoer approach is a polynomial function of $h^2$ in page 6 of lecture note 5.1.
3. Use backward Euler and Newton Raphson methods to derive the algorithm (formula) for the integration of a nonlinear circuit.
4. Illustrate the range of the $\lambda < 0$ in a complex plane so that we can derive the exponential of $\lambda$, $e^{\lambda}$, in Taylor’s expansion format using (1) single floating point precision and (2) double floating point precision. Explain the bottleneck of the calculation in deriving the solution with accuracy.
5. Derive the formula of the residual error for matrix exponential function using Krylove space, rational Krylow space, and invert Krylov space. Use a simple but nontrivial example to demonstrate the error vs. the stepsize.