

Math 269A: Assignment 7

Assigned Monday November 26, due Monday December 3

Theory

[1] Find the roots ξ of the characteristic polynomial $\rho(\xi)$ for the following

- 4th order Adams Bashforth
- 4th order BDF

You can find the numerical values using Matlab.

Computation

[2] Implement 4th order (i.e. $k=4$) BDF, using the coefficients in Table 5.3 of Ascher & Petzold, for the nonlinear equation

$$y' = -\lambda(y^2 - \sin^2 t) + \cos t$$

for $\lambda=20$ using Newton's method to solve the resulting nonlinear equations (note that this is the same ODE as in HW6, but now it is stiff). Do this for initial data $y(0) = 0$, for which the solution is $y = \sin t$. Use this knowledge to prescribe the values for the first few timesteps. Also use the time interval $[0, \pi/4]$ and time step $h = 0.1$ and 0.01 . Plot the resulting solutions.

What You Should Turn In

- Answers to the theoretical problems.
- A printout of the code and the graphs for the computational problems.