Maths 3018/6111 - Numerical Methods

Worksheet 5

Theory

1. Explain when multistep methods such as Adams-Bashforth are useful and when multistage methods such as RK methods are better.

2. Compute the coefficients of the AB3 algorithm.

3. Explain the meaning of stability, consistency and convergence when applied to numerical methods for IVPs. State the theorem connecting these.

4. Using the stability polynomial and your results above, check the order of accuracy and the stability of the 3 step Adams-Bashforth method.

Coding

1. Apply the 2-step Adams-Bashforth method to the ODE from Worksheet 4,

$$y' + 2y = 2 - e^{-4x}, \quad y(0) = 1.$$

   Use the Euler or Euler predictor-corrector method to start. Again, find the value of $y(1)$ (analytic answer is $1 - (e^{-2} - e^{-4})/2$) and see how your method converges with resolution.

2. Apply the 2-step implicit Adams-Moulton method to the above ODE, using the 2-step Adams-Bashforth method as a predictor. Use the Euler or Euler predictor-corrector method to start. See how your method converges with resolution.