



Midterm Exam Outline

Math 104B: Numerical Analysis

Professor: Paul J. Atzberger

- Integration
 - Newton-Cotes Methods (open and closed).
 - Newton-Cotes order of accuracy (odd and even cases).
 - Trapezoidal Quadrature, Simpson's Quadrature.
 - Composite Quadrature.
 - Gaussian Quadrature.
 - Gaussian Quadrature order of accuracy.
- Theory of Ordinary Differential Equations (ODEs)
 - Lipschitz continuity both scalar and vector-valued functions.
 - Definition of well-posedness.
 - Sufficient criteria for well-posedness.
 - Uniqueness, existence, robustness to perturbations.
- Numerical Approximation of ODEs
 - Euler's Method
 - Truncation error.
 - Error bound.
 - Stability.
 - Taylor Methods.
 - Runge-Kutta Methods
 - Explicit / implicit methods.
 - Second order methods.
 - Fourth order methods.
 - Multistep Methods
 - Adams-Moulton Methods.
 - Adams-Bashforth Methods.
 - Truncation error.
 - Stability.
- Convergence of Methods, Stability, and Stiffness
 - Consistency of methods.
 - Definition of A-stable method.
 - Stability region.
 - Stability of One-step Methods.
 - Stability of Multi-step Methods
 - Root conditions.
 - Convergence theory for One-step Methods.
 - Convergence theory for Multi-step Methods.
 - Stiff ODEs and performance of implicit vs explicit methods.