

Syllabus of the Comprehensive Exam

**MATH 571 Numerical Analysis of Ordinary
Differential Equations**

Topics

- **One-step methods:** Scalar problems and systems, implicit and explicit methods, consistency and convergence, error estimates.
- **Runge-Kutta methods:** General formula, implicit and explicit methods, Butcher tableaux, truncation error.
- **Linear multi-step methods:** Implicit and explicit methods, construction, initiation, consistency, stability, convergence, absolute stability, predictor-corrector methods, Backward Differentiation Formula (BDF) methods, A-stability, and $A(\alpha)$ -stability for stiff problems.
- **Boundary value problems:** Difference and shooting methods for linear and nonlinear BVPs.

References

- Butcher, *Numerical Methods for Ordinary Differential Equations*, 3th ed, 2016.
- Süli, *Numerical Solution of ODEs*, 2022.