Department of Mathematics, KFUPM

Math 571 Syllabus (Term 222)

Instructor: Khaled M. Furati

Course Title: Numerical analysis of Ordinary Differential Equations

Course Description: Theory and implementation of numerical methods for initial and boundary value problems in ordinary differential equations. One-step, linear multi-step, Runge-Kutta, and extrapolation methods; convergence, stability, error estimates, and practical implementation, Study and analysis of shooting, finite difference and projection methods for boundary value problems for ordinary differential equations.

Prerequisite: Math 471 or consent of the instructor

Textbook: Numerical Methods for Ordinary Differential Equations, Butcher, 3rd ed, 2016

References: Numerical solution of ODEs, Suli, 2022
Numerical methods for ODEs, Griffiths & Higham, 2010
Numerical solution of ODEs, Atkinson, 2009

Learning Outcomes:
1. Define the fundamental concepts of numerical methods for ODEs.
2. Explain the merits and limitations of each numerical method.
3. Use numerical methods for solving ordinary differential equations.
4. Analyze numerical methods based on their accuracy and stability.
5. Develop algorithms that describe the steps of numerical methods.
6. Implement algorithms for solving ODEs using suitable software.

Assessment: Assignments 30%, Project 10%, Midterm Exam 25%, Final Exam 35%

WK	Date	Topics
1	Jan 15-17	Preliminaries and IVP
2	Jan 22-24	One-step methods
3	Jan 29-31	
4	Feb 05-07	Runge-Kutta methods
5	Feb 12-14	
6	Feb19-21	
7	Feb 26-28	Linear multistep methods
8	Mar 05-07	
9	Mar 12-14	
10	Mar 19-21	Stiff problems
11	Mar 26-28	
12	Apr 02-04	Boundary value problem methods
13	Apr 09-11	
Eid break		
14	Apr 30-May 02	Project preparation
15	May 07-09	Review