Department of Mathematics and Statistics Colloquium

Student Research Presentations

Adaptive, Highly Accurate and Efficient, Parker-Sochacki Algorithms for Numerical Solution to Large Scale Dynamical Systems

Jenna Guenther
Morgan Wolf

Abstract: For nonlinear dynamical systems, an explicit adaptive procedure using a foundation of the Parker-Sochacki Method (PSM) produces better accuracy in less time with significantly fewer steps when contrasted with many standard adaptive algorithms that use a Runge-Kutta (RK) foundation. First, two simple PSM functions are developed, illustrating a class of functions that represent the backbone of a future PSM tool for the scientific community. At each step across the domain, combinations of these functions efficiently and recursively generate the coefficients of the Taylor polynomial of the solution to the ODE system. An adaptive stepping algorithm is derived which provides a simple way to either increase or decrease the order of the method during computation. PSM Adaptive is first developed theoretically and then demonstrated on several examples. Results are compared against standard RK adaptive algorithms.

A Necessary Condition for Exponential Matrix Solutions of Differential Equations

Alexander McAllister

Abstract: For linear differential equations, we will show that a well-known sufficient condition for having exponential matrix solutions is also necessary under the assumption that the leading matrix is analytic.

Monday, December 3 at 3:50 in Roop 103

Refreshments at 3:30