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A High Order Algorithm for Solving Reaction Diffusion Equations

Analysis and implementation of a high order finite difference algorithm for solving systems of one-dimensional reaction-diffusion equations will be discussed in this presentation. The diffusion term is linear while the reaction term is nonlinear. The algorithm is unconditionally stable, second order accurate in time, and fourth order accurate in space. The computational complexity of this high order algorithm is about the same as that of the traditional Crank-Nicolson method. The computational efficiency is further improved by representing the unknowns in the nonlinear reaction term using extrapolations from the solutions at previous time steps, thereby eliminating the need for linearization. Numerical results will be discussed in the presentation to demonstrate significant accuracy and efficiency improvement.