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Semi-
Extrapolated Finite Difference Schemes and Their Stability[1] ANDREW BRANDON, BRENDAN DRACHLER, CARTER ALEXANDER, Lycoming College — When solving partial differential equations, finite difference (FD) methods are a popular choice. Several factors come into play when choosing a FD method, such as stability and cost of computation. Implicit methods have large stability regions, while explicit methods typically have small regions. Yet implicit methods are expensive to use, while explicit methods are inexpensive. In response to the small stability regions of explicit methods and the cost of implicit methods, we developed a novel discretization technique that generates explicit schemes by uniquely applying extrapolation to implicit schemes. The use of extrapolation can severely curtail a scheme‘s stability, however, our technique results in explicit schemes that exhibit extended stability regions compared to those of analogous explicit schemes, without a loss in accuracy. In our presentation, we‘ll review the stability regions of several popular spatially centered FD schemes. We‘ll then discuss our technique and how it can be used to solve the advection-diffusion equation. Upon discretizing this benchmark equation according to our technique, we‘ll analyze the stability regions of the resulting schemes and demonstrate nontrivial improvements in stability as compared to the stability of analogous explicit methods.

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