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Semi-Extrapolated Finite Difference Schemes for Partial Differential Equations ANDREW BRANDON, LUCAS WILKINS, BRENDAN DRACHLER, Lycoming College — When solving partial differential equations, finite difference (FD) methods are a popular choice. A variety of factors come into play when choosing a FD method, such as stability and cost of computation. Explicit methods are inexpensive to use but they have small stability ranges. Implicit methods have large stability ranges, however, they are expensive to use. To reduce the cost of implicit methods, extrapolation is often applied, yet this results in an explicit scheme that usually has a greatly reduced stability range. In a response to the small stability ranges of explicit methods, we developed a discretization technique that uniquely combines implicit schemes with extrapolation. The resulting novel explicit schemes maintain accuracy and, when compared to analogous explicit schemes, exhibit an improved stability range. In our presentation, we will review the stability ranges of several popular FD schemes. We will then discuss our novel technique and how it can be used to solve the heat and advection equations. Upon applying our technique to these equations, we will analyze the resulting stability ranges and demonstrate a non-trivial improvement in stability compared to the ranges of analogous explicit methods.

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