

Leveraging time integration to increase efficiency and robustness of nonlinear implicit solvers

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Large scale nonlinear problems regularly arise as a core component within implicit time integration of complex PDE systems. In this context, the outer time integrator may provide a wealth of additional information that may be leveraged within the nonlinear solvers used for each step. Depending on the nature of the implicit time integration algorithm, varying amounts of information may be available to the solver to increase robustness and decrease cost.

In this talk, we will explore such techniques within the context of embedded diagonally-implicit Runge-Kutta time integration methods. These integrators provide a rich set of information that may be leveraged to construct highly accurate initial guesses and sharp solver tolerances, both of which are critical for efficiency and robustness within solvers for large-scale nonlinear problems that arise within each stage of the time integration method.