Integral deferred correction methods for multi–scale problems

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Abstract: We present an overview of integral deferred correction (IDC) methods, which promise to be accurate and efficient time integrators because they easily extend simple lower order numerical methods to higher order schemes by correcting provisional solutions. We emphasize the theoretical and numerical results for arbitrary order semi-implicit IDC methods constructed with additive Runge-Kutta integrators (IDC-ARK). IDC-ARK methods can efficiently, accurately, and stably compute solutions to differential equations with both stiff and nonstiff terms (fast and slow time scales). Further work is in progress to implement adaptive IDC methods, develop IDC methods that are accurate in the stiff limit (asymptotic preserving), and construct Strang split IDC methods. IDC methods and their variants can be applied in areas such as chemical rate equations, convection-diffusion equations, hyperbolic conservation laws with or without relaxation, Vlasov equations in the plasma physics setting, and other similar (frequently multi-scale) problems. This talk is based on joint work with A. Christlieb, B. Ong, and J.–M. Qiu.

Bio: Maureen Morton is a PhD Candidate in Applied Mathematics at Michigan State University. She received a BA from the University of Kansas in Mathematics and in Russian Language and Literature. Her research is in the area of Numerical Analysis and Scientific Computing, with a focus on numerical methods to solve multi-scale differential equations.