TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Wednesday, 20 November 2019, 4:00 p.m.

Unconditionally Stable ImEx Methods: How to solve complex problems without having to do complex solves

by Benjamin Seibold
Temple University

Abstract.

A common paradigm in Implicit-Explicit (ImEx) time-stepping is that the problem's stiff parts should be treated implicitly, and the time step is then restricted by the explicit components. However, it is in fact possible to design schemes and ImEx splittings in a way that unconditional stability is achieved. Such approaches admit an efficient treatment of problems in which the explicit part is stiff. Based on the notion of an unconditional ImEx stability region, we present a class of ImEx linear multistep methods that generalizes SBDF formulas to allow for arbitrarily large stability regions. We then argue how the ImEx splitting and the time-stepping scheme can be co-designed to optimize efficiency (accuracy over cost). The resulting methods allow one to efficiently time-step complex problems (such as nonlinear diffusion), without having to conduct any implicit solves of the complex operator.