TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Wednesday, 6 December 2017, 4:00 p.m.

Error Inhibiting Block One-Step Schemes for Ordinary Differential Equations

by Sigal Gottlieb
University of Massachusetts at Dartmouth and ICERM

Abstract. The commonly used one step methods and linear multi-step methods all have a global error that is of the same order as the local truncation error. In fact, this is true of the entire class of general linear methods. In practice, this means that the order of the method is typically defined solely by order conditions which are derived by studying the local truncation error. In this work we investigate the interplay between the local truncation error and the global error, and develop a methodology which defines the construction of explicit error inhibiting block one-step methods (alternatively written as explicit general linear methods in Butcher's 1993 paper). These error inhibiting schemes are constructed so that the accumulation of the local truncation error over time is controlled, which results in a global error that is one order higher than the local truncation error. In this work, we delineate how to carefully choose the coefficient matrices so that the growth of the local truncation error is inhibited. We then use this theoretical understanding to construct several methods that have higher order global error than local truncation error, and demonstrate their enhanced order of accuracy on test cases. These methods demonstrate that the error inhibiting concept is realizable. Future work will further develop new error inhibiting methods and will analyze the computational efficiency and linear stability properties of these methods.