

Parallelizing Internal Stages in High-Order Two-Derivative DIRK Methods with applications

Julius Ehigie

University of Lagos

In this talk, I will present the construction of new classes of efficient, high-order two-derivative Diagonally Implicit Runge-Kutta (DIRK) schemes for the numerical solution of differential equations. The order conditions, up to order six, are formulated using a set of bi-coloured rooted trees, alongside the derivation of new elementary weights. In particular, I introduce a family of two-stage fourth-order, fifth-order, and three-stage sixth-order schemes. These methods exhibit superconvergence and thus offer significant potential for improved accuracy. The stability and phase-lag properties of the schemes are analysed and discussed. Furthermore, I present numerical experiments on benchmark problems to demonstrate the performance of the new methods. Lastly, I propose an idea for a parallel computing architecture for implementing the internal stages of these class of methods, whereby the s internal stages can be executed concurrently on s parallel processors.