Implementation Schemes for Two-stage Gauss Method

R. Vigneswaran[†] and M. Khokulan

Department of Mathematics and Statistics, University of Jaffna, Sri Lanka
[†]vicky@jfn.ac.lk

Abstract: Various iteration schemes have been proposed to solve the non-linear equations arising in the implementation of implicit Runge-Kutta methods. In more general scheme, when applied to an s-stage Runge-Kutta method, each step of the iteration requires s function evaluations and s sets of linear equations to be solved. Convergence rates were obtained when applied to the scalar differential equation $x' = qx$. The convergence rate of this scheme is further investigated by forcing the spectral radius $\rho[M(z)]$ of the iteration matrix $M(z)$ to be zero at $z = 0$, to be zero at $z = \infty$ and to be zero at $z = 0$ and $z = \infty$, where $z = hq$ and h is the fixed step-size. The respective optimal parameters of the improved schemes are obtained for two stage Gauss method. Numerical experiments are carried out to evaluate and compare the efficiency of the new schemes and the original scheme.

Keywords: Implementation, Implicit Runge-Kutta methods, Rate of convergence, Stiff systems