Runge-Kutta type methods for directly solving special fourth-order ordinary differential equations

ABSTRACT

A Runge-Kutta type method for directly solving special fourth-order ordinary differential equations (ODEs) which is denoted by RKFD method is constructed. The order conditions of RKFD method up to order five are derived; based on the order conditions, three-stage fourth- and fifth-order Runge-Kutta type methods are constructed. Zero-stability of the RKFD method is proven. Numerical results obtained are compared with the existing Runge-Kutta methods in the scientific literature after reducing the problems into a system of first-order ODEs and solving them. Numerical results are presented to illustrate the robustness and competency of the new methods in terms of accuracy and number of function evaluations.