

Construction of improved Runge-Kutta Nystrom method for solving second-order ordinary differential equations

ABSTRACT

Improved Runge-Kutta Nystrom (IRKN) method for the numerical solution of second-order ordinary differential equations is constructed. The scheme arises from the classical Runge-Kutta Nystrom method also can be considered as two step method. IRKN methods require less number of stages which lead to less number of function evaluations per step, compared with the existing Runge-Kutta Nystrom (RKN) methods. Therefore, the methods are computationally more efficient at achieving the higher order of local accuracy. The algebraic order conditions of the method using the Taylor's series expansion are obtained and the methods of order 3, 4 and 5 are derived. The stability properties of method are discussed and numerical examples are given to show the efficiency of the proposed methods compared to the existing RKN methods.

Keyword: Improved Runge-Kutta Nystrom method; Runge-Kutta Nystrom method; Second-order ordinary differential equations; Algebraic order conditions