

Direct integration of the third-order two point and multipoint Robin type boundary value problems

ABSTRACT

This numerical study exclusively focused on the direct two point diagonally multistep block method of order four (2DDM4) in the form of Adams-type formulas. The proposed predictor–corrector scheme was applied in this study to compute two equally spaced numerical solutions for the third-order two point and multipoint boundary value problems (BVPs) subject to Robin boundary conditions concurrently at each step. The optimization of the computational costs was taken into consideration by not resolving the equation into a set of first-order differential equations. Instead, its implementation involved the use of shooting technique, which included the Newton divided difference formula employed for the iterative part, for the estimation of the initial guess. Apart from studying the local truncation error, the study also included the method analysis, including the order, stability, and convergence. The results of eight numerical problems demonstrated and highlighted competitive computational cost attained by the scheme, as compared to the existing method.

Keyword: Boundary value problems; Linear multistep method; Robin boundary conditions; Shooting method; Third-order differential equations