

An Improved Symmetric Numerical Approach for Systems of Second-Order Two-Point BVPs

ABSTRACT

This study deals with the numerical solution of a class of linear systems of second-order boundary value problems (BVPs) using a new symmetric cubic B-spline method (NCBM). This is a typical cubic B-spline collocation method powered by new approximations for second-order derivatives. The flexibility and high order precision of B-spline functions allow them to approximate the answers. These functions have a symmetrical property. The new second-order approximation plays an important role in producing more accurate results up to a fifth-order accuracy. To verify the proposed method's accuracy, it is tested on three linear systems of ordinary differential equations with multiple step sizes. The numerical findings by the present method are quite similar to the exact solutions available in the literature. We discovered that when the step size decreased, the computational errors decreased, resulting in better precision. In addition, details of maximum errors are investigated. Moreover, simple implementation and straightforward computations are the main advantages of the offered method. This method yields improved results, even if it does not require using free parameters. Thus, it can be concluded that the offered scheme is reliable and efficient.