

Application of conjugate gradient method with cubic non-polynomial spline scheme for solving two-point boundary value problems

Abstract

Objective - Conjugate Gradient (CG) method is used to solve two-point boundary value problems together with non-polynomial spline approach at cubic degree.

Methodology/Technique - To develop a system of linear equations in a matrix form, cubic non-polynomial splines are used to discretize the two-point boundary value problems so that the approximation can be computed using CG method. Since many previous researchers attempt to obtain the approximate solution for the two-point boundary value-problems at different degree of non-polynomial splines only, then the present paper aims to look into method which is best used with the cubic non-polynomial splines in order to approximate the solution of these problem

Findings - According to the performance analysis results in term of iterations number, execution time and maximum absolute error at different grid sizes, the application of CG method together with the cubic non-polynomial spline give the best approximation to the solution of two-point boundary value problems compared to the approximation shown by Successive Over Relaxation (SOR) method and Gauss-Seidel (GS) method.

Novelty - the performance of CG iterative method is found to be superior in respect of iterations number, execution time and maximum absolute error on various grid sizes.