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ABSTRACT

The numerical approximation for the solution of ordinary differential equations played an important role in Numerical Analysis and still continues to be an active field of research. The analytical solution of these differential equations may or may not be known. In a large number of cases it is possible to solve them numerically. One of the reasons is that numerical methods can give the solution when analytical methods fail.

The present thesis entitled "***Numerical Solution of Boundary Value Problems***" is devoted to the study of non-polynomial splines. The research work presented in this thesis consists of seven chapters. The chapter-wise summary is given herewith:

Chapter 1 contains historical note and literature survey of splines. Brief introduction of second, fourth and sixth-order boundary value problems are given. Finite difference methods have also been given. Some useful properties of band matrices are given.The existence and uniqueness theorems are also given. The review of spline functions namely cubic, quartic, quintic, sextic and septic spline functions along with few useful relations have been given.

In Chapter 2, we develop a generalized scheme based on non-polynomial sextic spline for the numerical solution of second-order singularly perturbed two-point boundary value problems. The proposed method is second, fourth and sixth-order accurate. Convergence analysis of the fourth-order method is briefly discussed. Numerical examples are given to illustrate the efficiency of our methods.

In Chapter 3, non-polynomial sextic spline function is applied to the numerical solution of a linear fourth-order two-point boundary value problems occurring in a plate deflection theory. We have developed a non-polynomial sextic spline. Direct methods of order two, four and six have been obtained. Numerical results are provided to demonstrate the superiority of our methods.

In Chapter 4, exponential sextic spline function is developed for the numerical solution of fourth-order nonlinear two-point boundary value problems. Convergence analysis of methods have been discussed. The proposed method is tested on three nonlinear problems.

In Chapter 5, we developed non-polynomial septic spline function for numerical solution of fourth-order two-point boundary-value problems. Direct methods of second, fourth and sixth order are developed. Three numerical examples are given to demonstrate the practical usefulness and efficiency of our methods.

In Chapter 6, Parametric septic spline have been used for the solution of linear sixth-order two-point boundary value problems. Convergence analysis of the method is discussed. Three numerical examples are given to illustrate the practical applicability and efficiency of our methods.

In Chapter 7, a family of numerical methods is developed for solution of nonlinear sixth-order two-point boundary value problems using parametric septic spline. Three numerical examples are given to illustrate the practical applicability and efficiency of our methods.

At last, a comprehensive bibliography has been given which covers the references of the present thesis.