PREFACE

Many problems in engineering and science can be formulated in terms of differential equations. In the study of path of electron, propogation of waves, flow of heat, etc we need the numerical solution of ordinary or partial differential equations. The vast majority of equations encountered in practice cannot however, be solved analytically and recourse must necessarily be made to numerical methods.

The origin of numerical solution of differential equation goes back to Bashforth and Adam(1882), Cowell Cromelin(1909) and F.R.Moulton (1921). Now adays a lot of reasurch is going on R-K methods.

There exists a class of equations which have no analytical solution or very difficult to obtain analytical solution. These problems can be made simple using numerical methods and approximate solutions are obtained. The natural idea for numerical methods for solving differential equations is to replace the derivatives by differences and then solve the resulting difference equations. The existance of large number of methods, each having special adventages and stability analysis, thus it is difficult to select a particular method with respect to use of computer.

In this dissertation we will explain some methods of solving ordinary differential equations and partial differential equations (P.D.E.). At the end we discussed some programs for solving initial value differential equations in Pascal.

Chapter I provides an introduction to numerical solution of ordinary differential equations and discussed its necessaty. Next, we give basic explanation of some related topics. Also this artical contains some basic definations and statements of theorems which are used in this dissertation.

Chapter II presents an extensive study of R-K methods. It contians derivations of second order and third order R-K methods. Next, we discussed convergence and stability analysis of these methods, also the same for fourth order R-K method. In this article, we also include R-K meth for higher order differential equations as $y'' = f(t,y,y')$. Also we developed adaptive numerical methods which include R-K-Treanor method for ordinary differential equations an R-K-Nystrom-Treanor method with stability for the second order differential equation $y'' = f(t,y)$ (i.e.independent of y').

Chapter III goes to multistep methods for solution of ordinary differential equations which includes explicit multistep methods. This contians the Adams-Bashforth formula and Nystrom formula. We discussed completely the stability analysis and convergence of Adams-Bashforth formula of order three. This artical contains extrapolation method. Here we explained Richardson extrapolation, Euler extrapolation methods and stability of Euler's method. This article ends with comparison of above methods.

One of the most rapidly expanding area of numerical analysis is that which deals with the approximate solution of partial differential equations. Thus solution of P.D.E. using numerical methods is included in chapter IV. In this explained the classification of P.D.E., also the difference method for parabolic partial differential equations. Thi contains Schmidt, Laasonen, Crank- Nicolson and Richardsc methods. We also discussed stability and convergence analysis of Schmidt and Crank-Nicolson method.

Today, high speed computers are used for solving problems of physical, chemical, electrical etc. Thus computer implementation of the numrical methods of solution of differential equations are essential. We prepared programs in pascal for some selected methods of solution of differential equations, which ends this article.

At the end references are given. These are arranged in alphabetical order. In text these are referred and * represents the published papers which are referred.