SYNOPSIS

The present text is the synopsis of the thesis entitled “E-VALUE-VECTOR ANALYSIS OF LINEAR AND NONLINEAR DIFFERENTIAL SYSTEM” to be submitted to the Veer Narmad South Gujarat University, Surat for the award of Ph.D. degree in the subject of mathematics.

The present study emphasizes the use of Eigenvalues and Eigenvectors of linear and nonlinear differential equations. In the real world, there exist many situations which can be modeled in the form of differential system. In the study of such problems mathematics plays a vital role. Especially, the study of e-value and e-vector with respect to stability and convergence view point. This differential system is either in linear or in nonlinear form. Eigenvalues is very important role of checking stability of system. The thesis demonstrates a method of finding stability of some real world problem using eigenvalues.

The thesis comprises of six chapters. The first chapter represents a general discussion about Eigenvalues and Eigenvectors. We discuss the estimation of eigenvalues of matrices and derive the formula for eigenvalues of complex matrices that lies in closed disks. Numerical examples are provided which will show the effectiveness of our results. In the last section of this chapter we discuss about the eigenvalues of infinite matrices.

The second chapter gives a discussion of eigenvalue problems for system of linear and nonlinear differential equations. Eigenvalues of system is more important for stability concepts, which are discuss in following chapters.
In the third chapter, we discuss about the stability theory of linear and nonlinear differential equations. Consider problems of stability of differential equations. We study the existence of eigenvalue for differential system. Derive system of homogeneous and nonhomogeneous differential equations in terms of eigenvalue problems $Av = \lambda v$, where A is $n^2$ matrix which can be in the Jordan canonical form which leads to complete solution of differential equation. On this solution, check the stability of differential system.

Chapter four demonstrates linearization of nonlinear differential equations. Here, we show how to perform linearization of systems described by nonlinear differential equations. The procedure introduced is based on the Taylor’s series expansion and on knowledge of Jacobian linearization process. We develop linear differential equation by a specific point, called an equilibrium point.

Finally, the fifth chapter is the shark-fish model, In that we check the stability of the same. Predator prey model for scientific problem has been formulated. Shark fish predator-prey model for the differential equations is defined. In order to check the system’s stability, eigenvalues are required for that a set of equilibriums points are discussed.

In the sixth chapter, we discuss the basic introduction on head lice problem and find the differential equations related to our assumption. Solve the differential equation by using equilibrium points and checked the stability of differential system by eigenvalues analysis. Finally, we will find the solution of differential system.
The present work justifies the application of eigenvalues. We conclude that, on the base of eigenvalues we can check the stability of differential system. Thus the wide applicability of eigenvalues is sought in this thesis.