PREFACE

Optimization is not only important in its own right, but also integral to many applied sciences such as operations research, management sciences, economics and finance, and all branches of math-oriented engineering. It provides a unique insight into any situation. Optimization introduces a computational situation where the goal is to obtain the best of all possible circumstances. Also, optimization techniques assist us in finding the best under prespecified circumstances. Essentially, the optimization is used to detect, characterize and compute the maxima or minima of a function for a set of acceptable points and certain predefined conditions.

The mode of optimization is not just confined to the mathematical arena. Optimization methods can be applied in many spheres of study to find solutions that maximize or minimize some study parameters, such as in producing a good or service, minimizing the cost of production, and maximizing profits. Such instances often have special structures: convex, nonconvex, linear, nonlinear, quadratic, semidefinite, dynamic, integer, stochastic programming, etc. Optimization is the source of vast theoretical foundations and advanced algorithms. Mathematically, identification of the solution is the essence of optimization, i.e., The minimization or maximization of a function or a set of functions in conjunction with a set of constraints, regardless of the number of decision variables.

This thesis describes a study of various optimization methods to solve GNEPs. Also in Chapter 5, we have proposed an extended KKT condition, so that in the future we can solve an interval-valued GNEPs This thesis is organized as follows.

Chapter 1 begins with the introduction to GNEP. Then, a literature review of GNEPs will be provided. After that, we derive KKT conditions for GNEP. Further, a discussion on GNEP reformations will be provided.

In Chapter 2, a study of a globally convergent improved BFGS method to solve GNEP is discussed. The author has solved GNEP by using two versions of the improved BFGS method by considering two inexact line search techniques: the Armijo-Goldstein line search technique and the MWWP line search technique. The algorithmic implementation and convergence analysis of the method with an estimate of the number of iterations to reach an ϵ-precise solution is provided. A performance comparison between the proposed methods is provided on some numerical problems.

Chapter 3 analyzes two types of GNEPs: player convex GNEP and jointly convex GNEP by considering the nonsmooth GNEP reformulation. The author solves both types of GNEPs by an inexact Newton method. The global convergence of the proposed method is also shown under some mild conditions. The numerical performances of the inexact Newtone method have been provided.

In Chapter 4, the author proposes an improved nonmonotone adaptive trust region (INATR) method to solve a constrained nonlinear system of equations, and uses this to solve GNEPs. The proposed optimization method converges globally. The numerical performance of INATR method with nonmonotone trust region (NTR) method and monotone trust region (MTR) method has been provided.

In Chapter 5, the author proposes extended first Gordan's theorem, extended second Gordan's theorem, and extended Fritz John condition for interval optimization problems. After that, the author proposes extended Karush-Kuhn-Tucker conditions for interval optimization problems and discusses its application to Support Vector Machines (SVM).

Finally, in Chapter 6, we conclude the thesis with some suggestions for future work.