Abstract

Multiobjective optimization emerges as a powerful strategy for addressing complex real-world problems where multiple objectives require simultaneous optimization. Realistic multiobjective optimization situations often involve conflicting objectives. Thus, rather than seeking a single optimal solution, multiple efficient solutions termed non-inferior or Pareto optimal solutions come to the fore. This thesis proposes some new trust region techniques to approximate the set of Pareto critical points in nonlinear multiobjective optimization problems. These approaches determine the descent direction at each iteration point by solving subproblems, which take care of the linear or quadratic approximations of the objective functions and constraint functions of the original problem. The convergence of each algorithm is analyzed and significant attention is dedicated to the numerical experiment of the algorithms in a set of test problems. The thesis investigates the following trust region concepts in different chapters.

- Adaptive trust region scheme using Geršgorin circle theorem.
- Trust region strategy aimed at creating evenly distributed Pareto fronts.
- Trust region scheme for constrained multiobjective optimization problems with equality and inequality constraints.
- Sequential quadratic approach in trust region algorithms.
- Performance profiles of the algorithms.

Keywords: Multiobjective optimization, Efficient solution, Mangasarian-Fromovitz constraint qualification, Slater constraint qualification, Trust region method, KKT optimality conditions, Purity metric, Spread metrics, Hypervolume metric.