Abstract of the Thesis

Title: SOME NEW LINE SEARCH TECHNIQUES FOR NONLINEAR MULTI-OBJECTIVE OPTIMIZATION PROBLEMS

In this thesis some new line search techniques are developed for nonlinear multi-objective optimization problems. These methods are free from any kind of priori chosen scalars or ordering information of objective functions as accepted in scalarization methods. The basic structure of these methods rests on the derivation of the descent direction of the optimization problem at every iterating point through subproblems. These subproblems use linear/quadratic approximation of the original problem. A non-differentiable penalty function is used in the constrained multi-objective optimization problems to restrict constraint violations. Convergence of each method is justified under some mild assumptions. Following line search techniques are explored in the thesis.

- Modified quasi-Newton method for unconstrained multi-objective optimization problems.
- A globally convergent sequential quadratic programming (SQP) method for nonlinear inequality constrained multi-objective optimization problems.
- A sequential quadratically constrained quadratic programming (SQCQP) based method for nonlinear inequality constrained multi-objective optimization problems.
- Modified SQCQP method for nonlinear inequality constrained multi-objective optimization problems.

The modified qausi-Newton method is restricted to unconstrained multi-objective optimization problems, whereas other three methods are explored for constrained case. In SQP and SQCQP methods approximated Pareto fronts are developed. Towards the end of the thesis a new technique is developed for selecting initial points to ensure the spreading of Pareto front. All the methodologies are illustrated and compared with existing methods through various test problems. It is observed that these methods provide better result in most of the test problems.

Keywords: multi-objective optimization, efficient solution, Mangasarian-Fromovitz constraint qualification, Slater constraint qualification, SQP method, SQCQP method, KKT optimality condition, purity metric, spread metrics, hypervolume metric.