Abstract

Modern age research interest in numerical optimization centers on developing efficient line search techniques for solving the nonlinear optimization problems. Most of these techniques include variants of the Newton method that exploit the Hessian matrix. This thesis develops some new line search techniques which take care Hessian modification for the purpose of either getting rapid convergence to the solution or relaxing the derivative for computational ease. The line search technique towards the end of the thesis paves a path for new schemes with derivative free conditions.

The thesis starts with positive definite modification of Hessian matrices, followed by two-phase implementation of Hessian matrices as modified Newton and quasi-Newton schemes for both unconstrained and constrained optimization problems. Next, a modification of the Hessian matrix through q-derivative is used that takes less information about the derivative of the function. Finally a line search scheme is introduced which completely avoids the derivative-information. Every methodology of this thesis is supported by a set of numerical examples and compared with existing methods.

Keywords: Line search techniques, Newton-like methods, Descent direction, Geršgorin's disc, Positive definite modification, Cubic order convergence, Quasi-Newton directions, Superlinear convergence, Merit function, q-derivative, Coordinate search, Axes rotation, Stencil expansion, Global convergence.