COMBINED METHODS FOR NONLINEAR PROGRAMMING

BY

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SYNOPSIS

In recent past there has been a considerable growth in the developments of optimum seeking methods for the general nonlinear programming problem (P)

$$
\begin{aligned}
(P) \qquad & \text{minimize} \quad f(x) \\
& \text{subject to} \quad h(x) = 0 \\
& \text{and} \qquad g(x) \leqslant 0,
\end{aligned}
$$

where $x \in R^n$, $f : R^n \to R$, $h : R^n \to R^m$ and $g : R^n \to R^p$.

Many computational techniques have been invented for solving (P); usually if the first order derivatives of the problem functions are available, the gradient related methods are generally favoured.

The dissertation analyses the methods for solving (P) that are relatively new. The aim of the dissertation is to study some combinations of the existing algorithms. The algorithms proposed here attempts to obviate the disadvantages of a certain algorithm by combining it with another.

A brief outline of the work follows as under :

The review of relevant past research on the methods of reduced gradient and penalty function approach for solving (P) is given in the two sections of the introductory chapter.

In the second chapter we consider a mixed nonlinear and linear programming problem. The motivation of the method presented in this chapter being that the transformation methods which convert a constrained problem into an unconstrained one generally destroy the structure of the problem. Movements in a nonlinear constraint manifold involve great difficulties where as efficient procedure exist for tackling the linear constraints. This chapter aims to preserve the highly effective simplex like method of working with the linear constraints while absorbing the nonlinear constraints in the penalty objective. An analysis of the method is developed which proves that the generated sequence of points converge to the local minima of the mixed problem considered. Some numerical examples are worked out to illustrate the procedure.

The third chapter deals with the method for solving (P) which combines the generalised reduced gradient technique and the penalty function approach. The restoration of feasibility at each iteration in the reduced gradient method for solving (P) causes a major difficulty in the sense that one requires solving a system of nonlinear equations. A combination of steepest descent and Newton's method has been used in this algorithm. Newton's move is particularly designed to approach the feasible region. The cannonical local rate of convergence has been established.

The chapter four discusses and reviews the differential descent method for unconstrained minimization.

The chapter five incorporates constraints in the differential descent methods through reduced gradient. This leads to a reduced differential descent method for minimization.

After giving a brief summary of the exact penalty function method in chapter six, we propose a new method based on the exact penalty function approach.

Chapter seven marks the conclusion of the thesis with indication of its performance, the scope and limitation of the present work.