Russian Mathematics (Iz. VUZ)
Vol. 42, No. 12, pp.47–54, 1998

Izvestiya VUZ. Matematika
UDC 519.853

METHOD OF EXTERIOR CENTERS WITH USE OF ADDUCED GRADIENT FOR THE PROBLEM OF NONLINEAR PROGRAMMING

V.S. Izhutkin and A.V. Blinov

Introduction

We consider the problem

$$\min\{f_0(x),\ x \in \Omega\}, \quad \Omega = \{x \in E^n \mid f_j(x) \le 0,\ j \in J\}, \tag{1}$$

where E^n is an n-dimensional Euclidean space, J is a finite set of indices, the functions $f_j(x)$ are from $C^{(2)}(E^n)$, $j \in J \cup \{0\}$.

By a solution of problem (1) we shall mean a point x_* satisfying necessary conditions of a minimum of first order: numbers $\lambda_*^j \ge 0$, $j \in J$, exist such that

$$f_0'(x_*) + \sum_{j \in J} \lambda_*^j f_j'(x_*) = 0, \quad \lambda_*^j f_j(x_*) = 0, \quad j \in J, \ \ x \in \Omega. \tag{2}$$

In [1], [2], a united scheme of construction and investigation of method for solving problem (1) was offered, based on the use of an "adduced" direction in the capacity of the motion direction at a current iteration point and application of various penalty functions for the choice of step's length.

Within the framework of the united scheme both known and new methods of exact (see [1]) and differentiable penalty functions (see [3]) were realized, as well as methods of possible directions (see [2]) and the modified Lagrange functions (see [4]), method of centers and barrier functions (see [5]).

In the present article we suggest to use in the capacity of the payoff function the exterior distance function (see [6], p. 84)

$$\Phi_\beta(x) = ((f_0(x) - \beta)^+)^2 + \sum_{j \in J} (f_j^+(x))^2, \quad y^+ = \max\{0, y\}, \tag{3}$$

realizing within the framework of the united scheme both the known and new methods of centers. Here β is penalty parameter. Let us note that function (3) was applied earlier by many authors in the methods of loaded functions.

1. Method of exterior center

The set

$$J_0(x) = \{j \in J \mid f_j(x) \ge 0\}$$

will be called the index set of "working" constraints.

Let the following conditions be fulfilled.

Supported by Russian Foundation for Basic Research (97-01-00680).