METHODS OF SOLVING THE STOCHASTIC PROGRAMMING PROBLEMS WITH QUANTILE CRITERION

A.I. Kibzun

Moscow Aviation Institute
e-mail: kibzun@mail.ru

Many applied problems are described by notions of the stochastic programming (see [1]). The average value of a loss function is the traditional criterion for stochastic problems. However, this criterion does not correspond often to the real problem. For example, the similar situation arises when we should guarantee the high precision of the control with a given probability (see [2]). In this case, the quantile criterion (VaR-criterion) is more adequate (see [3]). But the quantile criterion is more complicated than the criterion in the form of the expectation.
The paper suggests two algorithms for solving a quantile optimization problem in the two-stage statement. A strategy is chosen at the first stage. After that some random event is realized, whose unfavourable influence is corrected by the second stage strategy. In this case, the quantile function is the optimality criterion. The special case is considered, in which the loss function is bilinear, i.e. the one is linear in the strategies and random vector, separately. The random vector has the normal distribution.
The first algorithm is based on discretization of Gaussian measure and on the reduction of the problem to a mixed integer linear programming problem. In order to decrease the computer time the confidence method (see [3]) and the notion of the probability measure kernel are used. The second algorithm is also based on the confidence method. But the problem is reduced to solving a sequence of convex programming subproblems which are parameterized by a scalar parameter. The Monte Carlo method and properties of Gaussian measure kernel are used to check the probabilistic constraints that arise in the process of solving the subproblems. Opportunities of both the algorithms are illustrated by an example.

REFERENCES

1. D.B. Yudin *Problems and Methods of Stochastic Programming.* Moscow, Sovetskoe Radio, 1979, [in Russian].
2. V.V. Malyshev and A.I. Kibzun *Analysis and Synthesis of High Precision Control of Aircraft.* Moscow, Mashinostoenie, 1987, [in Russian].
3. A.I. Kibzun and Yu.S. Kan *Stochastic Programming Problems with Probability and Quantile Functions.* Chichester, Wiley, 1996.