On quasirandom search

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# Introduction

This paper looks at a combination of methods for finding the global extremum of a function of several variables: the simulated annealing method[1] and the stochastic gradient descent method[2]. The simulated annealing method gives an initial approximation for the global extremum and the stochastic gradient descent method yields its more precise value. For a more complete study (given the same number of calculations) of the function's domain, quasirandom numbers are used instead of pseudorandom numbers[3]. A modified method of simulated annealing, as it's described in [4], is also used. This modification uses the fact that a function , as , converges to a function concentrated at the global extremum of ; where can have several equivalent extrema. To illustrate this algorithm's operation, a problem of regression experiment planning was chosen — finding the D-optimal experimental designs.

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**References**

[1] Kirkpatrick S., Gelatt Jr. C.D., Vecchi M.P. Optimization by Simulated Annealing // Science, 1983, vol. 220, issue 4598, pp. 671-680

[2] Vapnik V. The Nature of Statistical Learning Theory. Information Science and Statistics. Springer Verlag, 2000

[3] Ermakov S.M. On the Halton quasi-random sequences randomization // Vestnik SPbSU. Mathematics. Mechanics. Astronomy, 2017, vol. 4 (62),
Issue 4, pp. 570–576.

[4] Ermakov S.M., Kulikov D.V., Leora S.N. Towards the analysis of the simulated annealing method in the multiextremal case // Vestnik SPbSU. Mathematics. Mechanics. Astronomy, 2017, vol. 4 (62), issue 2, pp. 220–226.

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