NON-LOCAL METHODS OF SOLUTIONS OF LINEAR-QUADRATIC OPTIMAL CONTROL PROBLEM

E. V. Aksenyushkina

Baikal National University of Economics and Law, Irkutsk
e-mail: aks.ev@mail.ru

The talk views the convex linear-quadratic problem

$$\Phi(u) = \langle c, x(t_1)\rangle + \frac{1}{2}\langle x(t_1), Dx(t_1)\rangle + \frac{1}{2}\int_T (\langle x(t), Q(t)x(t)\rangle + u^2(t))dt,$$

$$\dot{x} = A(t)x + b(t)u, \quad x(t_0) = x^0,$$

$$V = \{u(\cdot) \in PC(T): \ u(t) \in [u^-, \ u^+], \ \ t \in T\}.$$

For this task we present two independent methods of improvement of admissible controls, similar in complexity of realization (the price of one improvement - two of the Cauchy problem). It turns out that both methods can be naturally joined and get a combined method, which is within the same complexity provides dual improvement in functionality (the price of each improvement is one of the Cauchy problem). This method seems to be the most effective procedure of the numerical solution of the task.

Let k-iteration have the valid process $(u^k(t), x^k(t))$, $t \in T$. We will find the solution $p^k(t), \ t \in T$ with a combined system, together with the interim control

$$\dot{p} = -A(t)^T p + Q(t)x^k(t) - \Psi(t)b(t)(u_*(p,t) - u^k(t)),$$

$$p(t_1) = -c - Dx^k(t_1),$$

$$v^k(t) = u_*(p^k(t), t), \quad t \in T.$$

From the vector-function and auxiliary control

$$p(t, v^k, x) = p^k(t) + \Psi(t)(x - x^k(t)),$$

$$w^k(x,t) = u_*(p(t, v^k, x), t).$$

We will find the solution $x^{k+1}(t), \ t \in T$ of the phase system in conjunction with the control

$$u^{k+1}(t) = w^k(x^{k+1}(t), t), \quad t \in T.$$

The iteration is completed.

Thus, the iteration process of the combined method results in double improvement in the functional $\Phi(u^{k+1}) \leq \Phi(v^k) \leq \Phi(u^k)$, and each improvement comes at the price of one solution of the Cauchy problem.

LITERATURE

1. A.V. Arguchintsev *Optimal control: nonlocal conditions, computational methods, and the variational maximum principle* / A.V. Arguchintsev, V.A. Dykhta, V.A. Srochko — Izv. universities. Mathematics. — 2009, № 1, c. 3-43.
2. V.A. Srochko *Iterative methods for solving problems of optimal control*, M.: FIZMATLIT, 2000, 160 c.