An algorithm of adaptive $\epsilon$-minimax control for pursuit-evasion in discrete convex dynamical systems with several pursuers

Andrei F. Shorikov

Department of Information Systems in Economics, Urals State University of Economics, Russia [shorikov@usue.ru]

2000 Mathematics Subject Classification. 91 A50, 91 A06

In this report we consider the problem of adaptive $\epsilon$-minimax control for the pursuit-evasion process with incomplete information [1]–[4] in the class of convex discrete dynamical systems consisting of several controlled objects. Each object $I_j, j \in \{1, 2, \ldots, n\} = \overline{1,n}$ controlled by $n$ pursuers $P_j$ and the object $II$ controlled by the evader $E$ have a dynamics described by convex discrete recurrent vector equations. It is assumed that each pursuer $P_j$ knows the values of past realizations of his control impact on the object $I_j$. He also knows past realizations of the available information signal about the object $II$, which is measured with an error generated by a convex discrete vector equation. Moreover, the pursuer $P_j$ is informed about sets that restrict the changes of all a priori indeterminate parameters that describe the dynamics of the objects $I_j$ and $II$, and the input of the corresponding information signal. Each of these sets is assumed to be a convex, closed, and bounded polyhedron (with a finite number of vertices) in the corresponding Euclidean space. We also assume that there exists a participant $P$, a general coordinator of pursuit, who knows all the information known to the pursuers $P_j, j \in \overline{1,n}$, and that, at any moment of time, he can tell to any of them the values of state vectors of object $II$. To realize the $\epsilon$-minimax pursuit control for any fixed number $\epsilon > 0$ in a chosen family of admissible strategies of adaptive controls, we propose a finite recurrent algorithm, each step of which is based on the realization of a process of posterior $\epsilon$-minimax nonlinear filtration [3] and on solving some problems of linear and convex programming. The results obtained in this report are based on the works [1]–[4] and can be used in the computer modeling of real dynamical process and in the optimal design of navigation and control devices for different transportation systems.

This work was supported by the Russian Foundation for Basic research, project no. 04-01-00059.


