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OPTIMIZATION OF CONFLICT-CONTROLLED PROCESSES

Annotation. The paper deals with the game problem on approaching the cylindrical terminal set by a trajectory of the quasi-linear system. Concepts of upper, lower and matrix resolving functions are introduced in the form of selections of special set-valued mappings.

Key words: conflict-controlled process, set-valued mapping, Pontryagin's condition, resolving function, Aumann's integral.

The paper concerns quasi-linear conflict-controlled processes which are exposed to simultaneous action of continuous and impulse controls of two counteracting sides. The terminal set is assumed to be cylindrical. The game is analyzed standing on the side of the first player who strives to steer a process trajectory to the terminal set. Sufficient conditions are developed, providing realization of the pursuer's goal in some guaranteed time under any counteraction of the second player. In constructing his control the pursuer employs control prehistory of the second player or current instantaneous values of his control. Here the method of resolving functions is used as the basic method of investigation. The scheme of the method assumes Pontryagin's condition or some its modification to be fulfilled. On its basis special set-valued mapping and its support functions, named the resolving function, are built. Under the known current control of the second player the resolving function features quality of the first player game. In view of accumulative character of the game quality evaluation of the scheme, the first direct method can be expressed in its terms with the infinity as corresponding value of the resolving function [1, 2]. Also the functional form of the first direct method is given by the way of construction of special set-valued mappings and corresponding resolving functions. Comparison of the guaranteed times of the game termination is made for the above mentioned methods. The property for the joint LxB-measurability of the set-valued mappings and corresponding superpositional measurability of their selections make it feasible a measurable choice of continuous constituent of the first player control, analogously to the Fillipov-Castaing theorem. Corresponding condition for advantage concerning impact of impulse controls is also given. The cases of only continuous and only impulse controls of each player are analyzed separately as well as the case of impulse controls of both players. By construction, the resolving function is a key object of investigation and appears as the inverse Minkowski functional of certain set-valued mapping. This fact makes it possible to construct in analytic form the upper and the lower resolving functions for a wide class of conflict-controlled processes. This methodology is also developed for the matrix resolving functions [3]. Suggested scheme allows evaluation of the continuous and discrete controls quality in the game approach problems. The results are illustrated by the model examples.

References

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