

Punishment strategy in one pursuit game

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KeyWords: Time-mail optimal pursuit game, realizability area

ABSTRACT

We study a time-mail optimal model of pursuit. The game is supposed to be a nonzero-sum simple pursuit game between a pursuer and m evaders acting independently of each other. Here we assume that the evaders are discriminated and dictated the extremely disadvantageous behavior by the pursuer who has an element of punishment at his disposal. The aim of this paper is to find an equilibrium situation and to define the maximum number in participants of the game which can be kept in submission. We construct a realizability area of the punishment strategy for every evader and investigate different cases of its existence depending on different initial positions of the pursuer and evaders.

We came to the following conclusion: the Nash equilibrium which is extremely unfavorable for the evaders, is made and the conditions of its existence is analytically described. The areas, where the strategy of punishment of pursuer P is realizable are constructed. We found out that for two evaders ($m=2$) as well as for three ones ($m=3$) the realizability areas are never empty. In a case when $m>3$ it can happen to be not so and sometimes the punishment strategy is turned out to be realizable, but sometimes not. In other words, when $m>3$ (more than three evaders) the number of obedient evader depends on their initial positions and speeds. Experimentally we found out that in most of cases the maximal number of obedient evaders is equal nine. In reality keeping a large number of people in submission is practically impossible. As an example, the management by a company has a hierarchial structure based on a fact that each chief is able to control just several inferiors, otherwise, the industrial process would not be effective.

References

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