The importance of cooperation in a group pursuit game

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Abstract

A game of group pursuit in which players move on a plane with bounded velocities is considered. The game is supposed to be a nonzero-sum simple pursuit game between an evader and $m$ pursuers acting independent of each other. The case of complete information is studied. In other words, each player, choosing control variables at each time instant $t > 0$, knows the moment $t$ and his own as well as all other players’ positions. A new approach to finding a solution in these games for a case of two pursuers and one evader is proposed in [1]. The key point of the work is to construct some cooperative solutions of the game and compare them with non-cooperative solutions such as Nash equilibria. It is important to give a reasonable answer to the question if cooperation is profitable in differential pursuit games or not. We consider all possible coalitions of the players in the game. For example, each pursuer can promise some amount of the total payoff to the evader for cooperation with him. In that way, a cooperative game in characteristic function form is constructed. It is proved that in this game there exists the nonempty core for any initial positions of the players. However, in a dynamic game existence of the core at the initial moment of time is not sufficient to be accepted as a solution of the game. In the paper it is proved that the core in this game is time-consistent. A number of examples are given for consideration.

References