

A Nonzero-Sum Differential Game Model With Both
Competitive and Cooperative Strategy Variables

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ABSTRACT

A close look shows two ways for one player's decision on the strategy variables to affect the remaining players' objective functions. One player's myopic decision to increase his payoff for the others' strategies given may hurt the remaining players. This is the well-known prisoners' dilemma problem. We call this class of strategies 'competitive strategy'. Another class of strategies, which will be called 'cooperative strategy' in this paper, has the property that the players can manage to increase their payoffs without hurting the other players. An effort to increase one's payoff using the cooperative strategy variables helps the others' objectives as well as his own objective. This class of strategy variables causes the free-rider problem in a game situation. Most of studies in game theory were concerned with the first class of variables.

This paper is concerned with a problem incorporating both classes of variables. Our interest is to see how different the optimal strategies of a player controlling the two types of variables are under both the cooperative and noncooperative solution concepts. Several solution concepts appropriate for this problem will be introduced. In addition, the existence of Nash equilibrium is shown under certain conditions using the Kakutani theorem.