Trends in Applied Sciences Research, 2011
ISSN 1819-3579 / DOI: 10.3923/tasr.2011.

Honey Bees Foraging Optimization for Mixed Nash Equilibrium Estimation

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ABSTRACT

Concept of solving games is to find a set of equilibrant strategies in which, players have no interest to refuse it. In static games, strategies intended by players are unspecified and a player's pay-off is affected by other players' strategies. Thus, analyzing opponent's capabilities during decision making process is critical. It's clear that if the number of players or the cardinality of strategy sets increases, solving a game based on traditional approaches are impossible most of the times. Therefore, in this study a novel approach based on honey bees foraging optimization algorithms is proposed to solve static games with complete information to estimate pure and mixed Nash equilibrium. In proposed approach, equilibrium points of game are represented by food sources to be probed by honey bees in optimization process. To verify and validate method, several simulations are performed on some study cases. Simulation results prove that suggested approach generates more desirable solutions in precision and stability than other metaheuristics.

Key words: Game theory, honey bees foraging optimization algorithms, static games, mixed nash equilibrium

INTRODUCTION

Game theory is a branch of applied mathematics which has grown in context of economic science and took special place in various fields such as economy, biology, psychology, computer science, industry, political science, social science, philosophy, etc. Game theory has provided a framework for real world problems to be formulated as a game. A game is consisted of players set who can choose their actions among their strategy sets. The most important issue is that pay-off or result for each player is totally dependent on both his strategies as well as other players' strategies (Rasmusen, 2007; Navidi *et al*., 2011).

Depending on whether players are aware of opponent choices or not; players can play simultaneously or in turn; games are sorted out in to static and dynamic categories. Also based on various types of knowledge sharing among players, games can be classified in categories of games with complete information, games with incomplete information, symmetric and asymmetric games. During last decades, researchers have paid special attention to game theory that has led to introduce variety of games such as iterative games, bargain and signal games (Rasmusen, 2007; Navidi *et al*., 2011).