

Preface

Differential game refers to a kind of problem related to the modeling and analysis of conflict in the context of a dynamical system. More specifically, a state variable or variables evolved over time according to differential equations. It is a mathematical tool for solving the bilateral or multilateral problems in dynamic continuous conflicts, competition, or cooperation, which has been widely applied in the fields of military, industrial control, aeronautics and astronautics, environmental protection, marine fishing, economic management and the market competition, finance, insurance, etc.

This book is focused on the generalized Markov jump linear systems which is widely used in engineering and social science, using dynamic programming method and the Riccati equation method to study the dynamic non-cooperative differential game problems and its related applications. This book includes the following studies: the stochastic differential game of continuous-time and discrete-time Markov jump linear systems; the stochastic differential game of linear stochastic differential game of generalized Markov jump systems; the stochastic H_2/H_∞ robust control of generalized Markov jump systems; and the risk control of portfolio selection, European option pricing strategy, and the optimal investment problem of insurance companies. In addition, this book created a variety of mathematical game models to derive the explicit expression of equilibrium strategies, to enrich the theory of equilibrium analysis of dynamic non-cooperative differential game of generalized Markov jump systems. It is to analyze and solve the robust control problems of generalized Markov jump systems based on the game theory. The applications of these new theories and methods in finance and insurance fields were presented.

The main content is divided into the following six sections:

1. The introduction and basic knowledge

This section introduces the basic models and the latest research of generalized Markov jump systems, the research content of differential game theory of generalized Markov jump systems, and the related concepts of differential game theory.

2. The stochastic differential game of continuous-time Markov jump linear systems

From the perspective of stochastic LQ problem, this section studied the stochastic optimal control problem of continuous-time Markov jump linear systems, and then to extend study on the two-person Nash stochastic differential game problem, finally to explore the two person Stackelberg stochastic differential game problem, and to achieve the equilibrium solutions of various problems.

3. The stochastic differential game of discrete-time Markov jump linear systems

From the perspective of stochastic LQ problem, this section studied the stochastic optimal control problem of discrete-time Markov jump linear systems, and then to extend study on the two person Nash stochastic differential game problem, finally to explore the two person Stackelberg stochastic differential game problem, and to achieve the equilibrium solutions of various problems.

4. The stochastic differential game of generalized Markov jump linear systems

This part is to establish the following models: two person zero-sum stochastic differential game, two person nonzero-sum game, Nash game, Stackelberg game, to achieve the equilibrium solutions, and to obtain the explicit expressions of the equilibrium strategies.

5. The stochastic H_2/H_∞ control of generalized Markov jump linear systems

Based on Nash game and Stackelberg game, this part is to establish the Markov jump linear systems models, the stochastic H_2/H_∞ control of generalized Markov jump linear systems models, to achieve the mathematical expression of the optimal robust control.

6. The stochastic differential game of generalized Markov jump linear systems in the applications in the fields of finance and insurance

This part is to establish differential game models of the minimal risk control of portfolio selection, option pricing strategy, and the optimal investment of insurance companies. And regarding the probability measurements of the economic environment as a player, regarding the investors as another player, the differential game models are to achieve the optimal control equilibrium strategies by solving two person differential game problems.

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Counting on the References to the scholars quoted in the book, which make the fruitful base of our work!

Although we have made a lot of efforts for the completion of this book, due to the limited level, there must be a lot of shortcomings and deficiencies. Please to criticize and correct.

Guangzhou, China

Cheng-ke Zhang
Huai-nian Zhu
Hai-ying Zhou
Ning Bin

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Zhang, C.-k.; Zhou, H.-y.; Zhu, H.-n.; Bin, N.

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