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Editorial

Discrete Chaotic Dynamics for Economics and Social Science

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Discrete chaotic dynamical systems deal with the maps that are extremely sensitive to their initial conditions, which are known as the butterfly effect. The discrete chaotic dynamical systems are characterized by the existence of a positive Lyapunov exponent. It is well known that even a first-order discrete dynamical system can exhibit an astonishing variety of dynamical behaviors ranging from stable fixed points to chaotic regions. Discrete chaotic dynamical systems have emerged as an important field of research in science and engineering especially in areas such as biology, economics, cryptosystems, and secure communications.

This special issue is focused upon the modeling and applications of discrete chaotic dynamics in the two fields: economics and social science. In the research, several control algorithms and techniques have been developed to study and control the discrete control systems such as active control, adaptive control, backstepping control, sliding mode control, fuzzy logic control, artificial neural networks, and evolutionary algorithms.

This special issue also focuses on control methodologies for the discrete chaotic dynamics with applications for social and financial systems. This special issue contains five papers, the contents of which are summarized as follows.

"A Mathematical Model of Communication with Reputational Concerns" by C. Huang et al. investigates a mathematical model where an expert advises a decision maker for two periods. The decision maker is initially unsure about whether the expert is biased or not. After consulting the expert on the decision problem of period one, the decision maker updates belief about the expert's bias and consults the expert on the problem of period two. The authors show that more information is delivered in the model's first period than in the one-period situation of communication.

"Analysis and Control of the Complex Dynamics of a Multimarket Cournot Investment Game with Bounded Rationality" by L. Zhao introduces a dynamic multimarket Cournot model, which is based on a specific inverse demand function. Puu's incomplete information approach, as a realistic method, is used to contract the corresponding dynamical model under this function. Therefore, some stability analysis is carried out on the model to detect the stability and instability conditions of the system's Nash equilibrium. Based on the analysis, some dynamic phenomena such as bifurcation and chaos are found. Numerical simulations are used to provide experimental evidence for the complicated behaviors of the system evolution. It is observed that the equilibrium of the system can lose stability via flip bifurcation or Neimark-Sacker bifurcation and time-delayed feedback control is used to stabilize the chaotic behaviors of the system.

"The Government Incentive Regulation Model and Pricing Mechanism in Power Transmission and Distribution Market" by H. Zhang and J. Jiang derives new results in the power transmission and distribution market. The power transmission and distribution (T&D) market's natural monopoly and individual information have been the impediment to improve the energy efficiency in the whole T&D market. In order to improve the whole social welfare, T&D market should be controlled by government. An incentive regulation model with the target of maximizing social welfare has been studied. A list of contracts with transferring payment and quantity of T&D are given to motivate the corporation to reveal the true technical parameter and input the optimal investment. The corporate revenue, optimal investment, and effort are proved to depend on its own technical parameter. The part of incentive regulation model ends with the optimal pricing mechanism of T&D market. At the end of this paper, the authors also provide a numerical example to explain the main ideas of this research work and confirm its function graphically.

"Chaos Control on a Duopoly Game with Homogeneous Strategy" by M. Bai and Y. Gao investigates the dynamics of a nonlinear discrete-time duopoly game, where the players have homogenous knowledge on the market demand and decide their outputs based on adaptive expectation. The Nash equilibrium and its local stability are investigated. The numerical simulation results show that the model may exhibit chaotic phenomena. Quasiperiodicity is also found by setting the parameters at specific values. They demonstrate that the chaotic system can be stabilized to a stable state by using delayed feedback control method. The discussion of control strategy shows that the effect of both firms taking control method is better than that of single firm taking control method.

"Chaotic Synchronization of Modified Discrete-Time Tinkerbell Systems" by K. Ding and X. Xu studies the chaotic synchronization of chaotic modified discrete-time Tinkerbell systems. By constructing the Lyapunov function and using the linear feedback control, some synchronization criteria for modified discrete-time Tinkerbell systems are derived. The conservativeness characteristics of those synchronization criteria are compared. The effectiveness of derived results is demonstrated by six examples.

Of course, the selected topics and papers do not provide an exhaustive study of all areas of this special issue. Nonetheless, they represent rich many-faceted knowledge that we have the pleasure of sharing with the readers.

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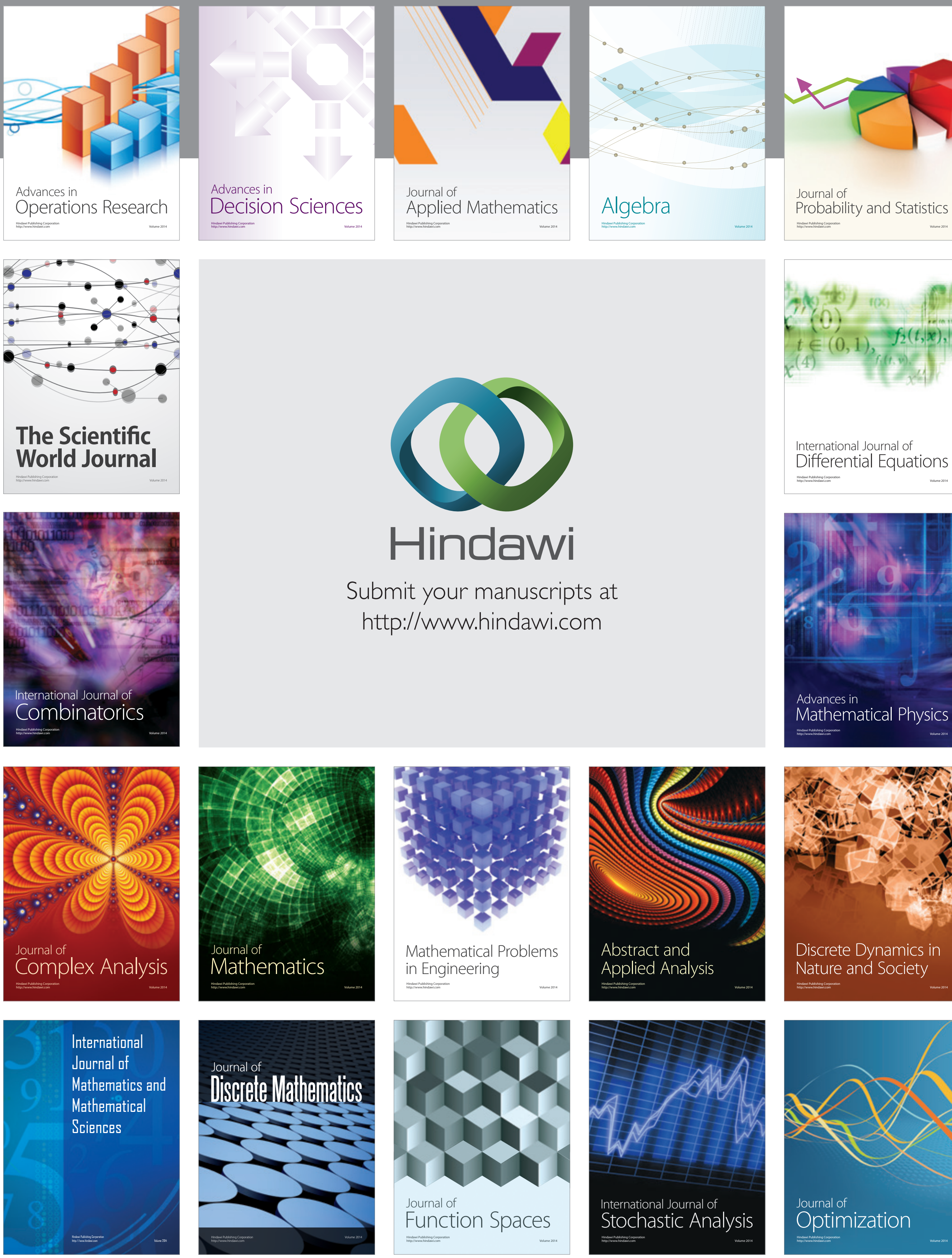
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