

# Foreword-Special Issue on Uncertain Theory and Application: Recent Development

**Xiang Li\*, Lixing Yang**

State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, Beijing, 100044, China

**Xiaowei Chen**

Department of Risk Management and Insurance, Nankai University, Tianjin 30071, China

\* Corresponding Author, E-mail: [lixiang@bjtu.edu.cn](mailto:lixiang@bjtu.edu.cn)

Real-world decision-making systems often exist numerous inherent and cognitive uncertainties. To handle these uncertainties, an efficient tool can be referred to as the probability theory if the size of sample data is sufficiently large. However, in reality, it is often difficult for a decision-maker to collect enough samples for the probability methodologies (even no-sample data). To efficiently handle this condition, Prof. Baoding Liu founded the uncertainty theory in 2007, in which uncertain variables and uncertain measure are defined as theoretical tools to describe and deal with uncertainties. As an important mathematical branch, up to now, uncertainty theory has been further developed by lots of researchers and successfully employed in a variety of real-world applications. In order to show the current state of uncertainty theory, this special issue intends to provide a platform to display the new developed researches in uncertainty theory and applications, such as management problems, economics, transportation problems, and so on.

Due to great interests to this special issue from a lot of researchers, a total of 20 papers have been received after we announced the Call-for-Paper in August, 2012. All these papers focus on investigating the theory and applications in the framework of uncertainty theory. After a rigorous review process, 8 papers are finally accepted to be published in this special issue. The paper by Xiaowei Chen and Jinwu Gao investigated some mathematical properties of uncertain differential equations. With the stability concepts, some sufficient and necessary conditions with respect to stability are proved for linear uncertain differential equations. The paper by Xiang Zhang *et al.* proposed two uncertain programming models to formulate a specific inverse minimum spanning tree problem with uncertain edge weights. The effectiveness of proposed models is verified by some numerical examples on a traffic network reconstruction problem. The paper by Shengguo Li *et al.* presented the concept of comonotonicity of uncertain vector on the basis of uncertainty theory, which is successfully applied to the premium pricing problems. The paper by Yufu Ning *et al.* proposed inventory models for fresh agriculture products, in which deterioration rate is supposed to be a time-varying function. The numerical results show the relationship of sale price and deterioration rate of fresh agriculture products. The paper by Deyi Mou *et al.* investigated a transportation problem with uncertain truck times and costs, and a solution method based on a stepwise optimization strategy is developed to solve the problem. The paper by Xingfang Zhang and Guangwu Meng investigated the methods of allocating ones fund to individuals in a higher school with a higher utility return based on theory of uncertain set, in which a genetic algorithm is designed to solve the problem. The paper by Chunxiao Zhao and Congrong Guo discussed the optimal age replacement policies on the basis of uncertain renewal process. Some results on the optimal age replacement time are obtained with the linear, zigzag and lognormal uncertain lifetimes. The paper by Li Ren first presented an individual risk model based on uncertainty theory, and its arithmetic was shown by a numerical example.

Finally, we sincerely thank Editor-in-Chief, Prof. Mitsuo Gen, for his kind support for the organization process of this special issue. We also thank all the authors and reviewers for their submissions and rigorous reviews.