
Editorial: Speeches at the opening ceremony of the 40th anniversary of the founding of grey system theory

Speeches at the
opening
ceremony

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29th November, 2022

First of all, I congratulate on the grand opening of the 40th anniversary of the birth of the grey system theory, and congratulate on the important influence of the grey system theory created by Chinese scientists in the world.

In the research studies of natural science, social science technology and engineering, due to the limitation of people's cognitive ability and the internal and external disturbance of the research object, the available information is always uncertain. The second half of the 20th century, with the deepening of people's understanding of system uncertainty, witnessed various theories and methods proposed to describe uncertain systems from different perspectives, including fuzzy mathematics, rough set theory and grey system theory. Among them, fuzzy mathematics deals with cognitive uncertainty and focuses on the objects with "clear connotation and unclear extension"; Rough set theory analyzes data based on equivalence relations, using upper and lower approximation sets to describe the boundary region of uncertain concept extension; The grey system theory focuses on the objects with "clear extension and unclear connotation" and the poor information uncertainty system with unknown distribution.

The grey system theory mainly extracts valuable information through mining of "a part" of the known information and realizes the correct description of the system operation behavior and evolution laws. As such, people can use mathematical models to realize the analysis, evaluation, prediction, decision-making and optimization control of uncertain systems with "poor information". The uncertainty systems with "poor information", which widely exist in the real world, have provided rich research resources and broad development space for the grey system theory.

Professor Sifeng Liu has devoted himself to the research field since the birth of the grey system theory. Over the past 40 years, he has led a group of young scholars to make a systematic and innovative study on the theories, methods and models of grey system and spread the kindling of grey system research to the whole world with the firm belief of "a group of people, a whole lifetime and a unique pursuit".

I got to know Prof. Liu at the turn of this century and worked together with him at Nanjing University of Aeronautics and Astronautics for many years. I was happy to see that Prof. Liu, as the Chair Professor of Management Science and Engineering, founded the corresponding doctoral program, which was successfully approved by the State Council, at NUAA, and promoted the College of Economics and Management of NUAA to a more advanced level. I have kept paying attention to his academic research since I moved to Beijing Institute of Technology. It is gratifying to see that he has made a series of important theoretical and applied research achievements by persisting in studying real problems, pursuing real contributions and creating real value for a long time.

Recently, Professor Sifeng Liu, through an in-depth analysis of the reliability growth data of major aerospace equipment, found that it has the coexistence characteristics of



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random, fuzzy, gray and rough data, and thus proposed new concepts such as general uncertainty data (GUD) and general uncertainty variable (GUV), which opened a new door to reliability growth research. In his late seventies, he still maintains the evergreen academic tree, which is encouraging young students to make unremitting efforts to climb the peak. I believe that NUAA will have a better tomorrow, and the grey system theory will have a better tomorrow!

Finally, I wish that the Chinese scientists will continue to make new discoveries, put forward new concepts, create new theories and realize the dream of becoming a powerful nation in science and technology as early as possible!

Haiyan Hu

Academician of the China Academy of Sciences and
former President of Beijing Institute of Technology

Congratulations on the 40th anniversary of the founding of the Grey System Theory

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Professor Sifeng Liu
Institute for Grey Systems studies
Nanjing University of Aeronautics and Astronautics

The complexity of the system structure and development process, the information asymmetry between the manufacturer and related parties, and the influence of multi-dimensional factors such as design, materials, technology, personnel, etc., make the reliability design, test, growth and optimization process of aerospace equipment face a lot of difficulties. In addition, the characteristics of complex systems, the limitations of existing observation methods and people's cognitive ability, as well as the impact of data acquisition methods, acquisition equipment, storage technology, etc., lead to the typical poor information characteristics of the data that people possess. The grey system theory founded by Professor Julong Deng of Huazhong University of Science and Technology in 1982 is a powerful tool for modeling, analyzing, forecasting and decision-making of poverty information system.

Over the past 40 years, after several generations of hard work, a Chinese original theory has established a relatively complete system structure and stepped onto the international academic stage step by step.

The grey system model and method have been applied to the analysis of the development data of major aerospace equipment, which has solved practical problems such as reliability growth evaluation, life prediction, cost calculation and intelligent scheduling, and achieved gratifying results. For example, the research achievement "key technology and application of complex equipment development and management in the context of poor information" completed by Professor Sifeng Liu's research team in cooperation with China Academy of Launch Vehicle Technology and other institutions won the first prize of National Defense Science and Technology Progress Award. And their research achievement "Key technology and application of gray system analysis in the collaborative development of large passenger aircraft", which was completed in cooperation with COMAC, won the second prize of the Science and Technology Progress Award of the Ministry of Education of China. There are also many application results displayed in this commemorative exhibition, which fully shows that the grey system theory has great applications.

Congratulations on the success of the 40th anniversary exhibition of the founding of the grey system theory! I wish the grey system theory will continue to carry forward!

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Baozhu Guo

Academician of the International Academy of Astronautics and
Former Chief Designer of China Aerospace Satellite Engineering

**Congratulations on the 40th anniversary of the founding of the Grey
System Theory**

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Professor Sifeng Liu
Institute for Grey Systems studies
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On the occasion of the grand opening of the “40th Anniversary Exhibition of the Founding of Grey System Theory” held by Nanjing University of Aeronautics and Astronautics, I would like to express my warm congratulations to the grey system research team of Nanjing University of Aeronautics and Astronautics on behalf of the International Association of Grey Systems and Uncertainty Analysis, express my sincere gratitude to the leaders and guests present, and to the experts who have been engaged in the research of grey system theory for a long time. I would like to express my sincere respect for the fruitful work of scholars!

Since the advent of the grey system theory in 1982, the grey system theory has developed rapidly. A Chinese original theory has successfully stepped onto the international academic stage and has had a major international impact.

In 2007, the IEEE Grey System Technical Committee was formally established. In 2012, the first meeting of the European Grey System Research Cooperation Network was held at De Montfort University, UK. In 2015, scholars from China, the United Kingdom, the United States, Canada, Spain, Romania and other countries jointly initiated the establishment of the International Association of Grey Systems and Uncertainty Analysis (GSUA). In recent years, scholars from Poland, Pakistan, Turkey and other countries have initiated the establishment of branches of GSUA in their countries. Two international journals edited by Institute for Grey Systems Studies, NUAA, and co-edited by scholars from all over the world have become top journals in this field. The series of international conferences of IEEE GSIS and GSUA which was organized and hosted by Institute for Grey Systems Studies, NUAA, and other institutions have become influential brand conferences. According to the general recognition of the international academic community, the international academic journals edited by an academic institution, the hosted international academic conferences and affiliated international academic organizations are important symbols of its international academic influence. This is probably the reason why Academician Jinpeng Huai, then Secretary of the Party Group and Executive Vice Chairman of the China Association for Science and Technology, wrote a special letter to Professor Sifeng Liu in December 2018, highly appreciating the important contribution to international cooperation made by him and Institute for Grey Systems Studies, NUAA.

My cooperation with Professor Sifeng Liu of Nanjing University of Aeronautics and Astronautics started in 2004 and has lasted for 18 years. We have jointly undertaken and completed a number of projects funded by Marie Curie International Incoming Fellowship of the European Union, the National Natural Science Foundation and the Royal Society of Britain, and the Leverhulme Trust, etc. According to the project plan, we visited dozens of universities in the United Kingdom, Spain, Romania, Poland, Canada and China to disseminate and exchange the research results of grey system theory. In recent years, we have jointly published four works and more than 40 papers, and co-edited the English version

of “Grey System Series” (published by Springer-Nature Group); We have jointly guided a number of master’s and doctoral students. In the past 18 years, dozens of teachers and students of Institute for Grey Systems Studies, NUAA, have visited De Montfort University, UK. My colleagues and students and myself have also visited and communicated in Nanjing many times. We have also jointly facilitated a number of cooperation and exchange projects between China, the European Union and the British government. These projects have played a positive role in the dissemination and development of grey system theory.

Congratulations on the complete success of the commemorative exhibition. We also hope that Nanjing University of Aeronautics and Astronautics and De Montfort University will continue to strengthen exchanges and cooperation, and that all colleagues engaged in the research of grey system theory will continue to work tirelessly in the field of grey system theory, search up and down, and make more new breakthroughs.

Thank you!

Yingjie Yang

Professor of Institute of Artificial Intelligence, De Montfort University
Executive President of International Association of Grey Systems and Uncertainty
Analysis (GSUA) and Sponsor of the European Grey System Research Cooperation Network.