



华中科技大学数学中心

Center for Mathematical Sciences

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Workshop on Modern Applied Mathematics
—— In Honor of James R. Brannan and
Jia Li's Life-Time Achievement

May 19, 2018

Center for Mathematical Sciences,

Huazhong University of Science and Technology (HUST)

Wuhan, China

Professor James R. Brannan



Professor James R. Brannan was born in May 3, 1946 in Villisca, Iowa, USA. He is the professor of Department of Mathematical Sciences in Clemson University, the member of the American Geophysical Union. He was awarded a PhD in Mathematics from Rensselaer Polytechnic Institute, in 1979.

Professor James R. Brannan is one of the outstanding mathematicians in the area of the mathematical modeling, stochastic differential equation. He works on the modelling of economics and geosciences dynamical systems.

Professor James R. Brannan has published two books: “Differential Equations: An Introduction to Modern Methods and Applications” and “Differential Equations with Boundary Value Problems: An Introduction to Modern Methods and Applications” (with William E. Boyce), and awarded numerous NSF grants for research.

Professor Jia Li



Professor Jia Li is the Department Chairman of Mathematical Sciences, University of Alabama in Huntsville . He graduated of Huazhong University of Science and Technology in 1981, and obtained a PhD in Department of Mathematics, University of Tennessee, in 1987.

Professor Jia Li is interested in dynamical systems, differential equations. He has done the excellent research works and creative achievement on dynamics of infectious diseases, environmental modeling and analysis, and mathematical ecology.

Professor Jia Li has published more than eighty scientific papers, and he is the associate editor of *Annals of Differential Equations*, *Journal of Biological Dynamics*, *Mathematical Biosciences and Engineering*.

PROGRAM OVERVIEW

Time	May 19 (Saturday)
8:50-9:00	Opening ceremony
9:00-9:30	James R. Brannan
9:30-10:00	Jia Li
10:00-10:30	Congping Lin
10:30-11:00	Haitao Xu
11:00-11:30	Xiongtao Zhang
11:30-12:00	Yiwei Zhang

Organizer:

Jinqiao Duan (duan@iit.edu.cn jqduan@hust.edu.cn)

Place for Workshop:

813 Room, Qiming School, Enming Building, Center for Mathematical Sciences, Huazhong University of Science and Technology, Luoyu Road, Wuhan, Hubei Province, China

Contact:

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PROGRAM

James R. Brannan (Clemson University, East Lake Professor in Applied Mathematics)

Title: Instability of Growth in Complexly Interdependent Economic Systems

Abstract: We extend the Solow model of economic growth to account for capital dependent saving, lag time between capital investment and output, and correlated noise in consumption. Investment coherency is modeled by expressing the saving rate as a sigmoid function of capital that, in effect, provides a positive feedback loop that increases sensitivity of output to random fluctuations. The combined effects of investment coherency and correlated input noise produce sample paths with the same statistical behavior as the GDP (gross domestic product). We use a continuous time formulation and analysis that lead to a corresponding discrete time model. Parameters are estimated from GDP data by minimizing one-step-ahead prediction error in conjunction with matching second order statistics of the model (mean, variance, and autocorrelation) to corresponding second order statistics of the data. The model illustrates how strong interdependency in an economic system can account for both small and large random fluctuations in output.

Jia Li (University of Alabama in Huntsville, East Lake Professor in Applied Mathematics)

Title: Joy of Math Research and My Extended Math Life

Abstract: In this informal talk, I will share with my friends my love of math research and why I decide to extend my math life after retirement.

Congping Lin (Huazhong University of Science and Technology)

Title: The role of excitability gradients in propagation of epileptiform Activity

Abstract: Mathematical models of excitable cells, such as neurones, are often characterized by different dynamic regimes, such as alternating rest and excited (seizure)

states. The onset of an epileptic seizure is an example of a "domino" like transition between states; as each node transitions into a seizure state other nodes in the network are sequentially recruited. These transient dynamics are often overlooked in favour of long term asymptotic behaviour. However, analysis of this type of transient cascade is instrumental in understanding the drivers of the underlying disease. We consider two phenomenological models of seizure initiation represented by a network of coupled bistable neurones with noise. Each node represents a population of neurons with intrinsic excitability related to how prone the node is to start transitions. We apply our theoretical framework to two different data sets with different spacial temporal scales: ictal-like bursting in mouse medial entorhinal cortex, and the onset of epileptic seizures in humans. We investigate the effects of spacial gradients in node excitability and coupling strength on the emergent network dynamics. We find that a linear excitability gradient is crucial to sequential recruitment of nodes to the ictal-like state and explains the propagation of ictal-like bursts in the mouse mEC. We explore the effects of spacial distributions of excitability and the effect of coupling in a two dimensional network on the onset of epileptic seizures in humans.

Haitao Xu (Huazhong University of Science and Technology)

Title: On the spectral stability of solitary waves in Hamiltonian lattices

Abstract: The stability theory of Hamiltonian systems has been an active topic for long, due to its close connection to applications in Mechanics, Engineering and many other subjects. It is known that the Hamiltonian H can be used to construct a Lyapunov function to provide information about the stability. This approach has been generalized for solitary waves in continuous Hamiltonian systems featuring symmetries by [Grillakis-Shatah-Strauss, 1987], where for example, translational symmetry corresponds to solitary traveling waves. One key feature of the results is that the stability of an interested solitary traveling wave changes when the derivative of Hamiltonian with respect to the wave speed c crosses zero. Despite the fact that Hamiltonian lattices are quite different from their continuous counterparts, a similar statement about dH/dc has recently been proposed for solitary traveling waves in Fermi-Pasta-Ulam lattice by [Friesecke-Pego, 2004] and latter for discrete breathers by [Kevrekidis-Cuevas-Pelinovsky, 2016]. In this talk, we derive an energy-based spectral stability criterion from a unifying perspective and provide explicit expressions for dependence of eigenvalues on the velocity c of the travelling wave in the vicinity of the critical point. We corroborate this conclusion with a series of analytically and numerically tractable examples.



Xiongtao Zhang (Huazhong University of Science and Technology)

Title: Collective Dynamics of Multi-agent Systems Modeling and Analysis.

Abstract: Collective dynamics of complex systems is often observed in our nature, in which self-propelled individuals organize themselves into an ordered motion through simple rules. To name a few, the aggregation of bacteria, flocking of birds, swarming of fish, herding of sheep etc correspond to such a collective motion. In my talk, I will concern on the Cucker-Smale (CS) model constructed by S. Smale and F. Cucker in 2007. I will introduce the time asymptotical behavior, phase transition and critical value etc. in CS model.

Yiwei Zhang (Huazhong University of Science and Technology)

Title: A rigorous computer aided estimation for Gelfond exponent of weighted Thue-Morse sequences

Abstract: In this talk, we will provide a mathematically rigorous computer aided estimation for the exact value of Gelfond exponent of weighted Thue-Morse sequence. This result improves the previous discussions on the Gelfond exponent by Gelfond, Devenport, Mauduit, Rivat, Sarkozy and Fan et. al.



Chu Culture

Chu was the name of a state and a clan. The Chu people believed that their ancestors were, in terms of age, Gao Yang, or Emperor Zhuan Xu, Lao Tong and Zhu Rong, and Yu Xiong. In the early Western Zhou Dynasty, Xiong Yi was made the monarch of Chu. After that, Chu State lasted about 800 years until it was conquered by Qin in 223 BC.

During the 800 years, the daring and innovative Chu people created a rich and profound culture, which is embodied by relics unearthed in the former territory of Chu. It is such relics that the Exhibition of Chu Culture presents to show a full picture of the splendid material and ideological culture of the Chu people

From the reign of Xiong Yi onwards, the Chu people had been making hard efforts to develop their society and economy. In the Spring and Autumn Period, King Zhuang made Chu one of the most powerful states in China. In the Warring States Period, Chu surpassed any other feudal state in the number of states it destroyed and the expansion of its territory. Such feats are attested to by the sword of Gou Jian, the king of Yue, and the spear of Fu Chai, the king of Wu, which were unearthed from Chu tombs.

Chu bronze articles form an important part of the Chinese bronze culture. Though it originated from the Central Plains, it displayed distinct local flavors. Chu, which possessed copper mines at Mt. Tonglin Daye and other places, achieved a high level in mining, smelting and casting.

The elegant and magnificent lacquered article is one of the highlights of Chu culture, embodying its special charm with original shapes, elaborate patterns, rich colors, and profound spiritual meanings. They had been well preserved thanks to the high groundwater level in the South.

China preceded any other country in the world in terms of raising silkworms, filature, and making silk fabrics. As confirmed by archeological findings, silk weaving had already been well developed

in Chu by the Spring and Autumn Period and the Warring States Period. Chu silk fabrics and embroidery are marked by a rich variety, exquisite decorative designs, and bright colors. Major decorative patterns are legendary birds and animals. Among them, patterns of dragons and phoenixes come in the greatest variety of forms; they are graceful, majestic and mysterious.

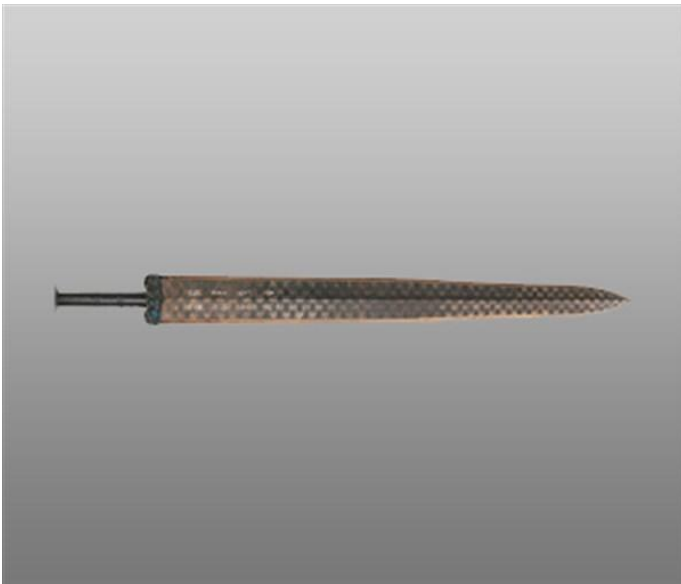


Chime-bells from the Tomb of Marquis Yi of the Zeng State

Early Warring States. Unearthed from the Tomb of Marquis Yi of the Zeng State in Hubei Suixian County in 1978.

Length:784cm,Height: 265cm.

Set on a curving shaped Copper-and-wood frame, the whole 65 pieces of chime bells is arranged in eight groups and three layers, the biggest of which is as high as 152.3 cm and as heavy as 203.6 kg. Every piece of the chime bell can ... while the whole set covers... The discovery of the chime bell set has i rewritten the history of world music.



The sword of Goujian

Late Spring and Autumn Period. Unearthed from Jiangling Wangshan No. 1 Tomb in Hubei in 1965. Length: 55.7cm, Width: 4.6cm. The blade of the sword is ribbed and decorated with black diamond pattern. Close to the hilt is the bird seal inscriptions —

The front side of the blade is set with blue glaze while the reverse side is set with turquoise.



Blue and White plum vase of the four loves in Yuan Dynasty

Yuan Dynasty. Unearthed from King Yingjing's Tomb in Chongxiang city in 2006.

Height: 38.7cm,

Surfacediameter: 6.4cm,

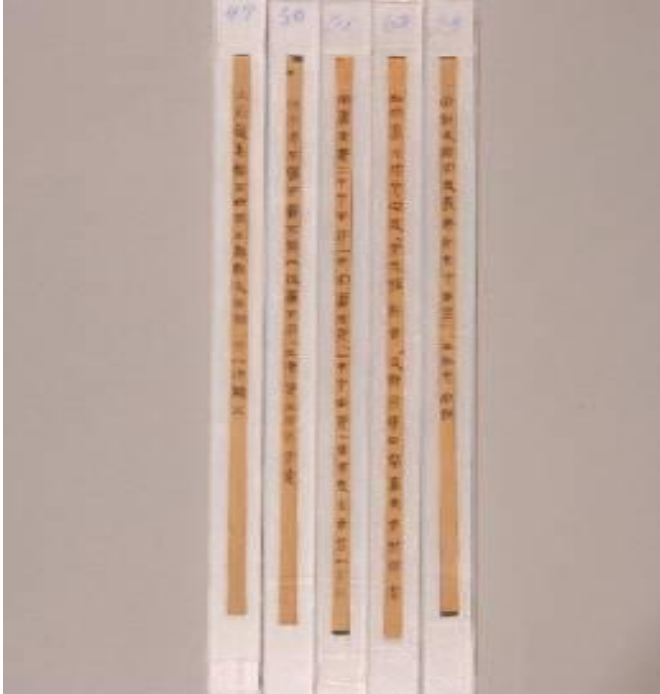
Bottom diameter: 13cm.

The stories of four ancients and their favorites are painted on the belly of the vase, which are respectively Wang Xizhi loves the orchid, Tao Yuanming loves the chrysanthemum, Zhou Dunyi loves the lotus and Lin Jing loves plum blossom and the crane.



Human skull fossils from Yunxian County

Western Hubei is one of the important areas of the ancient human fossil discovery. In 1989 and 1990, the Hubei institute of Cultural Relics has discovered in Yunxian county two human skull fossils, which are determined as homo erectus of about 1 million years ago.



Qin bamboo slips from Shuihudi, Yunmeng(The Qin Dynasty)

A total of over 1,150 Qin bamboo slips were unearthed at Shuihudi, Yunmeng County, Hubei in 1975. The characters are written in ink and Qin official script. The contents include a variety of texts, such as Chronicle, Yu Shu, Xiao L, Eighteen Qin Laws, Miscellaneous Laws of Qin, Questions and Answers on Law, Feng Zhen Shi, The Way of Serving the Government and Rishu. Qin bamboo slips from Shuihudi are mainly legal documents. They have greatly enriched our knowledge about Qin laws, and are important for studying the history of Chinese legal system.



Round dressing case with colored phoenix design (The Qin Dynasty)

The case is made of wood, with the body shaped by bending. There is a galloping phoenix painted at the center of the lid.

The lacquered article was one of the greatest inventions in ancient China, and one of the most characteristic of ancient Chinese cultural relics. Hubei is rich in lacquered article relics mainly because of the abundance in varnish trees and high ground water level.

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Center for Mathematical Sciences, at Huazhong University of Science and Technology, Wuhan, China, is a mathematical research and education institution. Its mission is to promote interactions between mathematics and other disciplines, and to connect branches of mathematics. The Center fulfills its mission by conducting select research and educational activities, including short courses, workshops, mini-workshops, and topic conferences.

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