3rd IWCFTA & 5th APWCCS, 2010

第三届国际混沌与分形理论及其应用研讨会

The third International Workshop on Chaos- Fractals Theories and Applications

Jointly held with

第五届亚太地区混沌控制与同步研讨会

The Fifth Asia-Pacific Workshop on Chaos Control and Synchronization

Advanced Program

Kunming, Yunnan, China, October 28-31, 2010

http://www.chaos-fractal.cn

第三届国际混沌、分形理论及其应用研讨会

The Third International Workshop on Chaos- Fractals Theories and Applications

Kunming, Yunnan, China, October 29-31, 2010

联合主办单位(Cosponsors)：

东北大学 (Northeastern University)

香港城市大学 (City University of Hong Kong)

云南师范大学 (Yunnan Normal University)

IEEE (Institute of Electrical and Electronics Engineers

IEEE Circuits and Systems Society (CASS)

承办单位(Host-sponsor):云南师范大学(Yunnan Normal University)

协办(Assistant-sponsor):云南省数学会(The Mathematical Society of Yunnan Province)

第五届亚太地区混沌控制与同步研讨会

The Fifth Asia-Pacific Workshop on Chaos Control and Synchronization

Kunming, Yunnan, China, October 29-30, 2010

联合主办单位(Cosponsors)

IEEE Circuits and Systems Society (CASS)

IEEE CASS Nonlinear Circuits and Systems Technical Committee

香港城市大学混沌与复杂网络中心(Center for Chaos and Complex Networks, City University of Hong Kong)

云南师范大学(Yunnan Normal University)

承办单位(Host-sponsor)：

云南师范大学(Yunnan Normal University)

第三届国际混沌、分形理论及其应用研讨会

The Third International Workshop on Chaos-Fractal Theories and Applications

Kunming, Yunnan, China, October 29-31, 2010

The 3rd IWCFTA aims to provide a high-level international forum for scientists, researchers and engineers to present the state-of-the-art advancements in the studies of chaos-fractal theories and their applications to complex systems, cryptography, information processing, multimedia, communications, biology, economics and finance.

Workshop Co-chairs

Guanrong (Ron) Chen (City University of Hong Kong, China)
Chair Professor, IEEE Fellow

Zhiliang Zhu (Northeastern University, China)
Dean of National Pilot Software College

Workshop Associate Co-chairs

Zhen Guo (Yunnan Normal University, China)
Dean of School of Mathematics

C.K. Michael Tse (The Hong Kong Polytechnic University, China)
Chair Professor, IEEE Fellow

Program Committee

Hongjun Cao (Beijing Jiaotong University, China)
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Yu Huang (Sun Yat-sen University, China)
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Guoping Jiang (Nanjing University of Posts and Telecommunications, China)
Dejian Lai (University of Texas at Houston, USA)
Xiaofeng Liao (Chongqing University, China)
Francis C. M. Lau(The Hong Kong Polytechnic University, China)
Derong Liu(University of Illinois at Chicago, USA), IEEE Fellow
Xiangdong Liu (Dalian Nationalities University, China)
Tiecheng Li (Tsinghua University, China)
Yuxia Li (Shandong University of Science and Technology, China)
Zhong Li (Fern University at Hagen, Germany)
Wei Lin (Fudan University, China)
Jinhu Lv (AMSS, Chinese Academy of Science, China)
Yue Ma (Kyoto University, Japan)
Yaobin Mao (Nanjing University of Science and Technology, China)
Yuming Shi (Shandong University, China)
Chuanjun Tian (Shenzhen University, China)
Xiaoyun Tong (Weihai school, Harbin University of Technology, China)
Guoyuan Qi (Tshwane University of Technology, South Africa)
Yan Wang (Shenyang Ligong University, China)
Lidong Wang (Dalian Nationalities University, China)
Xingyuan Wang (Dalian University of Technology, China)
Xiaofan Wang (Shanghai Jiao Tong University, China)
Min Wu (South China University of Technology, China)
Xiaofeng Wu (Guangzhou Naval Academy, China)
Ling Yang (Soochow University, China)
Qigui Yang (South China University of Technology, China)
Xiaosong Yang (Huazhong University of Science and Technology, China)
Simin Yu (Guangdong University of Technology, China)
Xinghuo Yu (RMIT University, Australia) IEEE Fellow
Huaguang Zhang (Northeastern University, China)
Deping Zhao (Shenyang Jianzhu University, China)
Tianshou Zhou (Sun Yat-sen University, China

第五届亚太地区混沌控制与同步研讨会

THE FIFTH ASIA-PACIFIC WORKSHOP ON CHAOS CONTROL AND SYNCHRONIZATION

Kunming, Yunnan, China, October 29-30, 2010

The main purpose of this Workshop is to bring together leading researchers and experts worldwide, especially those from the Asia-Pacific region, to further promote and develop the cutting-edge research on chaos control and synchronization theory and its engineering applications.

Workshop Chair

Guanrong (Ron) Chen (*City University of Hong Kong, China*)

Organizing Committee

Cuncai Hua (*Yunnan Normal University, China*)

Yuxia Li (*Shandong University of Science and Technology, China*)

C K Michael Tse (*Hong Kong Polytechnic University, China*)

Hai Yu (*Northeastern University, China*)

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Program Committee

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Pitikhate Sooraksa (*King Mongkut's Institute of Technology Ladkrabang, Thailand*)

Tetsushi Ueta (*Tokushima University, Japan*)

Local Organizing Committee of the two conferences (两会务组织工作委员会):

Prof. Ziqing Liang (梁子卿　教授)		**Yunnan Normal University, China (云南师范大学)**
Prof. Zhen Guo (郭震　教授		**Yunnan Normal University, China(云南师范大学)**
Prof. Cuncai Hua　(化存才　教授)	**13808713139**	**Yunnan Normal University, China(云南师范大学)**
Dr. Hai Yu (于海　博士)	**13804059171**	**Northeastern University, China(东北大学)**
Dr. Chong Fu (付冲　博士)	**13700046324**	**Northeastern University, China(东北大学)**
Assoc. Prof. Haihong Liu (刘海鸿　副教授)	**13668759433**	**Yunnan Normal University, China(云南师范大学)**
Assoc. Prof. Hui Yang (杨慧　副教授)	**13700668883**	**Yunnan Normal University, China(云南师范大学)**
Assoc. Prof. Chenglin Xu (胥成林　副教授)	**15808700758**	**Yunnan Normal University, China(云南师范大学)**
Assoc. Prof. Shuang You (由骧　副教授)	**13888290815**	**Yunnan Normal University, China(云南师范大学)**
Ken Chen (陈恳　讲师)	**13577152501**	**Yunnan Normal University, China(云南师范大学)**

Advanced Program of IWCFTA & APWCCS

Thursday, October 28, 2010	
08:00-17:00	**Registration of the 3rd IWCFTA and 5th APWCCS (Yunnan Dianchi Garden Resort Hotel & Spa)**
Friday, October 29, 2010	
08:30-12:00	**Registration of the 3rd IWCFTA and 5th APWCCS (Yunnan Dianchi Garden Resort Hotel & Spa)**
08:30-12:00	**Opening ceremony of the 3rd IWCFTA and 5th APWCCS (Yunnan Dianchi Garden Resort Hotel & Spa)** **group photos，Coffee break, three keynote speeches** **(1) Prof. Maciej Ogorzalek,** ***Fractals for Nano/Tera Microelectonics*** **(2) Prof. Tetsuro Endo,** ***Onset and Chaos of the Propagating Pulse Wave in a Ring of Coupled Bistable Oscillators*** **(3) Prof. Miguel A. F. Sanjuan,** ***Partial Control of Chaotic Systems***
12:20	**Dinner (Yunnan Dianchi Garden Resort Hotel & Spa)**
14:00-18:00	**Presentations of sessions of the 3rd IWCFTA and 5th APWCCS, separately (Yunnan Dianchi Garden Resort Hotel & Spa)**
18:30	**Dinner (Yunnan Dianchi Garden Resort Hotel & Spa)**
Saturday, October 30, 2010	
08:15-12:00	**Presentations of sessions of the 3rd IWCFTA and 5th APWCCS, separately (Yunnan Dianchi Garden Resort Hotel & Spa)** **Two keynote speeches, separately** (1) Prof. Qun Ding 丁群 教授, 数字混沌加密芯片及在网络信息加密传输中应用 (In Chinese) (2) Prof. Simin Yu 禹思敏教授, 连续混沌系统的若干生成方法、硬件实现及其在通信中的应用 (In Chinese)
12:20	**Dinner (Yunnan Dianchi Garden Resort Hotel & Spa)**
15:00-16:10	**One keynote speech and Closing remark of the 3rd IWCFTA and 5th APWCCS (Yunnan Normal University//note the starting time is 14:00 PM, by bus, at the gate of Yunnan Dianchi Garden Resort Hotel & Spa)** **(1) Prof. Sergej Celikovsky,** ***Generalized Lorenz System: History, Classification and Synchronization***
16:10-17:40	**Visit the historical site of the National Southwest Associated University(1938-1946) (Yunnan Normal University, leaving time is17:40,by bus)**
18:30-21:00	**Two Conferences' Banquet (Aini Dining Shan Zhuang Hall, Dianchi Road, Kunming City)**
Sunday, October 31, 2010	
One-day tour to the Stone Forest in Kunming City or multi-day tours to other traveling routes in Yunnan Province //note the starting time for route 1 is 8:00 AM, by bus, at the gate of the Yunnan Dianchi Garden Resort Hotel & Spa	
Monday, November 1, 2010	
End of the joint 3rd IWCFTA and 5th APWCCS	

Tour according to Selected traveling routes (staring from Oct.31, 2010):

Route 1: The Stone Forest in Kunming City (for one day on Oct. 31, 2010, by bus)

Route 2: Dali, Lijiang and Shangri-la in Yunnan Province, China (five-seven days, by train)

Route 3: Xishuangbanna in Yunnan Province, China (four days, by air)

Ruote 4: Tengchong and Ruili in Yunnan Province, China (four days, by air)

Advanced Program of IWCFTA & APWCCS

2010 年 10 月 28 日星期四	
08:00-24:00	会议注册 (昆明海埂, 云南滇池温泉花园国际大酒店)
2010 年 10 月 29 日星期五	
08:30-12:00	会议注册 (云南滇池温泉花园国际大酒店)
08:30-12:00	**APWCCS & IWCFTA** 开幕式 (云南滇池温泉花园国际大酒店，西山爽气厅) 两会共同开幕式，照相，3 场大会报告 (1) Prof. Maciej Ogorzalek, *Fractals for Nano/Tera Microelectonics* (2) Prof. Tetsuro Endo, *Onset and Chaos of the Propagating Pulse Wave in a Ring of Coupled Bistable Oscillators* (3) Prof. Miguel A. F. Sanjuan, *Partial Control of Chaotic Systems*
12:20	午餐 (云南滇池温泉花园国际大酒店)
14:00-18:00	分组会议 (云南滇池温泉花园国际大酒店，国际会议中心一楼会议室)
18:30	晚餐 (云南滇池温泉花园国际大酒店)
2010 年 10 月 30 日星期六	
08:15-12:00	分组会议 (云南滇池温泉花园国际大酒店，国际会议中心一楼会议室) 分别进行 2 场大会报告 (1) 丁群 教授，数字混沌加密芯片及在网络信息加密传输中应用 (In Chinese) (2) 禹思敏教授，连续混沌系统的若干生成方法、硬件实现及其在通信中的应用 (In Chinese)
12:20	午餐 (云南滇池温泉花园国际大酒店)
15:00-16:10	会议闭幕式 (云南师范大学, 下午 14:00 在滇池温泉花园国际大酒店门口乘车前往) 1 场大会报告和两会共同闭幕式 (1) Prof. Sergej Celikovsky, *Generalized Lorenz System: History, Classification and Synchronization*
16:10-17:40	参观国立西南联合大学旧址**(1938-1946)** (云南师范大学，17:40 乘车离开)
18:30-21:00	晚宴 (昆明滇池路偻佝山庄)
2010 年 10 月 31 日,星期日	
旅游 石林一日游(早上 8:00 在滇池温泉花园国际大酒店门口乘车)，或者云南省内精品旅游	

注： 按所选旅游线路旅游考察(从 2010 年 10 月 31 日开始)：

线路-I：昆明石林(1天，2010年10月31日)

线路-II：云南大理、丽江、香格里拉(5-7天, 火车)

线路-III：云南西双版纳(4天，双飞)

线路-IV：云南腾冲、瑞丽(4 天，双飞)

Contents

酒店距离市区 8 公里，距离机场 14 公里，距火车站 10 公里；距国贸中心 12 公里。

Friday, October 29, 2010

Opening Ceremony of the 3rd IWCFTA and 5th APWCCS

两会开幕式

(Xishan Multi-function Hall at the left of the gate of Yunnan Dianchi Garden Resort Hotel & Spa;

云南滇池温泉花园国际大酒店，西山爽气厅)

08:30 Entrance

08:45-09:10 // Compere: **Chairman, Prof. Guanrong Chen**

Speeches of President and Chairman (Prof. Ziliang Zhu)

09:10-9:45

Group photos

Coffee break

09:45-12:00//Compere: **Prof. Guanrong Chen**

Three keynote speeches

(1) // 09:45-10:30//

Prof. Maciej Ogorzalek, Fractals for Nano/Tera Microelectonics

(2) // 10:30-11:15//

Prof. Tetsuro Endo, Onset and chaos of the propagating pulse wave in a ring of coupled bistable oscillators

(3) // 11:15-12:00//

Prof. Miguel A. F. Sanjuan, Partial Control of Chaotic Systems

Presentations of the 3rd IWCFTA and 5th APWCCS

(International conference center-meeting rooms of Yunnan Dianchi Garden Resort Hotel & Spa; 云南滇池温泉花园国际大酒店，国际会议中心一楼会议室; The author marked with "*" is the speaker;打"*"者为报告人)

Session 1 (meeting room No.2): Chaotic Dynamics

Part 1:

14:00-16:00/ Compere: Prof. Yu Huang

(1) //14:00-14:20//

***Lijun Pei, Lixia Duan, and Huayan Liu //Zhengzhou University, Zhengzhou, China**

Dynamics of the Coupled Lorenz-RÖssler Systems

(2) // 14:20-14:40//

***Jigui Jian and Hui Yu// China Three Gorges University, Yichang, Hubei, China**

New Estimations of Globally Exponentially Attractive Sets and Synchronization Controlling of a Class of Chaotic Finance Systems

(3) // 14:40-15:00//

***Bo-Cheng Bao, Xiao-feng Wang, and Jian-Ping Xu// Jiangsu Teachers University of Technology, China**

Multi-Wing Butterfly Attractors in L ü System

(4) //15:00-15:20//

***Enzeng Dong, Zengqiang Chen, Zhuzhi Yuan, Enzeng Dong, and Zaiping Chen//Tianjin University of Technology, China**

A New Four-wing Hyper-chaotic Attractor and Its Circuit Implementation

(5) //15:20-15:40//

***Yunfang Han, Fangyue Chen, and Yi Wang// Hangzhou Dianzi University, Zhejiang, China**

Subsystems and Glider Dynamics of Hyper Bernoulli CA Rule 26

(6) //15:40-16:00//

***Yi Wang, Fangyue Chen, and Yunfang Han// Hangzhou Dianzi University, Zhejiang, China**

Glider Dynamics and Topological Dynamics of Bernoulli-shift Rule 61

16:00-16:20 Coffee break

Part 2:

16:20-18:00/ Compere: Prof. Hongjun Cao

(7) //16:20-16:40//

***Zhengwen Tu and Jigui Jian //China Three Gorges University, Yichang, Hubei, China**

Estimating the Ultimate Bounds and Positively Invariant Sets for a Class of General Lorenz-type New Chaotic Systems

(8) //16:40-17:00//

***Wei Xue, Jingjing Mu, and Hongyan Jia// Tianjin University of Science and Technology,Tianjin, China**

A novel one equilibrium hyper-chaotic system and its bifurcation analysis

(9) //17:00-17:20//

Shaowei Shen and Junbiao Guan// Zhejiang Gong Shang University, China

THE STUDY OF ONE-DIMENSIONAL CELLULAR AUTOMATA WITH NEAREST-NEAREST NEIGHBORHOODS

(10) //17:20-17:40//

***Zhiliang Wang, Huaguang Zhang, and Ning Sun// Northeastern University, China**

Comparison Inequalities for Nonlinear Fractional-Order Systems

(11) //17:40-18:00//

***Lu Wang and Qun Ding// Hei Longjiang University , Harbin, China**

The bifurcation analysis of digital chaos circuit and its application

Session 2 (meeting room No.3): Complex System and Chaotic Synchronization

Part 1:

14:00-16:00/ Compere: Prof. Fangyue Chen

(1) //14:00-14:20//

***Kehui Sun, Xia Wang, Linzi Yin, and Congxu Zhu// Central South University, Changsha, Hunan Province, China**

Chaos and bifurcations of the fractional-order unified system

(2) // 14:20-14:40//

***Lixia Duan, Dehong Zhai, Xuhui Tang, and Qishao Lu// North China University of Technology, Beijing, China**

Bursting and Mode Transitions in Coupled Nonidentical Modified Morris-Lecar Neurons

(3) // 14:40-15:00//

***Lin Ji and Yujuan Wang// Department of Chemistry, Capital Normal University, Beijing, China**

Chemical Connection Induced Firing Pattern Transition in Coupled Chaotic Neuron System

(4) //15:00-15:20//

***Weifeng Jin and Fangyue Chen// Zhejiang Chinese Medical University, China**

Global Attractors and Chaos of Complex Bernoulli-shift Rules

(5) //15:20-15:40//

Huanmei Qin// University of Shanghai for Science and Technology, China

The Chaos Analysis of the Unbalanced International Trade at the Later Stage of the Global Financial Crisis

(6) //15:40-16:00//

Chengrong Xie and *Yuhua Xu// Department of maths, Yunyang Teacher's College, Hubei,China

Chaos control and synchronization of a new chaotic system

16:00-16:20 Coffee break

Part 2:

16:20-18:00/ Compere: Prof. Yuming Shi

(7) //16:20-16:40//

Shaojuan Ma// North University for Nationalities, Yinchuan, China

Chaos in a new kind of stochastic brain waves model

(8) //16:40-17:00//

***Yaqi Wang and Guo-ping Jiang// Nanjing University of Post, China**

Spreading of epidemics on scale-free networks with traffic flow

(9) //17:00-17:20//

***Xinghua Huang and Yiping Lin// Kunming University of Science and Technology, Kunming, China**

Dynamical Behavior of A Three Species Food Chain System with Time Delayed Harvesting

(10) //17:20-17:40//

***Wenjie Yang and Yiping Lin//Kunming University of Science and Technology, Kunming, China**

Bifurcation and Chaos Analysis for a Lotka-Volterra System with Time Delay

(11) //17:40-18:00//

Jing Bai and *Yongguang Yu// Beijing Jiaotong University, Beijing, China

Sliding Mode Control of Fractional-order Hyperchaotic Systems

Session 3 (meeting room No.4): Theory and Applications of Fractals

Part 1:

14:00-16:00/ Compere: Prof. Zengqiang Chen

(1) //14:00-14:20//

***Yiru Huang, Jian Huang, Jian-sheng Yang, and Yan-ping Liu// Shanghai University, Shanghai, China**

Fractal—Research on the Complex Carry System and Its Decimal Set

(2) // 14:20-14:40//

***Chih-Chin Huang, Shu-Chen Cheng, and Yueh Min Huang// National Cheng Kung University, Taiwan, China**

The Design of a Fractal-based Number Generator

(3) // 14:40-15:00//

***Bo Qu and Paul S. Addison// Nantong University, Jiangsu Province, China**

Modeling flow trajectories using fractional Brownian motion

(4) //15:00-15:20//

***Bingcheng Wang and Zhaohui Ren// Shenzhen University, China**

Feature Analysis Mechanical fault signals Based on correlation dimension and complexity

(5) //15:20-15:40//

***Gang Xiong, Shu-ning Zhang, and Li Shu**

The Quadratic TimeVarying Hausdorff and Large Deviation Multifractal Spectrum of Stochastic Fractal Signal

(6) //15:40-16:00//

Gang Xiong, Shu-ning Zhang and *Li Shu

The Time-varying Legendre Multifractal Spectrum Based on WTMM

16:00-16:20 Coffee break

Part 2:

16:20-18:00/ Compere: Prof. Yiru Huang

(7) //16:20-16:40//

***Jianping Cai and Meili Lin// Zhangzhou Normal University, China**

Finite-time synchronization of non-autonomous chaotic systems with unknown parameters

(8) //16:40-17:00//

Zhiliang Zhu, *Jiangning Gao, and Hai Yu //Northeastern University, China

Face detection based on fractal and complexion model in complex background

(9) //17:00-17:20//

***Yuli Zhao, Zhiliang Zhu, and Hai Yu//Northeastern University, China**

Fractal Color Image Coding Based on Isosceles Triangle Segmentation

(10) //17:20-17:40//

***Tingting Zhao and Shaojuan Ma// Northern University for Nationalities, China**

Modified projective synchronization of oscillating circuit with random parameter

(11) //17:40-18:00//

***Yanyan Lin and Shaojuan Ma// Northern University for Nationalities, China**

Chaos synchronization between two stochastic Lorenz-family systems

Session 4 (meeting room No.5): Presentations of the 5th APWCCS

Part 1:

14:00-16:00/ Compere: Prof. Simin Yu

(1) //14:00-14:20//

Hongjun Cao//Beijing Jiaotong University, Beijing, China

Synchronized bursting patterns of map-based neuron

(2) // 14:20-14:40//

Zhihao Ge// Henan University, Kaifeng, P.R. China

Monotone Traveling Wave Solution for a Delayed Reaction-Diffusion Equation

(3) // 14:40-15:00//

***Haihong Liu, Fang Yan and Chenglin Xu// Yunnan Normal University, Kunming, China; Shanghai University, Shanghai, China**

The bifurcation and exact traveling wave solutions of (1 + 2)-dimensional nonlinear Schrodinger equation with dual-power law nonlinearity

(4) //15:00-15:20//

***Yunxian Dai and Yiping Lin //Kunming University of Science and Technology, Kunming, China**

Hopf bifurcation of a hybrid ratio-dependent three species food chain with time delay

(5) //15:20-15:40//

***Dong Wang, Mengjiao Chen, Minghao Yang, Wei Ren //Shaanxi Normal University, Xian, China**

A stochastic neural firing generated at a Hopf bifurcation and its biological relevance

16:00-16:20 Coffee break

Part 2:

16:20-18:00/ Compere: Prof. Qun Ding

(6) //16:20-16:40//

Eric Campos //Instituto Potosino de Investigación Cient ficay Tecnológica, Mexico

A multi-vibrator circuit based on chaos generation

(7) //16:40-17:00//

D.Nugrahani, K.Klomkarn, *P.Sooraksa // King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand

Performance Comparison of Chaotic Signals with Gold Code as PN-Sequence based on CDMA System

(8) //17:00-17:20//

P.Kruepetch, S.Areejit, *K.Klomkarn and P.Sooraksa //King Mongkut's Institute of Technology Ladkrabang, Thailand

Automatic Titration and CHUA's Controller for Waste Management System

(9) //17:20-17:40//

***Tassanai Banlue, Pitikhate Sooraksa and Suthichai Noppanakeepong//King Mongkut's Institute of Technology Ladkrabang, Bangkok Thailand**

Non-linear Visual Servo System for Printed-Circuit Board Fault Injection Test

Saturday, October 30, 2010

Presentations of the 3rd IWCFTA and 5th APWCCS

(International conference-meeting rooms of Yunnan Dianchi Garden Resort Hotel & Spa; 云南滇池温泉花园国际大酒店，国际会议中心一楼会议室；The author marked with " * " is the speaker; 打"*"者为报告人)

Session 1 (meeting room No.2): Applications of Chaos

Part 1: Chaos-based Control and Optimization

08:15-9:55/ Compere: Prof. Eric Campos

(1)// 08:15-8:55//

(2) // 08:55-9:10//

***Shaojuan Ma and Tingting Zhao// Northern University for Nationalities, China**

Control of chaotic behavior in stochastic forced Brusselator

(3) // 09:10-9:25//

***Jiaxi Zhou, Daolin Xu, and Yingli Li// Hunan University, China**

Chaotifing Duffing-type System with Large Parameter Range Based on Optimal Time-Delay Feedback Control

(4) // 09:25-9:40//

Zhiyan Yang, *Tao Jiang, and Zhujun Jing// Beijing Wuzi University, Beijing, China

Chaos Control in Duffing-Van der Pol system

(5) // 09:40-9:55//

***Yin Li and Wei Yan// Shaoguan University, Shaoguan, Guangdon, China**

Lag, complete and anticipated control of the no-automatic system and Modified Chua circuit

09:55-10:20 Coffee break

Part 2: Chaos-based Cryptography, Chaos-based Secure Communications

10:20-12:00/ Compere: Prof. Pitikhate Sooraksa

(6) //10:20-10:40//

***Zengqiang Chen and Qian Zhou//Nankai University, Tianjin, China**

Implementation of LT codes with a revised Robust Soliton distribution by using Kent chaotic map

(7) //10:40-11:00//

***Vinod Patidar, G. Purohit, K.K. Sud, and N.K. Pareek// Department of Physics School of Engineering Sir Padampat Singhania University Bhatewar, Udaipur– 313 601 Rajasthan, INDIA**

Image encryption through a novel permutation-substitution scheme based on chaotic standard map

(8) //11:00-11:20//

***Jing Pan, Qun Ding, and Baoxiang Du// Hei Longjiang University, Harbin, China**

The Optimization Scheme of Chaotic Masking Secure Communication Based on Lorenz System

(9) //11:20-11:40//

***Xiangdong Liu, Xueye Ang, and Cunrui Wang// Dalian Nationalities University, Dalian, China**

A New Chaotic Image Scrambling Algorithm Based on Sorting Transformation

(10) //11:40-12:00//

***Qinqin Wu, Guangyi Wang, and Liping Yuan// Hangzhou Dianzi University, Hangzhou, China**

E-mail Encryption Based on Dual Chaotic Map

Session 2 (meeting room No.3):

Part 1: Chaos-based Cryptography, Chaos-based Secure Communications and other fields

08:15-9:55 / Compere: Prof. Yuncai Wang

(1) // 08:15-8:55//

(2) // 08:55-9:10//

***Hongyan Jia, Wei Xue, and Zengqiang Chen//Tianjin University of Science and Technology, Tianjin, China**

Analysis and circuit implementation of a three-wing or four-wing chaotic attractor

(3) // 09:10-9:25//

***Hai Yu, Zhiqiang Zhang, Jian Gao, and Zhiliang Zhu// Northeastern University, China**

Cryptanalysis and improvement on a block encryption algorithm based on dynamic sequences of multiple chaotic systems

(4) // 09:25-9:40//

***Yuanyuan Sun, Rui-qing Kong, Xing-yuan Wang, and Lian-cheng Bi//Dalian University of Science and Technology, Dalian, China**

An Image Encryption Algorithm Utilizing Mandelbrot Set

(5) // 09:40-9:55//

***Qiang Jia and Wallace K.S. Tang// City University of Hong Kong, Tat Chee Avenue, Kowloon, China**

Synthesizing Chaotic Systems with Genetic Programming

09:55-10:20 Coffee break

Part 2: Presentations of the 5th APWCCS

10:20-12:00 / Compere: Prof. Heyuan Wang

(6) //10:20-11:00//

(7) //11:00-11:15//

***Wanli Yang and Suwen Zheng// Institute of Nonlinear Science, Academy of Armored Forces Engineering, China**

Impulsive Synchronization for Reaction-Diffusion System

(8) // 11:15-11:30//

***Zhuo-qin Yang, Ting-ting Guan// Beihang University, Beijing, China**

Generation mechanisms of electrical bursting patterns by slow variables with different time scales

(9) //11:30-11:45//

***Lijun Pei, Li Zhang //Zhengzhou University, Zhengzhou, Henan, China**

Hopf bifurcation and generalization of the delayed coupled Lorenz-Rossler system

(10) //11:45-12:00//

Shao-juan MA/ /North University for Nationalities, Yinchuan, China

Stochastic Hopf bifurcation and random control in a kind of stochastic Brusselator system

Session 3 (meeting rooms No.4-5): Presentations of the 5th APWCCS

Part 1: Presentations of the 5th APWCCS

08:15-9:55 / Compere: Prof. Fang-yue Chen

(1) // 08:15-8:55//

Keynote speech: Prof. Qun Ding. Digital chaos encryption chip and its application in the network information encryption transmission //丁群 教授, 数字混沌加密芯片及在网络信息加密传输中应用 (In Chinese)

(2) **// 08:55-9:25//**

Prof. Yu Huang // Sun Yat-Sen University, China

Rapid Fluctuation for Chaotic Dynamical Systems

(3) // 09:25-9:55//

Prof. He-yuan Wang // School of Sciences, Liaoning University of Technology, Jinzhou, China

Chaotic behavior and numerical simulation of Lorenz system for the incompressible flow between two concentric rotating cylinders

09:55-10:20 Coffee break

Part 2: Presentations of the 3rd IWCFTA

10:20-12:00 / Compere: Prof. Kwok-Wo Wong

(1) //10:20-11:00//

Keynote speech: 禹思敏教授, 连续混沌系统的若干生成方法、硬件实现及其在通信中的应用 (In Chinese)

(2) //11:00-11:30//

Prof. Fangyue Chen// Hangzhou Dianzi University, Hangzhou, Zhejiang, P.R. China

For Cellular Automata, Transitivity implies Chaos

(3) //11:30-12:00//

Prof. Yuncai Wang// Taiyuan University of Technology, Taiyuan, Shanxi, China

Generation of wideband chaotic light from laser diode and applications

One keynote speech, Mini-talk and Closing remark of the 3rd IWCFTA and 5th APWCCS

(Yunnan Normal University, 云南师范大学//note the starting time is 14:00, by bus, at the gate of Yunnan Dianchi Garden Resort Hotel & Spa, 下午两点在酒店门口乘车前往)

15:00-16:10/ Compere: Chairman, Prof. Ziliang Zhu

(1) **//15:00-15:45//**

Prof. Sergej Celikovsky, ***Generalized Lorenz System: History, Classification and Synchronization***

(2) //15:45-16:10//

Mini-talk/ Closing remark// ***Chairman,*** **Prof. Guanrong Chen**

(3) **//16:10-17:40//**

Visit the historical site of the National Southwest Associated University (1938-1946)//An English Guider

(Yunnan Normal University, leaving time is 17:40 PM, by bus)

Keynote Speeches for the 3rd IWCFTA and 5th APWCCS

Fractals for Nano/Tera Microelectonics

Prof. Maciej Ogorzalek
Department of Electrical Engineering, AGH University of Science and Technology
Krakow, Poland
Email: maciej@eie.polyu.edu.hk

Abstract: In the last decade fractals from an area of interest restricted for theoreticians and artistically-oriented members of academic communities came to many spectacular applications. This lecture presents an overview of basic geometric concepts of fractal geometry. Further a number of examples of very advanced applications in microelectronic circuits will be presented. These applications show enhancement of properties of microelectronic circuits through construction of fractal surfaces e.g. in biosensors, fractal electrodes, fractal antenna, solar cells and super-capacitors, etc. Properties of geometric structures exhibiting fractal geometries indicate their applicability in ever growing miniaturization (nano-structures) and frequency of operation (TeraHz range). Fractal theories apart from bringing ideas to non-conventional geometric constructions provide also useful tools for analysis of micro-system operation in the extreme conditions in the nano and tera range when standard macroscopic physical laws and circuit-theoretic approaches (such as the Ohm's law) are not applicable any more.

About the Speaker

Dr. Maciej Ogorzalek is Professor of Electrical Engineering and Computer Science and Head of the Department of Information Technologies, Jagiellonian University Krakow, Poland the oldest (1364) and most prestigious higher education institution in the country.

He held several visiting positions in Denmark, Switzerland, Germany, Spain, Japan, Hong Kong. He received a Research Award from the Ministry of Education of Spain in 2000 and worked for one year at the National Microelectronic Center, Sevilla, Spain. In 2001 he received a Senior Award from the Japan Society for Promotion of Science as visiting professor at Kyoto University and in 2005 Hertie Foundation Fellowship at The Goethe University Frankfurt-am-Main. 2006-2009 he held the Chair of Biosignals and Systems, Hong Kong Polytechnic University under the Distinguished Scholars Scheme.

Author or co-author of over 250 technical papers published in journals and conference proceedings, author of the book Chaos and Complexity in Nonlinear Electronic Circuits (World Scientific, 1997).

He served as Editor-in-Chief of the Circuits and Systems Magazine 2004-2007, Associate Editor for the IEEE Transactions on Circuits and Systems Part I, 1993-1995 and 1999-2001, he was elected Member of the Editorial Board Proceedings of the IEEE 2004-2009.

He serves also as an Associate Editor Journal of the Franklin Institute (1997-), Secretary of the Editorial Board for the Quarterly of Electrical Engineering (1993-2000), Member of the Editorial Board of Automatics (both in Polish), and Member of the Editorial board of the International Journal of Circuit Theory and Applications (2000-). Since 2009 he is an Associate Editor of the NOLTA Journal (Japan).

Dr. Ogorzalek is an IEEE Fellow (1997). He served the IEEE Circuits and Systems Society in various capacities including VP fpr Region 8, Administrative Vice-president, and finally 2008 Society President. He was CAS Society Distinguished Lecturer (2004-2005) and received the 2002 Guillemin-Cauer Award and IEEE-CAS Golden Jubilee Award.

Onset and chaos of the propagating pulse wave in a ring of coupled bistable oscillators

Prof. Tetsuro Endo
Department of Electronics and Bioinformatics, Meiji University
Kawasaki, 214-8571 Japan
Email: endoh@isc.meiji.ac.jp

Abstract: Various propagating wave phenomena such as chaotic pulse wave propagation and propagation of phase-inversion wave have been investigated. A basic question concerning these systems is the condition under which propagating wave can emerge. It is known as propagation failure phenomenon that propagating wave fails to propagate below a certain coupling strength. In our previous research, we found by computer simulation, the propagating pulse wave in an inductor-coupled bistable oscillator system, and confirmed that it existed in comparatively large parameter region. It is robust against fluctuation and noise for relatively large coupling factor. Namely, there exists a standing pulse wave for weak coupling case, and as the value of coupling strength increases beyond a certain critical value, a propagating pulse wave appears in some parameter region. In this study, we focus our attention on the formation mechanism of propagating pulse wave. As an example, we investigate one of the onset mechanisms of propagating pulse wave for the ring of six-coupled bistable oscillator case with the aid of bifurcation theory. As a result, we have found that a global bifurcation of maps based on the heteroclinic tangle in conjunction with pitchfork bifurcation, converts the fixed point corresponding to the standing pulse wave to the invariant circle corresponding to the propagating pulse wave. In addition, we demonstrate the chaotic propagating pulse wave for large coupling factor whose propagating direction changes randomly. We calculate probability density of one-span length and investigate the mechanism of chaotically propagating pulse wave.

About the Speaker

Prof. Tetsuro Endo received the B.E., M.E. and Dr. Eng. degrees in Electrical Engineering from Keio University, Yokohama, Japan in 1972, 1974 and 1977, respectively. From 1977 to 1992, he was with the Department of Electrical Engineering, National Defense Academy, Yokosuka, Japan where he was an Assistant Professor, a Lecturer, and an Associate Professor. In April 1992, he joined the Department of Electronics and Communication, Faculty of Science and Technology, Meiji University, Kawasaki, Japan, as a Professor. His research interests

include the study of nonlinear dynamics and chaos of coupled oscillators and phase-locked loops. From 1986 to 1989, he served as a Secretary of the Technical Group on Nonlinear Problems of IEICE. From 1995 to 1997, he was an Associate Editor of IEEE Transactions on Circuits and Systems. From 1996 to 1998, he served as a Vice Chairperson and Chairperson of the Technical Group on Nonlinear Problems of IEICE. From 2006 to 2008, he served as a Vice President of the Fundamentals Society of IEICE. In 2006, he was elected as a Fellow of IEICE. Dr. Endo is a senior member of IEEE.

Generalized Lorenz System: History, Classification and Synchronization

Prof. Sergej Čelikovský
Institute of Information Theory and Automation, the Academy of Sciences of the Czech Republic
Faculty of Electrical Engineering, Czech Technical University in Prague, the Czech Republic
Email: celikovs@utia.cas.cz

Abstract: Generalized Lorenz system (GLS) was first mentioned by Celikovsky and Vanecek in 1994 in order to provide a class of system which would be broader one than the well-known classical Lorenz system, but at the same time it would keep its basic equations structure. In 1999, Chen and Ueta introduced a new chaotic system with equations resembling the classical Lorenz one, yet with topologically very different chaotic attractors, called by others, later on, as the Chen system. In 2002, Celikovsky and Chen derived common canonical form for both Chen and classical Lorenz system, thereby showing that all previous systems are covered by the GLS class and its canonical form may be characterized by a single scalar parameter. Moreover, this scalar parameter could be used to tune subtle nonlinear phenomena like chaos and various kinds of bifurcations leading to it, while remaining parameters were eigenvalues of linear approximation at the origin. Furthermore, Celikovsky and Chen discovered and analyzed in 2002 the so-called hyberbolic type generalized Lorenz system (HGLS), being in a certain sense a complementary to the GLS. Finally, the same authors provided in 2005 yet another canonical form, enabling global exponential synchronization of two copies of GLS's or HGL's via a scalar synchronizing signal. This result was, later on, used for a novel digital encryption scheme based on continuous time chaotic system. Technique for the complete GLS and HGLS classification is, in particular, based on the special classification tools using the ideas stemming from the well-known LaSalle principle. In this keynote talk, this classification tool will be presented in a more detail, together with the resulting complete classification of GLS and HGLS. The technique for the synchronization based on nonlinear transformation and output injection leading to the observer canonical form of GLS will be explained and the synchronization of two copies of GLS demonstrated. Brief discussion of possible applications in encryption will be presented as well.

About the Speaker

Dr. Sergej Čelikovský

Expertise: Nonlinear systems, chaos control and synchronization, nonlinear stability and stabilization, nonlinear observers, modelling, analysis and control of underactuated systems with applications to walking robots.

Degrees: MSc. from Faculty of Numerical Mathematics and Cybernetics of the Moscow State University, Department of Optimal Control 1984; RNDr. degree (Rerum Naturalium Doctoris) from the Mathematical and Physical Faculty of Charles University in Prague 1985; Ph.D degree from the Institute of Information Theory and Automation of the Czechoslovak Academy of Sciences 1989.

Visiting positions: Research associate at the Faculty of Mathematics, University of Twente, Enschede, NL, 1994, and at the Department of Mechanical and Automation Engineering of the Chinese University of Hong Kong, 1996; Visiting professor at CINVESTAV-IPN, Unidad Guadalajara, Mexico, 1998-2000.

Currently: Associate member of the Centre for Chaos and Complex Networks at the City University of Hong Kong; Chief research fellow and the Head of Department of Control Theory in the Institute of Information Theory and Automation of the Academy of Sciences of the Czech Republic; Associate Professor at the Czech Technical University in Prague. Senior Member IEEE, member of the IFAC TC on Nonlinear Systems, Secretary of the Czech IFAC NMO.

Associate Editors: Dynamics of Continuous, Discrete an Impulsive Systems (2004-2006); IEEE Transaction on Automatic Control (2006-2009); from 2004 Member of Editorial Board of Kybernetika; from 2010 Guest Associate Editor of International Journal of Bifurcation and Chaos. Subarea Chair of the IPC of the: IFAC Nonlinear Control Symposium NOLCOS 2007, Pretoria, South Africa and IFAC Nonlinear Control Symposium NOLCOS 2010, Bologna, Italy.

IPC members: numerous conferences, in particular, IFAC Conference on Chaos Control 2006 in Reims, FR, and2009, London, GB; 3rd International Conference on Dynamics, Vibration and Control (ICDVC-2010), Hangzhou, China; 5th Asia-Pacific Workshop on Chaos Control and Synchronization, Kunming, China.

Publications: co-author of one book and two book chapters, co-editor of the book, over 40 papers in international journals, over 80 papers in international conference proceeding, over 800 SCI citations (auto-citations excluded).

Partial Control of Chaotic Systems

Prof. Miguel A. F. Sanjuán
Nonlinear Dynamics, Chaos and Complex Systems Group
Departamento de Física, Universidad Rey Juan Carlos
Tulipán s/n, 28933 Móstoles, Madrid, Spain
Email: miguel.sanjuan@urjc.es

Abstract: When we attempt to control a linear system in which some noise has been added, typically we need a control higher or equal to the amount of noise added. When we have a region in phase space where there is a chaotic saddle, all initial conditions will escape from it after a transient with the exception of a set of points of zero Lebesgue measure. The action of an external noise makes all trajectories escape even faster. Attempting to avoid those escapes by applying a control smaller than noise seems to be an impossible task. Here we show, however, that this goal is indeed possible, based on a geometrical property found typically in this situation: the existence of a horseshoe. The horseshoe implies that there exists what we call safe sets, which assures that there is a general strategy that allows one to keep trajectories inside that region with a control smaller than noise. We call this type of control partial control of chaos [1,2] that allows one to keep the trajectories of a dynamical system close to the saddle even in presence of a noise stronger than the applied control. In this talk recent progress and new results on this control strategy are presented. This is joint work with James A Yorke (USA), Samuel Zambrano and Juan Sabuco (Spain).

[1] Samuel Zambrano, Miguel A. F. Sanjuán, and James A. Yorke. Partial Control of Chaotic Systems. Phys. Rev. E **77**, 055201(R) (2008).

[2] Samuel Zambrano and Miguel A. F. Sanjuán. Exploring Partial Control of Chaotic Systems. Phys. Rev. E **79**, 026217 (2009).

[3] Juan Sabuco, Samuel Zambrano, and Miguel A. F. Sanjuán. Partial control of chaotic transients and escape times. New Journal of Physics, 2010.

About the Speaker

Prof. Miguel A. F. Sanjuán received a Bachellor Degree in Physics by University of Valladolid, Spain, in 1981,

where he was granted the Outstanding Graduation Honor for Undergraduated Studies and a PhD Degree by National University at a Distance (UNED), Madrid, Spain in 1990, on Nonlinear Dynamics and Chaos. He is Full Professor of Physics at the Universidad Rey Juan Carlos, Madrid, Spain, where he has been the Founder of the Department of Physics. He is currently Head of the Department of Physics and Head of the Nonlinear Dynamics, Chaos and Complex Systems Research Group. He was elected Foreign Member of the Lithuanian Academy of Sciences in the areas of Physics and Mechanical Engineering within the Technical Sciences Division on March 18 2008. Member of Editorial Boards of six international journals (Communications in Nonlinear Science and Numerical Simulation, Discrete and Continuous Dynamical Systems B, Journal of Vibroengineering, Journal of Nonlinear Systems and Applications, International Journal of Bifurcation and Chaos and Mathematical Problems in Engineering). Supervisor of 12 PhD Theses in Nonlinear Dynamics, Chaos and Complex Systems. Participation in Thesis committees in Spain, France and Cameroon. Referee on Nonlinear Dynamics, Chaos and Complex Systems on more than 40 scientific journals. Principal Investigator and Researcher in more than 20 competitive funded projects. Author and Co-author of more than 100 scientific articles, edited 4 books and more than 100 communications to conferences. Around 50 invited lectures in seminars and conferences in Spain, Europe, USA, China, Japan, India, Cameroon, Mexico, Chile, Brazil. Fellowship of the Japan Society for the Promotion of Science. University of Tokyo. Coauthor of one review for Reviews of Modern Physics. Its impact factor is higher than Nature and Science. Scientific Evaluator of Research Agencies in Spain, Chile, Argentine, France, Georgia and INTAS-EU. Organizer of different Meetings, Seminars and Conferences in Nonlinear Dynamics. Secretary of the Specialized Group on Physics of Life Sciences. Spanish Physics Royal Society, since April 2004. Member of many Scientific Committees for evaluation and research. He has participated in many popularizing research activities and author of a blog on Complexity. Member of Organizing and Scientific Committees of many conferences. Visiting Research Associate of the Institute for Physical Sciences and Technology of the University of Maryland. Visiting Research Associate of the University of Tokyo.Visiting Researcher in Germany, Lithuania, Italy, USA, Japan, Portugal. Currently Visiting Research Professor at Beijing Jiaotong University from the ``Key Invitation Program for Top-Level Experts'' from the `State Administration of Foreign Experts Affairs'' of the Chinese Government. August-January 2011.

连续混沌系统的若干生成方法、硬件实现及其在通信中的应用

禹思敏 教授
广东工业大学，中国
Mail: gdutsiminyu@yahoo.com.cn

摘要：报道了近年来有关多翅膀和多涡卷等连续时间混沌系统建模、电子电路、DSP 和 FPGA 技术实现及其在通信中应用等若干课题的国内外研究进展情况。主要内容包括以下几个方面：

一、近年来国内外有关多翅膀和多涡卷混沌系统的研究进展。

二、在双翅膀广义 Lorenz 系统族基础上，解决多翅膀和网格多翅膀混沌吸引子体系的建模问题，建立一个包括 Lorenz、Chen、Lü、Rucklidge、Shimizu-Morioka、Sprott 等若干广义 Lorenz 系统在内的多翅膀和网格多翅膀混沌吸引子体系及其最新研究进展。

三、基于切换控制与异宿环的连续时间动力系统混沌化的建模方法及实例介绍。

四、基于混沌反控制的连续时间动力系统混沌化的建模方法与电路实现。

五、混沌电路模块化设计及其改进形式。两个典型实例介绍：（1）网格多涡卷蔡系统的模块化电路设计与实现；（2）多翅膀混沌系统的改进型模块化电路设计与实现。

六、用电子电路、DSP 和 FPGA 技术产生多翅膀与多涡卷混沌信号与实现语音和图像混沌混保密通信。两个典型实例介绍：（1）基于 DSP 技术的语音数字混沌保密无线通信及其硬件实现；（2）基于 FPGA 嵌入式以太网传输的数字图像混沌保密通信及其硬件实现。

七、DSP 技术平台的语音数字混沌保密无线通信和 FPGA 嵌入式以太网传输数字图像混沌保密通信的现场演示。

报告人简介

禹思敏，1957 年 5 月出生，工学博士、教授、博士生导师。2001 年毕业于华南理工大学电路与系统专业，获博士学位。2006 年 3 月应邀访问香港城市大学混沌与复杂网络学术研究中心，2005 年 9 月至 2009 年 7 月三次应邀访问中国科学院数学与系统科学研究院。兼任香港城市大学混沌与复杂网络学术研究中心协作成员、IEEE Transactions on Circuits and Systems、Chinese Physics Letters、Chinese Physics、物理学报、电子与信息学报、控制理论与应用、通信学报等国内外期刊审稿专家和国家自然科学基金项目通信评议专家、广东省 211 工程三期重点学科建设项目“复杂工业过程的建模、优化与控制”学科带头人。作为主要完成人，获 2007 年度教育部自然科学奖一等奖一项，获奖项目名称为“几类典型复杂系统的建模、分析与应用”。正式授权国家发明专利 5 项。近年来主持国家和省自然科学基金以及纵向科研项目 10 项，其中主持国家自然科学基金 2 项、广东省自然科学基金 3 项、广东省“211 工程”第三期重点建设项目 2 项、广东省科技计划项目 1 项、广州市科技计划项目 1 项。在 IEEE Trans. CAS、Chaos、IJCTA、PLA、IJBC、CSF、中国科学、物理学报、Chinese Physics、IJMPB、Physica A、电子学报、通信学报等国内外期刊上发表论文 80 多篇，其中在 IEEE Trans. CAS 上发表论文 5 篇，在国内外 SCI 刊物上发表期刊论文 40 多篇。

Digital chaos encryption chip and its application in the network information encryption transmission

Prof. Qun Ding
Key Laboratory of Electronics Engineering, College of Heilongjiang Province
College of Electronic engineering, Heilongjiang University, Harbin, China
Email: qunding@yahoo.cn

Abstract: Chaos system is a complicated nonlinear dynamic system .Chaos system which has good Pseudo random property, orbital unpredictability, extremely sensitive characteristics for initial state and the control parameters makes chaos secure communication and chaotic information encryption become a important research subject in recent years, furthermore digital encryption system design based on chaos is more suitable for the need of encryption system and secure communication system currently. Review the initial stage of digital chaos encryption system studied in 1989 to 1996, there are some papers on digital chaos encryption during these periods, however, through analysing chaotic system digitized , people found that security flaws of the digital chaotic encryption system that is the degradation of the digital chaotic encryption system, because of all algorithms are operated within precision limits in digital encryption algorithm, so chaotic sequence that is generated by iteration is not chaotic system orbit theoretically, and also not completely have chaotic characteristics , added the result of approximation, the chaotic sequence will finally evolve into a sequence with cycle making encryption algorithm may be cracked based chaos theory design. But the initial value sensitivity and the huge initial key space provided by digital chaotic system could not still be substituted by traditional digital encryption algorithm, moreover digital chaos sequence still have many original

basic characteristics of chaotic system; if we can improve the accuracy of digital chaos under the impact of limited precision. Digital chaotic encryption domain still has prospects of research and development. So people had been studying and improving the degradation of the digital chaotic system characteristics from 1997 to now. This paper studies digital chaos characteristics and also points out main problems that need to be solved about digital chaos system based on digital chaos system platform built at present, meanwhile conducts in-depth study about short periodicity and correlation, proposes improved methods , then designs digital chaos encryption chip and applies it into network information encryption transmission system.

About the Speaker

Expertise: chaos key sequence generator, Cryptographic algorithm IP core, Encryption chip design, Network Encryption System, detection and analysis of encryption signal, Chaotic secure communication and synchronization and so on. Degrees: the undergraduate course study, from electronic engineering, Harbin engineering university in 1984; MA, from instrument science and technology, Harbin industrial university in 1997; PHD, from instrument science and technology, Harbin industrial university in 2007.Currently: professor of electronic engineering, Heilongjiang university; Doctoral supervisor; dean of electronic engineering; director of key Laboratory of Electronics Engineering in College of Heilongjiang Province; executive director of Heilongjiang instrumentation, Leader of electronic and information engineering key subject in Heilongjiang province. Professor Qun Ding has been engaged in the research of information hardware encryption technology, chaos cipher and chaotic secure communication, accomplished 12 research projects, participated in 2 State Natural Science Foundation of China projects as principal and 3 provincial projects, Obtained 1 provincial science and technology progress prize, obtained and declared 6 patents, published more than 60 academic papers and 30 papers retrieved by SCI, EI, ISTP. As a principal, she is subsidized by state natural sciences foundation "research of chaos sequence cipher encryption chip based FPGA (No.60672011)", "digital chaotic new model and its application in the information encryption system (No.61072072)", and Provincial scientific research project "network encryption card based SOC (No.GZ06A101)". Meanwhile, she has undertook and completed some practical research projects about data encryption system, the video encryption transmission device for customs, data link terminal digital spread spectrum modulation and demodulation technology and so on in recent years. She held the post of executive chairman in "the 4th Asian-pacific region chaos control and synchronization international conference (APWCCS2007)" in 2007, she was the committee member in charge of work in "International chaos fractal theory and practical conference (IWCFTA)" respectively from 2008 to 2010.

Abstracts of 5th APWCCS

A multivibrator circuit based on chaos generation

E. Campos-Canton
Departamento de Fısico Matematicas, UASLP, Alvaro Obregon 64, Col. Centro, C.P. 78000 San Luis Potosi, S.L.P., Mexico; Email: eric.campos@ipicyt.edu.mx
Division de Matematicas Aplicadas, IPICYT, Camino a la Presa San Jose 2055, Col. Lomas 4 seccion, C.P. 78216 San Luis Potosi, S. L. P., Mexico.
R. Femat
Division de Matematicas Aplicadas, IPICYT, Camino a la Presa San Jose 2055, Col. Lomas 4 seccion, C.P. 78216 San Luis Potosi, S. L. P., Mexico.
I. Campos-Canton
Facultad de Ciencias, UASLP, Alvaro Obregon 64, Col. Centro, C.P. 78000 San Luis Potosı, S.L.P., Mexico.

J. G. Barajas-Ramirez
Division de Matematicas Aplicadas, IPICYT, Camino a la Presa San Jose 2055, Col. Lomas 4 section, C.P. 78216 San Luis Potosi, S. L. P., Mexico; Email: jgbarajas@ipicyt.edu.mx

Abstract: We present a parameterized method to design multivibrator circuits via piecewise-linear (PWL) chaotic systems, which can exhibit double-scroll oscillations. The circuit is conformed exploiting a parametric modulation that manipulates the equilibrium stability of each linear subsystem. Chua's oscillator is used as benchmark to illustrate the effectiveness of the proposed method to design multivibrator circuits. Thus, our proposal allows one the design of the three configurations of a multivibrator: Monostable, Astable, and Bistable. Potential applications are illustrated designing a pulse generator and a full S-R flip flop device based on our all-in-one multivibrator circuit.

Keywords: Multivibrator circuits, PWL Systems, Chaos-based design

Performance Comparison of Chaotic Signals with Gold Code as PN-Sequence based on CDMA System

D. Nugrahani, K. Klomkarn, P. Sooraksa
Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang (KMITL), Chalongkrung Rd, Ladkrabang, Bangkok 10520, Thailand
dewi_en12@yahoo.com, kkkitdak@kmitl.ac.th, pitikhate@gmail.com

Abstract. In this paper, we purposed logistic map, Henon map, Lorentz, Chua's circuit, Chen system, and Chebyshev chaos as a PN-sequence in DS-CDMA. Since the spreading sequence in chaotic sequences is no longer binary, the application of the chaotic sequences in digital communication is limited. Digital encoding technique is used to transform continuous values to binary sequences to adopt it in digital communication system. The studied of digital encoding is given in [4] is also investigated.

Keywords: Chaos, CDMA, Gold code, data synchronization

Automatic titration and Chua's controller for waste management system

P. Kruepetch, S. Areejit, K. Klomkarn, P. Sooraksa
Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang (KMITL), Chalongkrung Rd, Ladkrabang, Bangkok 10520, Thailand
pratya62@hotmail.com, ar_suwilai@hotmail.com, kkkitdak@kmitl.ac.th, pitikhate@gmail.com

Abstract: This paper is an applied research using automation technology for environment. The objective of the research is to build a prototype an infectious for waste management system. The infectious waste causes a wide range of obnoxious odors. Good micro-organisms, unharmful for human, are employed for the treatment by means of automatic spraying technique. Adding microorganisms into the water, we select the chaotic signal for mixing strategy to improve the mixing efficiency. The entire operation of the system can be controlled via bluetooth communication system. For the used vegetable-oil waste, we transformed the waste into energy by using Chua's circuits to accelerate the chemical reaction as a vibration catalyst. A novel low-cost

automatic titration to determine fatty acid of the used oil is also implemented. The output of the research is the desired prototype and the outcome is knowledge transferring to communities. Based on Thai TV news about this KMITL automatic waste treatment machine, the prototype has received a great attention from many local administrative governments of many provinces in Thailand.

Three novel contribution of this paper are as follows:

(a) Automatic titration using Chua's circuit as a vibration catalyst
(b) New application for chaos in the areas of transforming waste used oil into bio-diesel energy
(c) Automatic chaotic spraying and mixing good bacteria to kill bad odor for infectious waste

Non-linear Visual Servo System for Printed-Circuit Board Fault Injection Test

Tassanai Banlue[*], Pitikhate Sooraksa [**], Suthichai Noppanakeepong[†]
Faculty of Engineering, King Mongkut's Institute of Technology Ladkrabang, Chalongkrung Rd., Ladkrabang, Bangkok 10520, Thailand
E-mails: btassanai@gmail.com, pitikhate@gmail.com, knsuthic@kmitl.ac.th

Abstract: Many of Fault Injection Testers (FIT) are still in design and development phase finding for best solution. It is usual for such complex machine has never been defined a clear process for reference. This paper describes the design, development and implementation of a Smart Visual Servo (SVS) for Automated Printed-Circuit Board (PCB) Fault Injection Tester in micro scale. The requirement is to land one or more probes which attached on the robot arm at test points on the PCB plane then inject diagnostic signal to verify that the part reacts appropriately. It is well known that errors can be characterized from any joint of robot arms, stepping motors including imperfect fiducial marking even perfect precision of well calibrated machine has been done. However, missing rate at 1-5% is meaningful for manufacturing especially while testing for several hundred points. Therefore, we integrated this SVS to feedback the errors by recognizing center of actual landing points. The result shows that the designed SVS is very applicable in correcting errors. The Fault Injection Tester yields higher accuracy near perfection and becomes more reliable. The correction statistics can also indicate effectiveness of the designed nonlinear-control system for preventive maintenance efficiently.

Keywords: Visual servo, robot vision, non-linear control

Hopf bifurcation and generalization of the delayed and coupled Lorenz-R össler system

Lijun Pei[1] Li Zhang[2]
[1] Department of Mathematics, Zhengzhou University, Zhengzhou, Henan 450001, China
peilijun@zzu.edu.cn, lijunpei@yahoo.com.cn
[2] MOE Key Lab of Mechanics and Control of Aerospace Structures Nanjing University of Aeronautics and Astronautics, Nanjing, Jiangsu 210016, China; zhangli@nuaa.edu.cn

Abstract: In this paper, dynamics of the coupled Lorenz-Rossler system with coupling delay is

considered employing the analysis software of the delayed dynamical systems-DDE-BIFTOOL, and the effects of the coupling and delay on the dynamics of the system are disclosed. For the unidirectional delayed coupled system, only the coupling effects the equilibriums and their stability, but delay can't affect the local dynamics. But for the bidirectional delayed coupled system, not only the coupling but also delay can affect the local dynamics. The stable Hopf bifurcation occurs due to them and thus the generalized synchronization of Lorenz and Rossler system takes place. It implies that the delay can restrain the chaotic behavior.

Key words: chaos; generalized synchronization; time delay; Hopf bifurcation

Stochastic Hopf bifurcation and random control in a kind of stochastic Brusselator system

Shao-juan Ma
School of Information & Computing Science, North University for Nationalities, Yinchuan, 750021 China; E-mail address: dr.sjma@gmail.com

Abstract: Owning to the uncertain factors of external environment, manufacture, material and installation some parameters in practical model are not constant and will be characterized as bound random parameters. The study of this kind of model is more accurate than deterministic one. We may find some phenomena are more prominence which can be neglected in deterministic one, especially the sensitive behavior. To study and control these sensitive behaviors in this kind of stochastic system also becomes important.

The bifurcation in nonlinear dynamical system results from the variation of dynamic behavior as the parameter is changed. The saddle-node bifurcation can lead to a series of destructive dynamical behavior, such as jump of the amplitude and lag. The period-doubling bifurcation can lead to chaos state. Hopf bifurcation can change the stability at the equilibrium point. Therefore in recent years controlling and anti-controlling bifurcation has caught many attentions. The aim of bifurcation control is to design a controller to modify the bifurcation properties of a given nonlinear system, thereby to achieve some desirable dynamical behaviors.

The theories of bifurcation and bifurcation control in deterministic system have already been applied into many fields, such as engineering, biological and chemical system. There are some summarizes about bifurcation control [1]. However these results are only about the bifurcation control in deterministic system. The method and theory about bifurcation control in stochastic system is not built completely, especially in stochastic system with random parameter. Orthogonal polynomial approximation [2-4] is based on the expansion theory of orthogonal polynomials without the limitation of small perturbation, which are shown that is better for studying the dynamical behavior [5] in stochastic system with random parameter. References [6-8] have also illustrated that bifurcations and chaos in stochastic system with random parameter are different from the deterministic system which own their features. Wu [9] has discussed the chaos and its control via orthogonal polynomial approximation in detail. Now a few references have discussed stochastic Hopf bifurcation and no reference explores the bifurcation control in this kind of stochastic system. In this paper, the Hopf bifurcation and control in nonlinear dynamical system with random parameter are discussed.

Firstly according to the orthogonal polynomial approximation in Hilbert space, the Brusselator system with random parameter can be reduced into the deterministic equivalent system. Then the Hopf bifurcation in deterministic equivalent system is discussed by the mathematical analysis

tools and the first Lyapunov coefficient method. The studies discovered that different from the deterministic system, the critical value of stochastic Hopf bifurcation is determined not only by deterministic parameters in stochastic system, but also by the intensity of random parameter. As the intensity of random parameter is increased, the critical value of stochastic Hopf bifurcation is decreased. The theoretical results are verified by numerical simulations. We also find that the direction and stability of bifurcation in stochastic Brusselator system is not changed as the random intensity is small. Theoretical results are verified by numerical simulations.

Next we have controlled stochastic Hopf bifurcation in Brusselator system by nonlinear feedback method controller with random parameter. By means of numerical simulations, we find that nonlinear random feedback method can control stochastic Hopf bifurcation in stochastic van der Pol system available. Besides, comparing with nonlinear deterministic feedback controller, we must adjust the feedback intensity in nonlinear deterministic feedback controller in great degree to control stochastic Hopf bifurcation, but to achieve the same control effect we only need to change the random intensity of nonlinear random feedback controller a little as the feedback intensity is very small. Therefore, combining with orthogonal polynomial approximation ,the random feedback method may be also hopeful for further controlling other nonlinear phenomena in nonlinear stochastic dynamical system.

Besides, orthogonal polynomial approximation may be also hopeful for further studying other nonlinear phenomena including chaos control and synchronization in stochastic Brusselator system we considered.

Keywords: Stochastic Brusselator system, orthogonal polynomial approximation, stochastic Hopf bifurcation, random nonlinear feedback method control

Generation mechanisms of electrical bursting patterns by slow variables with different time scales

Zhuo-qin Yang, Ting-ting Guan[1]

[1] *School of Mathematics and System Sciences and LMIB, Beihang University, Beijing 100191, China*

E-mail address: yangzhuoqin@buaa.edu.cn

Abstract: In contrast to standard bursting with only one slow variable, phantom bursting is driven by the interaction of two slow variables with disparate time constants. The phantom idea is quite general and can work with a wide range of possible identities for the two slow inhibitory variables. For concreteness, we describe a particular biophysical realization of the phantom model by focusing on two important slow negative feedback mechanisms -a slowly activating Ca2+-dependent K+ current and a ATP-sensitive K+ current controlled by a Ca2+-based nucleotide oscillation (ADP/ATP ratio). In this model, there exist three slow processes, the faster slow variables, subspace Ca2+ concentration, Css and ER Ca2+ concentration (Cer), and the slower slow variable the Ca2+-dependent ADP/ATP ratio (a), which interact to evoke fast, medium and slow bursting in pancreatic beta-cells.

Complex patterns of bursting action potentials and Ca2+ bursting oscillations are exhibited in pancreatic beta-cells, and different [Ca2+]i signaling is primarily determined by distinct firing patterns, which could differentially support insulin secretion. Our model offers an opportunity for the mathematical analysis of different electrical bursting patterns when changing only model parameter. Three slow processes with different time scales, giving rise to the bursting patterns with different oscillatory periods, makes the fast/slow analysis of bursting dynamics that become

much more difficult. Due to robustness to fast, medium and slow oscillation periods, bifurcation mechanisms and different topological types of the bursting patterns can be obtained by that of only fast bursting patterns as the slower slow variable a is nearly constant. Accordingly, the fast bursting patterns with two faster slow variables Css and Cer, are investigated by the fast/slow analysis, where Css is considered as a bifurcation parameter controlling the fast spiking, however, Cer has no effect on the equations of the fast subsystem. This appears that only the slow variable Css plays a key role in the dynamic mechanisms and topological types of different bursting patterns in pancreatic beta-cells. In this way, the reducing methods can help us to reveal inherent nature of complex bursting dynamics induced by interaction of multiple time-scales slow variables. At the same time, it may provide an instruction for further simplifying mathematical models of pancreatic beta-cells.

Keywords: pancreatic beta-cells model; bursting; fast/slow analysis, slow variables with different time scales

A novel autonomous chaotic bursting after period doubling bifurcation discovered in biological experiment

Hua-guang Gu[1], Li Li[2]
[1]College of Life Science, Shaanxi Normal University, Xian, Shaanxi 710062, China
[2] Science and Training Center of Chinese Astronautics, Beijing 100193, China
E-mail:guhuaguang@263.net

Abstract: A bifurcation scenario whose procedure was from period 1 bursting, to period 2 bursting, to period 4 bursting, to chaotic bursting, to period 5 bursting was discovered in the biological experiment on a neural pacemaker. The characteristics of the period 4 and 5 bursting were analyzed. The period 4 bursting was identified as π(2, 2) bursting, locating in a period doubling bifurcation sequence. The period 5 bursting was a novel bursting different to common π(5) bursting.

Deterministic mechanism was identified from the chaotic bursting using first return map of interspike intervals, nonlinear prediction and unstable period orbit with surrogate data. Higher dimensional unstable periodic orbits, period-4 orbit and period-5 orbit, were detected in the chaotic bursting locating near period 4 and period 5 bursting, respectively. The periodic number of the orbits was higher than those studied previously. The location of the unstable period-k (k=4, 5) orbit is similar to that of neighboring period k bursting. The probability of the chaotic trajectory visiting unstable period-k (k=4 or 5) orbit is higher when the chaotic bursting is closer to the corresponding period k bursting. In addition, lower order unstable periodic orbits, such as period 2 orbit and period 3 orbits, were also detected in the different regime of the chaotic bursting. UPOs with multiple (four) kinds of different periodic numbers were embedded in the chaotic bursting.

The results revealed not only the structures, classifications and evolutions of unstable period orbit (UPO) in the chaotic bursting, but also identified the underlying relationships between the evolution of UPO in the chaotic bursting and neighboring stable periodic bursting lying in the bifurcation scenario. The chaotic bursting exhibited more complex dynamics such as higher order UPOs, multiple UPOs and period doubling bifurcation to chaos, provided a novel example of chaos discovered in the biological rhythm.

Keywords: chaos; period doubling bifurcation; unstable period orbit; neural firing pattern

Chaos-like stochastic neural firing patterns induced by coherence resonance at a period adding bifurcation*

*Hua-guang Gu***, Dong Wang, Xiao-yan Zhao*
College of Life Science, Shaanxi Normal University, Xian, Shaanxi 710062, China
***E-mail: guhuaguang@263.net*

Abstract: It is very important to indentify whether a non-periodic neural firing pattern generated in biological experiments is chaotic or stochastic, based on the results from the estimations by nonlinear time series measures. In the present investigation, two neural firing patterns generated in the experimental neural pacemaker and simulated in the stochastic Chay model but not in the deterministic model, lying between period 2 bursting and period 3 bursting, were indentified to be stochastic, although exhibiting chaos-like characteristics.

These two firing patterns both exhibited transition between period 2 burst and period 3 burst. The case I pattern was transition between a string of period 2 burst and a string of period 3 burst, while between a single period 2 burst and a single period 3 burst in case II pattern. On one hand, the two firing patterns were found to show chaos-like characteristics by the application of nonlinear time series measures on interspike interval (ISI) series: deterministic structures in first return maps, short term predictability and deterministic periodic orbits. On the other hand, if period 2 burst (or period 3 burst) was defined as an event, the IEI series can not be predicated, showing that there existed stochastic components in the firing pattern. The occurrence of period 2 or period 3 burst is stochastic and dependent in case I pattern while stochastic and independent in case II pattern. The bifurcation analysis showed that two patterns were generated near a bifurcation point from period 2 bursting to period 3 bursting under the influence of noise by coherence resonance. Case I was generated near the bifurcation with coexistence of 2 bursting and period 3 bursting while case II with no coexistence.

The results showed that analysis on eigen events can help to identify the underlying dynamics, and systematical usage of nonlinear time series measures may lead to accurate judgment of the complex firing patterns.

Keywords:stochastic neural firing pattern, period adding bifurcation, coherence resonance, chaos

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A stochastic neural firing generated at a Hopf bifurcation and its biological relevance

*Dong Wang, Mengjiao Chen, Minghao Yang, Wei Ren**
College of Life Science, Shaanxi Normal University, Xian, Shaanxi 710062, China

*E-mail:renwei1964@vip.sina.com; mascot0000@yahoo.com.cn

Abstract: Previous studies reported a number of noise-induced stochastic neural firing rhythms, which were termed as integer multiple firing patterns. Such non-periodic firing patterns are identified to be stochastic by means of estimations of nonlinear time series measures and suggested to be generated at a Hopf bifurcation via interplay between noise and the system's dynamics. A series of such integer multiple patterns were experimentally discovered by using an experimental neural pacemaker, which is produced by chronic nerve injury. The injured nerve does not encode normal sensory information, and thus, the biological relevance of the integer multiple firing patterns are unclear.

Baroreceptors are sensory nerve terminals of blood pressure. They generate neural firing trains to encode and input the changes of blood pressure into the central nervous system. Their biological function is fundamentally important in maintenance of a normal blood pressure level. In the present investigation, we studied the firing patterns generated by baroreceptors in rabbits. Integer multiple firing patterns were observed in *in vitro* experiments by adjusting the pressure in the blood vessel. These non-periodic firing patterns were characterized to be stochastic, but not chaotic, by a series of nonlinear time series estimations.

In order to find out the dynamic mechanism of the integer multiple firing patterns observed in rabbit baroreceptors, we adjusted the pressure in the blood vessel and discovered a gradual change from resting to periodic firing in the firing activities of the baroreceptors. Interestingly, integer multiple firing patterns were observed between the resting state and the periodic firing. We then compared these integer multiple with those previously observed in the experimental neural pacemaker and discovered very similar dynamic characteristics. Using a neural model with dynamics of a supercritical Hopf bifurcation, we simulated the bifurcation process of firing patterns and observed the induction of the integer multiple firing patterns by adding noise. The results strongly suggest that the integer multiple firing rhythms generated by rabbit baroreceptors result from interplay between noise and the system's dynamics.

In realistic biological systems, including the rabbit baroreceptors, intrinsic noise is inevitably produced from perturbations and thermal dynamic fluctuations. The variation of blood pressure is also unstable. The biological significance of noise and the noise-induced firing rhythms is an interesting question to be addressed.

Keywords: stochastic neural firing pattern, Hopf bifurcation, blood pressure, baroreceptors, chaos

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Quadratic Tracer Dynamical Models for Tobacco

Jiye Qiang [1, 2,*], Cuncai Hua [3] and Shaohua Wang[1, *]

1. *College of Agronomy, Nanjing Agricultural Universit/y/Key laboratory of Crop Physiology & Ecology in South China ,Ministry of Agricultural , Nanjing 210000, Jiang Su, China*

2. *College of Tobacco, Yunnan Agricultural University, Kunming 650201, Yunnan, China*

[*]*Corresponding author; Email: qiangjiye@126.com*

3. School of Mathematics, Yunnan Normal University, Kunming 650092, Yunnan,China
Email:cuncai-hua@139.com

Abstract: Hitherto all of the tracer dynamical models for plant are linear. The linear dynamical models describe uniformly transferring process of tracer dosages. In this paper, in order to study the non-uniformly transferring process of the tracer dosages, two quadratic tracer dynamical models are established for tobacco. Firstly, adding the tracer dosages to tobacco once at zero time, we assume that the absorption of tobacco from the tracer dosages is fast and is a quadratic function of the quantity of dosages and that the exclusion of the tobacco from the tracer dosages is slow and a linear function of the quantity of dosages. A single-compartment quadratic dynamical model of Logistic type is established for the leaves of tobacco. Secondly, a two-compartment quadratic dynamical model is established for the leaves and culms of tobacco. It is shown by qualitative analysis of the models that the tracer dosages added to the leaves of tobacco is excluded finally. However, the tracer dosages are stayed in finite time. Thirdly, two methods are given for computing the parameters in the models. Finally, two quantitative quadratic tracer dynamical models are obtained by computing the data from an experiment for "K326" type tobacco with Sarpe method. The results are in agreement with the qualitative ones.

Keywords: tracer dynamical models, tobacco, tracer dosages

Dynamical Analysis of Cortical Pyramidal Neuron Model Ⅱ

Lei Wang, Shen-quan Liu
Department of Mathematics, School of Sciences, South China University of Technology
Guangzhou, 510640, China；Email: mashqliu@scut.edu.cn

Abstract Burst firing is a prominent feature of cortical pyramidal neurons and it is thought to have significant functional roles in reliable signaling and synaptic plasticity. From the study of a kind of cortical pyramidal neuron model, the paper made a detailed analysis of the complex bursting produced in it. By discussed the roles of electrophysiological parameters under different cases, the rich dynamical properties are contained in the complex bursting of the pyramidal neuron, such as the InterSpike Intervals(ISIs) is period adding bifurcation and period doubling bifurcation. From the model results, we can get a further understanding of the rich firing patterns and rhythm coding which are contained in the burst firing of cortical pyramidal neuron.
Keywords: Compartment model; bursting; Period adding bifurcation; Period doubling bifurcation

Global exponential synchronization between different chaotic systems with unknown parameters

Tie-dong Ma[1], Jie Fu[2]*
[1] College of Automation, Chongqing University, Chongqing 400044, China
[2] College of Opto-Electronic Engineering, Chongqing University, Chongqing 400044, China
[*] Corresponding author. E-mail address: tdma@cqu.edu.cn

Abstract: This paper proposes a nonlinear feedback control method to realize global exponential synchronization with unknown parameters and channel time-delay between Lü system and Chen system. Some effective observers are given to estimate the unknown parameters of drive system. Based on the Lyapunov stability theory and linear matrix inequality (LMI) technique, some sufficient conditions of global exponential synchronization of the two chaotic systems are

derived. Simulation results show the effectiveness of the proposed controller finally.

Keywords: global exponential synchronization, unknown parameters, channel time-delay, Lyapunov stability theory

An Approach to the Continuous-time Chaos based Stream Ciphers

Yifang Weng
Department of Automation, Beijing Technology and Business University, Beijing 100048, China
E-mail address: wengyf@th.btbu.edu.cn； mascot0000@yahoo.com.cn

Abstract: The pseudo random sequences generated by chaos have been used in cryptography. The safety is a very important issue in this new kind of cryptosystem. There are some stream ciphers based on discrete-time chaos. It is seldom to find the stream ciphers based continuous-time chaos. Although the latter has larger secret seeds-key space than discrete-time chaos, which is of benefit to security, the obstacle is that the sequences generated by the continuous-time chaos have long-length run-course, and very large departure time caused by strong correlation characteristics. These are obviously harmful to security. To make full use of the advantage of continuous-time chaos and to overcome the problems mentioned above, a new methodology to generate stream ciphers by continuous-time chaos is proposed in this talk. The key technique we establish is the orbit perturbation of chaotic motion with stochastic variable. As a result, the ideal pseudo random sequence generator is obtained, and the secrete key of the stream ciphers is dynamic one. Taken Lorenz equations as an example, after using the orbit perturbation method, first of all, its Approximate Entropy rises 83.27% compared with the one before, which means its complexity increasing greatly. Secondly, the departure time is decreased to 0.2 second, only 0.57% of the one before. Therefore the correlation characteristics are satisfied. At last the sequence passes the test of random characteristics at 5%, its run-course closes to the ideal values. Further, the chaotic cryptosystem on computer network has been developed, which take the Lorenz stream cipher as the core encryption algorithm. It verifies that the method is applicable. The conclusion is that the orbit perturbation method is effective. When it applies to the continuous-time chaos, the random characteristics of the sequence are good for high safety encryption.

Keywords: pseudo random sequence, cryptography, orbit perturbation, dynamic key

Parameter identification for chaotic system based on adaptive control

Jian-Gang Zhang, Yan-dong Chu, Ying-Xiang Chang, Xin-lei An
School of Mathematics, Physics and Software Engineering, Lanzhou Jiaotong University, Lanzhou, 730070, People's Republic of China; E-mail address: zhangjg7715776@126.com

Abstract: Based on existent parameter adaptive control of continuous time chaotic system, control gain and summation function under different cases are added. For a large class of chaotic systems, the approach is improved by making optimum combination of parameter error summation function and selecting appropriate control gain. The improved method is proved rigorously by using stability theory of differential equations, and it is applicable for parameter identification with variable parameter real values with time. The agility and feasibility of improved parameter identification method are verified by computer simulation of a novel chaotic system and a non-autonomous complex dynamical system.

Keywords: parameter identification; adaptive control; summation function

Design and Implementation of a Random Bit sequence Generator using Chaotic Maps

Himan Khanzadi, Mohammad Eshghi, Shahram Etemadi Borujeni
Computer Engineering Department, Faculty of Computer and Electrical Engineering, Shahid Beheshti University, 1983963113 Tehran, Iran
E-mail address: Hi.khanzadi@mail.sbu.ac.ir, m-eshghi@sbu.ac.ir, etemadi@sbu.ac.ir

Abstract: In this paper, a random bit sequence generator based on chaotic maps is introduced. In this generator, two chaotic map functions with two different keys are used. The Bifurcation diagram and searching method are used to calculate the initial state of the chaotic maps in order to produce the output random bit sequence.

Chaotic Logistic and Tent functions classically are defined in an analogue space. In order to implement these chaotic maps on a hardware digital platform, these chaotic maps are modified. A digital chaotic Logistic and Tent maps are introduced in this paper. A design for implementation of these modified chaotic maps is also presented. The output bits of two chaotic maps are EX-ORed to produce a random sequence of 1000000 bits. These designs are implemented on FPGA and the results are reported in the paper. The proposed designs are tested by producing 100 samples of 1,000,000 bits; and they pass the standard FIPS 140-1 and NIST statistical tests for random bi generators.

Keywords: chaotic map, bifurcation, random bit sequence, digital implementation

Introduction to a new one-dimensional piecewise nonlinear chaotic map, Mehrab map

Shahram Etemadi Borujeni[1, 2], Mohammad Eshghi[2], Mahdi Safarnejad Boroujeni[3]
[1]Computer Engineering Department, University of Isfahan, Isfahan, Iran
[2]Computer Engineering Department, Shahid Beheshti University, Tehran, Iran
[3]Computer Engineering Department, Sharif University of Technology, Tehran, Iran
E-mail address: etemadi@eng.ui.ac.ir, m-eshghi@sbu.ac.ir, safarnejad@ce.sharif.edu

Abstract: In this paper, a new one-dimensional map is introduced. It is a piecewise nonlinear map which is defined as follows:

$$x_{n+1} = M_1(a, r, x_n) = \begin{cases} r\sqrt{x_n / a}, & x_n < a \\ r\sqrt{(1-x_n)/(1-a)}, & x_n \geq a \end{cases}$$

where $x_n \in [0,1], r \in (0,1], a \in (0,1).$

Lyapunov exponent of the proposed map with respect to parameters is calculated and bifurcation diagram is also plotted. The chaotic region of the map is found covering all range of *r* and most values of $a \in (0.27,\ 1)$. Invariant density of the map is analytically delivered. It is linearly corresponding to variable *x* and independent of parameter *a*. Simulation is also confirmed its chaotic behavior. Uniform invariant density is usually desired for some applications such as

$$x_{n+1} = M_2(a, r, x_n) = \begin{cases} r\sqrt{x_n / a}, & x_n < a \\ r\left(1-\sqrt{(1-x_n)/(1-a)}\right), & x_n \geq a \end{cases}$$

cryptography.

Therefore a second version of the proposed map is defined as follows:

According to new calculation and simulation of Lyapunov exponent and bifurcation diagram, respectively, the chaotic region of this map, M_2, is expanded to all values of parameters *a* and *r*.

Invariant density of the map is calculated, too. It is found that for most value of *r* and some values of *a*, the invariant density is approximately uniform. The proposed map is useful for cryptography applications, where initial value and parameters are used as secret keys.

Keywords: Chaotic map, Lyapunov exponent, bifurcation, invariant density, cryptography

A Chaotic Image Encryption System

Himan Khanzadi, Mohammad Eshghi, Shahram Etemadi Borujeni
Computer Engineering Department, Faculty of Computer and Electrical Engineering, Shahid Beheshti University, 1983963113 Tehran, Iran
Hi.khanzadi@mail.sbu.ac.ir, m-eshghi@sbu.ac.ir, etemadi@sbu.ac.ir

Abstract: In this paper, we propose an algorithm for image encryption using the random bit sequence generator based on chaotic maps. Chaotic Logistic and tent maps are used to generate needed random bits sequences. Pixels of the plain image are permuted using these chaotic functions, and then it is partitioned into 8 bit map planes. In each plane, bits are permuted and substituted according to random bit and random number matrixes, which are also the products of these functions. The pixels and bit maps permutation stage are based on a chaotic random Ergodicmatrix.

This chaotic encryption method produces encrypted image whose performance is evaluated using chi-square test, correlation coefficient, number pixel of change rate (NPCR), unified average changing intensity (UACI), and key space. The histogram of encrypted image is approximated by a uniform distribution with low chi-square factor. Horizontal, vertical, and diagonal correlation coefficients of two adjacent pixels of encrypted image are calculated, which is less than of this factor of other proposed methods. The NPCR and UACI values of encrypted image are also calculated. The results shows that a swiftly change in the original image will result in a significant change in the ciphered image. Total key space for the proposed method is (2^2160), which is large enough to protect the proposed encryption image against any brute-force attack.

Keywords: permutation, substitution, chaotic map, image encryption

Chaotic Image Encryption using Baker and Mehrab Maps

Shahram Etemadi Borujeni[1, 2] Mohammad Eshghi[2]
[1]Computer Engineering Department, University of Isfahan, Isfahan, Iran
[2]Computer Engineering Department, Shahid Beheshti University, Tehran, Iran
E-mail address: etemadi@eng.ui.ac.ir, m-eshghi@sbu.ac.ir

Abstract: In this paper, a new chaotic image encryption scheme is introduced. The operation of scheme is based on substitution-permutation architecture and includes two stages. In substitution stage, a new defined one dimensional chaotic map is used as a pseudo random image generator.

The pixels of the plain image are nonlinearly combined with corresponding pixels in random image. In permutation stage, baker map is used to rearrange the pixels of substituted image. The substitution and permutation operations need two different keys. Mehrab map in substitution stage includes two parameters and one initial value while Baker map in permutation stage includes only one parameter and two initial values. Therefore, total key length is 384 bits, 192 for each stage.

Mehrab map, which is used in substitution stage, is piecewise nonlinear map that is chaotic in all values of parameters according to bifurcation diagrams and Lyapunov exponent and its invariant density is approximately uniform. Baker map shows better rearrangement with compare to standard and cat maps, in permutation stages.

All part of the proposed chaotic encryption scheme are simulated and tested using different images. The performance of the scheme is also measured by uniformity of histogram, chi-square test, MSE, correlation coefficient. According to results of simulation and measurements, the proposed chaotic image encryption system is robust against statistical attacks. The key space is also large enough to protect the scheme against the Brute force attack.

Keywords: Image encryption, Baker map, Mehrab map, chaotic cryptography

The stochastic optimal control model for China's optimum economic growth

Guo-fu Wu, Sen-fa Chen, Tao Chen
School of Economics and Management, Southeast University, Nanjing 210096, China; gdwgf@sina.com

Abstract: Enlightened by the thought of Chen Mu Fa, this paper chooses Prescott's paradigm to analyze China's optimum economic growth and finds a stochastic optimal control model for China's economic growth. We acquire a worthy Euler equation of the model and give the optimal numerical solution of this model, which would help planers could easily allocate investment of capital and labor on China's economy best.

Key words: China's optimum economic growth; stochastic optimal control model; Prescott's paradigm

Synchronized bursting patterns of map-based neuron

Hongjun Cao
Department of Mathematics, Beijing Jiaotong University, Beijing 100044, China
E-mail address: hjcao@bjtu.edu.cn

Abstract: In this talk, first of all, synchronized patterns of bursts are investigated with regard to a system consisting of N identical Rulkov map-based neurons coupled by reciprocal electrical and chemical synapses with fast threshold modulations. Second, bifurcation conditions and mechanisms leading to synchronizations of bursting are taken into account by using the fast-slow decomposing technique, the phase plane analysis, as well as the master stability function. Finally, as a phenomenological example, synchronizations and propagations of bursting are numerically shown by using raster plots of relatively large-scale neuron networks consisting of N identical Rulkov neurons under different topological structures.

Keywords: synchronization, Rulkov map-based neuron model, network.

Chaotic behavior and numerical simulation of Lorenz system for the incompressible flow between two concentric rotating cylinders

He-yuan Wang
School of Sciences, Liaoning University of Technology, Jin'zhou, 121001
E-mail: wangheyuan@hotmail.com

Abstract: A spectral method is used to derive a series of equations for axisymmetric Couette-Taylor flow. A three-mode system, which is similar to the Lorenz systems, is obtained by a suitable three modes truncation of the Navier-Stokes equations for the incompressible flow between two concentric rotating cylinders. The stability of the three-mode systems is discussed, the existence of its attractor and the estimation of Hauadorff dimension are given. Moreover, numerical simulation results of chaos behavior are presented.

Keywords: Couette-Taylor flow, the Lorenz systems, attractor

The convergence of the solution for two dimensional Hasegawa-Mima equation with viscous term

Hui Yang, Yi Li
School of Mathematics Yunnan Normal University, Kunming, China, 650092
E-mail: yh_m1026@yahoo.com.cn

Abstract：In this paper, we consider the nonlinear equation that describes coupled drift modes and ion-acoustic waves which neglects the nonadiabatic electron response; we call it Hasegawa-Mima equation. First we consider the periodic boundary problem for the perturbed Hasegawa-Mima equation in two dimensions, and finally we find that the solution of the periodic boundary problem for the perturbed Hasegawa-Mima equation can converge to the solution of the periodic boundary problem for Hasegawa-Mima.

Key Words: two dimensional Hasegawa-Mima equation; a priori estimate

The bifurcation and exact traveling wave solutions of (1 + 2)-dimensional nonlinear Schrodinger equation with dual-power law nonlinearity

Haihong Liu[1;2], Fang Yan[2], Chenglin Xu[1]
1. Department of mathematics, Yunnan Normal University, Kunming 650092, P. R. China
2. College of Science, Shanghai University, Shanghai 200444, P. R. China
mathlhh@yahoo.com.cn, fangyanynnu@yahoo.com.cn, xuchenglin@ynao.ac.cn

Abstract: By using the method of dynamical systems, this paper researches the bifurcation and the exact traveling wave solutions for (1+2)-dimensional nonlinear Schrodinger equation with dual-power law nonlinearity. Exact parametric representations of all wave solutions are given.

Keywords: bifurcation, solitary wave solution, periodic wave solution, nonlinear Schrodinger equation

Hopf bifurcation of a hybrid ratio-dependent three species food chain with time delay

Yun-xian Dai and Yiping Lin
Department of Applied Mathematics, Kunming Uuniversity of Science and Technology, Kunming, Yunnan, 650093, China; Email: dyxian1976@sina.com

Abstract. In this paper, we study a model of a hybrid ratio-dependent three species food chain with middle-predator's time delayed harvesting. We first investigate the existence and the local stability of the positive equilibrium. Then taking time delay τ as the bifurcation parameter, we get the condition on which Hopf bifurcation occurs and the bifurcation direction by using Hassard's method. Finally we present an example to illustrate the results.

Keywords: Predator-prey model, stability, time delay, Hopf bifurcation

Steady bifurcation, existence and simplification of solitary wave and periodic wave solutions of some classical nonlinear wave equation models

Cun-cai Hua

School of Mathematics, Yunnan Normal University, Kunming 650092, Yunnan, China

E-mail address: cuncai-hua@sohu.com

Abstract: In this talk, steady bifurcation, existence and simplification of solitary wave and periodic wave solutions of some classical nonlinear wave equation models are outlined systematically. Some conditions for the existence and coexistence of solitary waves are given for a perturbed sine-Gordon equation, KdV-mKdV equation, cubic-quintic nonlinear Schrodinger equation and nonlinear drift-wave equation in magnetized plasmas respectively on the basis of the steady bifurcation and energy integral of the conservative dynamical system satisfied by the traveling waves. Simplified formulations for partial solitary waves and periodic waves are derived by using an approximate dynamical system method with aid of interpolation polynomials.

Keywords: bifurcation, nonlinear wave models, solitary waves, periodic waves

Rapid Fluctuation for Chaotic Dynamical Systems

Yu Huang

Department of Mathematics, Sun Yat-Sen University, 510275, China; stshyu@mail.sysu.edu.cn

For Cellular Automata, Transitivity implies Chaos

Fangyue Chen

School of Science, Hangzhou Dianzi University, Hangzhou, Zhejiang 310018, P.R. China; fychen@hdu.edu.cn

Generation of wideband chaotic light from laser diode and applications

Yun-Cai Wang

Institute of Optoelectronic Engineering, Department of Physics and Optoelectronics, College of Science, Taiyuan University of Technology, Taiyuan 030024, Shanxi, China; Email:wangyc@tyut.edu.cn

Semiconductor laser is a nonlinear system, and its dynamics can be approximately governed by Lang-Kobayashi equations [1]. Laser's fast response endows itself with the ability to generate high speed chaotic signal with several GHz, which far exceeds the bandwidth of chaotic circuit and makes it possible to securely communicate with high speed at Gbit/s [2].

In this paper, we demonstrate the generation of wideband chaotic signal with semiconductor

lasers and some novel applications.

Firstly, we enhance the chaotic laser's bandwidth up to 20GHz using the experimental setup as shown in Fig.1 (a). The blue curve in Fig.1 (b) is the power spectrum of chaotic light from laser diode with optical feedback, and the black one is that of the bandwidth-enhanced chaotic signal. Obviously, the bandwidth is enlarged from 5GHz to about 20GHz. In addition, this method can emit ultra-wideband radio-over-fiber (ROF) signals, which satisfy the FCC mask for indoor communication as shown in Fig.1 (c).

Benefiting from the wideband spectrum, chaotic signal from laser diode has ultra-short correlation time, which induces ultra-narrow delta-like autocorrelation curve. Based on the correlation characteristics, we propose a novel optical time domain reflectometry (OTDR), named as chaos correlation OTDR. It can precisely detect faults on optical fibers with accuracy of ±3cm in the range of about 60km, as demonstrated in Fig.2 (a) ~ (c). We further experimentally prove that this method also can be applied to diagnose faults on wiring and to detect target in warning lidar with anti-jam. In addition, we extract high-speed random codes by using chaotic laser as physical entropy source. The experimental setup, 1Gbit/s random codes and its correlation trace are shown in Fig.3 (a) ~ (c), respectively.

In conclusion, it is believed that chaos in laser will play an important role in development of chaos and fractal, and bring out technology innovation in communications, sensor, and measurements.

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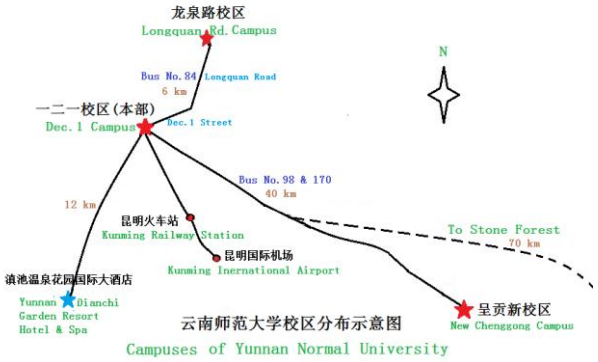
Appendix

CD of Proceedings of the 3rd IWCFTA

Introduction to the three cosponsors

List of participants (provided electronically)



国立西南联合大学数学类研究生培养特色

Characteristics for Bringing-up of Mathematics Postgraduates in the Historical National Southwest Associated University

国立西南联合大学时期(1938-1946)的数学类研究生屈指可数,但它却有自己的培养特色,主要表现为四个方面:在培养机构方面,是以研究院理科研究所的形式组织；在招生考试方面,是由知名的数学教授亲自命题，如江泽涵(高等分析，对泛函分析有突出贡献,2002 年 10 月由北京大学举办了百周年诞辰纪念活动)，陈省身(高等几何)，华罗庚(高等代数)，赵访熊(微积分及微分方程,对应用数学和计算数学有突出贡献，2008 年 11 月由清华大学举办了百周年诞辰纪念活动)，重视考生的基础；在创造能力培养方面，是以大学者华罗庚(对数论有卓越贡献, 2010 年 9 月由中科院数学与系统科学研究院举办了百周年诞辰纪念活动)、陈省身(对微分几何有卓越贡献,明年可能在天津南开大学举办百周年诞辰纪念活动)、许宝騄(对概率统计有卓越贡献,2010 年 7 月由北京大学举办了百周年诞辰纪念活动)等的研究为主导方向,讨论班盛行,学术交流频繁,提倡师生合作研究;在研究生培养的成效方面,它为造就中科院院士王湘浩，台湾中央研究院院士王宪钟，概率论的国际著名学者钟开莱奠定了重要的基础.

There were very few mathematics postgraduates during the period of the well-known National Southwest Associated University (1938-1946). However, there were four main aspects of characteristics for bringing-up postgraduates. The first of all is the organizing unit of bringing up postgraduates; it was organized in the form of academes and graduate school for sciences. The second is the aspect of examinations for taking in postgraduates, the work for the examination papers were finished by the famous mathematics professors such as Tsai-han Kiang (for Mathematical Analysis), Shen-sheng Chen (for Higher Geometry), Luo-geng Hua (for Higher Algebra) and Fang-xiong Zhao (for Calculus and Differential Equations) themselves in the university, emphasizing on the basic knowledge of the courses from the examinees. The third is the aspect of bringing up the creative ability for postgraduates; it was magistral of the research directions of Professors Luo-geng Hua who made great contributions to Number Theory and Applied Mathematics and whose anniversary activities of his 100th birthday were held in Beijing by the academy of Mathematics and System Science of Chinese Academy of Sciences in September of this year, Shen-sheng Chen who made great contributions to Differential Geometry and whose anniversary activities of his 100th birthday may be held in Tianjing by Nankai University next year, and Pao-Lu Hsu who made great contributions to Probability and Statistics and whose anniversary activities of his 100th birthday were held in Beijing by Peking University in July of this year. Discussing courses were popular, and the academic exchanges were frequent. Cooperating research work was promoted between teachers and students. The fourth is the effect of bringing up postgraduates, it established important basis for Xiang-hao Wang who became an academician of Chinese Academy of Sciences later, Xian-zhong Wang who became an academician of Central Academe in Taiwan later, and Kai-lai Zhong who became a world famous scholar in Probability Theory later.