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## WELCOME MESSAGE

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On behalf of the Organizing Committee, it is our greatest pleasure to welcome you to *2008 IEEE International Conference on Cybernetics and Intelligent Systems (CIS)* and *2008 IEEE International Conference on Robotics, Automation and Mechatronics (RAM)*. This is the third CIS and RAM conferences following the previous ones held in Singapore and Thailand in 2004 and 2006 respectively. The purpose of this biennial joint conference is to promote activities in various areas of cybernetics, intelligent systems, robotics, automation and mechatronics by providing a forum in exchange of ideas, presentations of technical achievement, and discussions of future directions.

The two conferences are jointly organized by IEEE Systems, Man and Cybernetics Society Singapore Chapter, IEEE Robotics and Automation Society Singapore Chapter, IEEE Singapore Section, IEEE Chengdu Section and the University of Electronic Science and Technology of China. They are technically supported by Computational Intelligence Laboratory of the University of Electronic Science and Technology of China, Center for Intelligent Machines of the Nanyang Technological University, Center for Intelligent Control of the National University of Singapore, and Mechatronics Group of the Singapore Institute of Manufacturing Technology.

This year, a total number of 952 papers for two conferences have been submitted from 36 different countries and regions. These submissions include both regular and invited papers. All submitted papers have been peer reviewed by the members of International Program Committee, which were coordinated by the Program Chairs and the Invited Sessions Chairs. The International Program Committee has assembled a comprehensive technical program that covers a broad spectrum of topics in *Cybernetics, Intelligent Systems, Robotics, Automation, and Mechatronics*. For 2008 CIS, we received a total of 561 submissions; and 341 papers have been selected for the conference proceedings, while for 2008 RAM, we received a total of 391 submissions; and 273 papers have been selected for the conference proceedings. To encourage the submission of high quality papers, 2008 CIS-RAM would follow our tradition of giving out the best conference paper awards to deserving participants.

The technical program begins on 22 September 2008, and comprises 54 oral sessions in 6 parallel tracks, and 6 interactive sessions spanning a period of three days. The proceedings are provided in CD-ROM version, thanks to the work of the Publication Chair. We are grateful to have three distinguished speakers: Professor Masayoshi Tomizuka (USA), Professor Michael Y. Wang (Hong Kong), and Professor Deyi Li (China) offering plenary lectures on mechatronics considerations for assisting humans, compliant mechanisms for MEMS and flexonics, and knowledge discovery from networks, respectively. Paper sessions cover a broad spectrum of topics and emerging areas addressing informatics, intelligent transportation systems, human/computer interaction, RFID/wireless sensors, mechatronic system design, kinematic and dynamic modeling, bio-inspired robots, medical robotics, micro/nano robots etc. The collection of papers includes original works on abstractions, algorithms, theories, methodologies and case studies in the areas of CIS and RAM. The highlights of the Social Program include a welcome reception on Sunday evening (21 September) and the conference banquet on Tuesday (23 September).

Apart from attending the technical program, you are encouraged to explore the colorful and dynamic city of Chengdu. Chengdu is the capital of Sichuan Province, one of the vibrant cities in Southwest of China. It is the 5<sup>th</sup> most populous city in China. The Chengdu's cuisine is

considered to be the most outstanding in China. It also has lots of tea houses and bars. One of the key industries is the Traditional Chinese Medicine (TCM). It also houses major pharmaceutical R&D centers and hi-tech companies like Intel, Microsoft, Lenovo, etc.

Finally, we would like to express our sincere gratitude to everyone involved in making the conference a success. Many thanks to advisory board members, the organizing committee members, the plenary speakers, the invited session organizers, the program committee and reviewers, the conference participants, and of course, to all the contributing authors who will be sharing the results of their research. It is our great pleasure to have you with us at the conference, where we hope new ties are made and existing ones renewed and strengthened. With our best wishes for a wonderful and stimulating stay in Chengdu!



*Guilin Yang, General Chair*



*Zhang Yi, General Chair*



*Chee Meng Chew, Program Chair (CIS)*



*Louis Soo Jay Phee, Program Chair (RAM)*

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## CONFERENCE ORGANIZATION

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### International Advisory Committee

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#### **CIS 2008**

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Northeastern University, China  
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Washington State University, USA  
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#### **RAM 2008**

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University of Electronic Science and Technology of China, China

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University of Electronic Science and Technology of China, China

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## Organizing Committee

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<b>General Chairs:</b>	<b>Guilin Yang</b> Singapore Institute of Manufacturing Technology, Singapore <b>Zhang Yi</b> University of Electronic Science and Technology of China, China
<b>CIS Program Chair:</b>	<b>Chee Meng Chew</b> National University of Singapore, Singapore
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<b>Webmasters:</b>	<b>Wei Dong</b> Nanyang Technological University, Singapore <b>Kim Doang Nguyen</b> Nanyang Technological University, Singapore

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## Program Committee

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### Invited Session Organizers

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Yunhua Li  
Shuai Mei  
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Guo Lian Hou	Waree Kongprawechnon	Dikai Liu
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Zujun Hou	Sam Kwong	Guoqiang Liu
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Shu-Wei Hsu	Armein Z R Langi	Lifang Liu
Shawn Hu	Hon-Shiang Lau	Lijun Liu
Wei Hu	Hyung-Soo Lee	Ming Liu
Chuangfeng Huai	Ly Guat Lee	Na Liu
Chenn-Jung Huang	Pin-Chan Lee	Qian Liu
Chun-Chieh Huang	Sanghyup Lee	Shubo Liu
Deqing Huang	Sangyoon Lee	Suyi Liu
Dong Huang	Sangyoun Lee	Wan Quan Liu
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Hong Men	Huaiwei Ren	Zheng Long Sun
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Teck Chew Ng	Ali Selamat	W W Tan
Tao Ni	Arosha Senanayake	Woei Wan Tan
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Ying Tang	Quanyu Wang	Shusong Xing
Yongchuan Tang	Rong-Ji Wang	Zong-Yi Xing
Tangfei Tao	Shaoping Wang	Zuoxia Xing
Zhou Tao	Shenghui Wang	Qianli Xu
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Abdel Hamid Tayebi	Wei qun Wang	Fen Xu
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Jason Teo	Wen-June Wang	Jianxin Xu
Andrew Teoh	Xiaoye Wang	Jianxin Xu
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Susy Thomas	Xin Wang	Jinxue Xu
Siripun Thongchai	Xiuhui Wang	Linsen Xu
Bo Tian	Xueqian Wang	Mantao Xu
Wei Tian	Yanqing Wang	Shuxiang Xu
Kar-Ann Toh	Yao-Te Wang	Wenxing Xu
Kar-Ann Toh	Yi Wang	Xiaoliang Xu
Shiwen Tong	Yinglong Wang	Yong Xu
A. Akbarzadeh Tootoonchi	Yunfeng Wang	Yongfa Xu
Chung-Shi Tseng	Zhelong Wang	Yuge Xu
Yuan-Jye Tseng	Zhenhua Wang	Anke Xue
Prahlad Vadakkepat	Arnat Wattanasungsuit	Guomin Xue
I. Vanderfeesten	Jin-Yu Wei	Chen Xuejiang
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Kamaraj Vijayarajan	Xinjiang Wei	Wei-Yong Yan
Vivek Vijaykumar	Zu-Kuan Wei	Wei-Yong Yan
Bing Wang	Li Wen	Bo Yang
Chaoli Wang	Naoufel Werghi	Chengfu Yang
Cong Si Wang	Hinyong Wong	Duwei Yang
Fudong Wang	Ngai Wong	Hong Yang
Guixiang Wang	Manop Wongsaisuwan	Huei-Fang Yang
Hao-Chuan Wang	Dengfeng Wu	Kai Yang
Hee Lin Wang	Haixia Wu	Li Yang
Hongjun Wang	Huapeng Wu	Lin Yang
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Jacky Wang	Xiao-Hong Wu	Soo Siang Yang
Jiangang Wang	Chai Wutiwiwatchai	Stephen J.H. Yang
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Lipo Wang	Hailong Xing	Chun Jian Yu



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Haifeng Yu  
Junwei Yu  
Lei Yu  
Ming Yu  
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Tina Yu  
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Xiaoliang Zhou  
Yu Zhou  
Zhi-Hua Zhou  
Bin Zhu  
Dachang Zhu  
Dayong Zhu  
Jin Zhu  
Kunpeng Zhu  
Lei Zhu  
Mingchao Zhu  
Wenzhuang Zhu

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## ACKNOWLEDGEMENT

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The Conference and Organizing Committee Chairs wish to thank all the international advisors and members of the Organizing Committee for the contributions in organizing this Conference. The Chairs also wish to acknowledge all the sponsors for their generous support and all others who have in one way or another contributed towards the success of this Conference.

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### Organizers

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IEEE Systems, Man & Cybernetics Society Singapore Chapter  
IEEE Robotics & Automation Society Singapore Chapter  
IEEE Singapore Section  
IEEE Chengdu Section  
University of Electronic Science and Technology of China

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### Supported By

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Center for Intelligent Machines, Nanyang Technological University  
Center for Intelligent Control, National University of Singapore  
Mechatronics Group, Singapore Institute of Manufacturing Technology  
Computational Intelligence Laboratory, University of Electronic Science and Technology of China

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## GENERAL INFORMATION

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<b>Conference Venue:</b>	Sheraton Chengdu Lido Hotel No. 15, Section 1, Ren Min Zhong Road, Chengdu, Sichuan Province, 610015 China Tel: +86 28 8676 8999 Fax: +86 28 8676 8888
<b>Opening Ceremony:</b>	Ballroom, Level 3
<b>Plenary Sessions:</b>	Ballroom, Level 3
<b>Oral Presentation Rooms:</b>	Song Hall, Level 3 (RAM - 1) Tang Hall, Level 3 (RAM - 2) Han Hall, Level 3 (RAM - 3) Jin Sha Hall, Level 4 (CIS - 4) Long Quan Hall, Level 4 (CIS - 5) Jia Ling Hall, Level 4 (CIS - 6)
<b>Interactive Session Location:</b>	Foyer, Level 3
<b>Secretariat Room:</b>	Huang Long Hall, Level 3
<b>Coffee/Tea Break(s):</b>	Foyer, Level 3
<b>Lunch:</b>	Ballroom, Level 3
<b>Conference Contact:</b>	CIS-RAM 2008 Conference Secretariat c/o Integrated Meetings Specialist Pte Ltd Blk 998 Toa Payoh North #07-18/19 Singapore 318993 Tel: +65 6356 4727 Fax: +65 6356 7471 Email: <a href="mailto:cisram@inmeet.com.sg">cisram@inmeet.com.sg</a>

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## SESSION INFORMATION

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All Chairpersons and Speakers are requested to be in their respective session rooms at least 10 minutes prior to the commencement of each session.

A total of 20 minutes has been allocated for each oral presentation, including time for questions. Session chairpersons will strictly enforce this limit. Presenters are requested to keep their presentation within the time limits stated.

Presentations must be carried out using **Microsoft PowerPoint** on video projector. No slide projector will be provided.

For presenters using Microsoft PowerPoint, they are encouraged to bring their files on a CD ROM or USB flash drive (thumb drive) and upload their file **during the daily tea breaks or lunch time** directly onto the laptop or desktop computer provided in the designated room of the presentation. Presenters may also use their own laptops if their presentations require special software or codec.

Interactive sessions are allocated in Foyer, Level 3. Presenters of papers should be available beside your poster during the interactive presentation period. Please put up your poster 15 minutes before your session commences and remove your poster when your interactive session is over. Each presentation will be assigned a board and will be labeled with a Poster Reference Number. The maximum size of the poster is A1 in portrait direction, i.e., 841mm (height) X 594mm (width).

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## TRAVEL INFORMATION

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### Transportation Information

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Southwest Airlines will facilitate travel in Sichuan with a multitude of international flights and also a special tourist flight to Jiuzhai Valley. The air stewardess will impress you with sweet smiles and considerate cares, and they could also offer you tip about your business trip, sightseeing and holiday-making. Your plane will land in Shuangliu county, 12km away from Chengdu. If time permits, you may also taste the local rabbit delicacy and acquaint yourself with the trip in the land of spice. In addition, it is only a 30-minute drive to enter Chengdu proper and press closer to life in Chengdu if a bus is taken on the airport.

Taking a train to Chengdu, one will be warmly attended by the Chengdu stewardesses, who are typically beautiful Chengdu girls. While enjoying the verdant forest views outside the train window, one could be relieved by the conveniences provided by the train station, such as luggage consignment and whole trunk transportation of cargos. At present, the train station dispatches 46 passenger trains each day, accommodating 33,000 passengers and 50,000 passengers on peak days. It will usher in more passengers as the first train from Chengdu to Lhasa is put through on 1 July 2006.

There are six major long-distance bus stations in Chengdu, namely Wukuaishi bus station, Shiling bus station, Chengdu Bus Center, Beimmen Bus Center, Xinnanmen Bus Center and Chadianzi Bus Center. The classification of routes is quite specified, facilitating the passengers with a clear destination. Even new comers will never lose their way here, because in general the passersby are so warm-hearted that they are simply walking dictionaries about the bus information.

Supported by 366 public buses in every direction, the city of Chengdu is known for easy access to transportation means. Even lane dwells are never worried about the absence of public buses. Besides, the ticket rate of these buses is by no means expensive: RMB 2 for buses with air conditioners and RMB 1 for general buses.

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## Hotel & Vicinity

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Sitting in Ren Min Zhong Road in Chengdu, Sheraton Chengdu Lido Hotel is near to the CBD area, the Exhibition Hall of Sichuan Province as well as the government offices. Being well-equipped, the hotel is only a 30-minute-drive from Shuangliu international airport and very close to famous scenic spots like Panda Breeding Base, Wushu Temple and Marquis Wu's Temple.

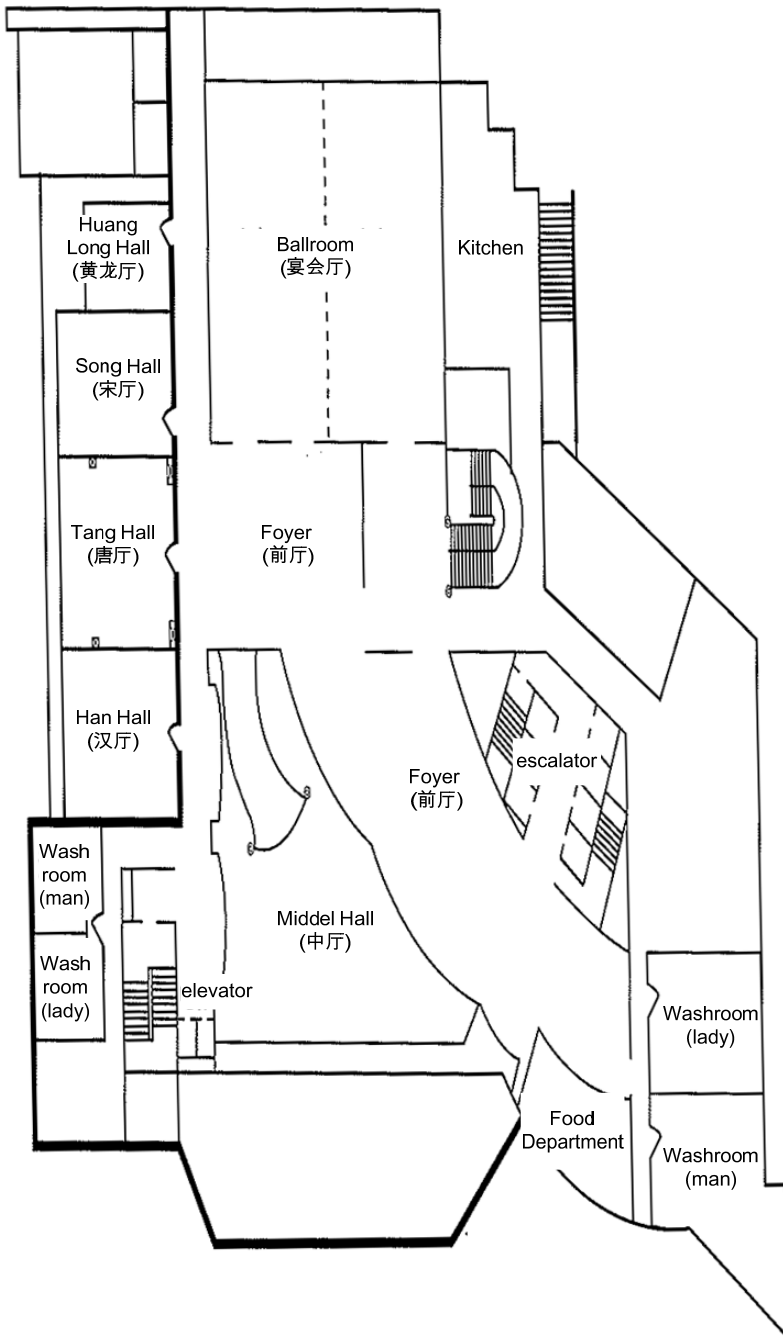
**Credit card accepted:** Visa Card, Peony Card, Golden Spike Card, Greet Wall Card, Long Card, Master Card, American Express Card, Diners Card and JCB Card.

**Transport:** at the downtown area, the hotel is 3 miles from the train station and 18 miles from the airport.

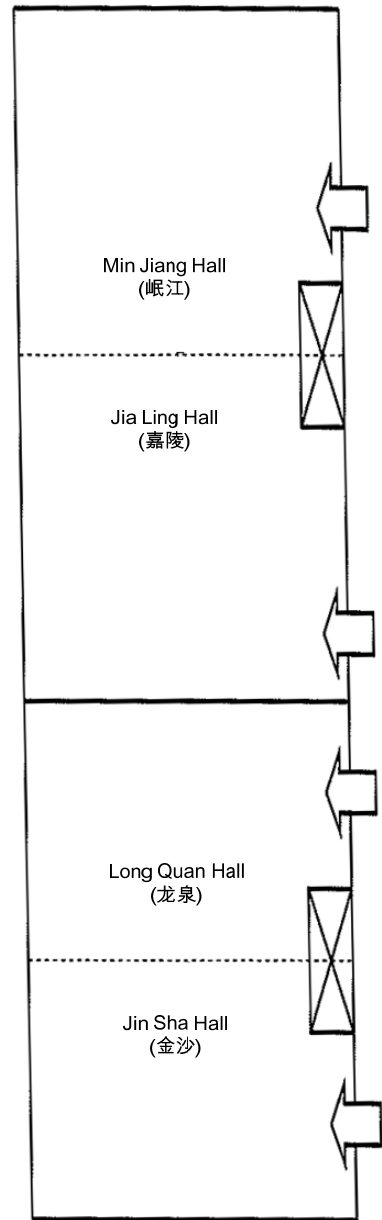
**Address:** No. 15, Section 1, Ren Min Zhong Road, Chengdu, Sichuan Province



# HOTEL FLOORPLAN



3<sup>rd</sup> FLOOR



4<sup>th</sup> FLOOR

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## CONFERENCE ACTIVITIES

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### Conference Registration

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**21 September 2008, Sunday**

13:00 – 20:00

Foyer, Level 3

**22 – 23 September 2008, Monday – Tuesday**

08:00 – 15:00

Foyer, Level 3

**24 September 2008, Wednesday**

08:00 – 12:00

Foyer, Level 3

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### Welcome Reception

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**21 September 2008, Sunday**

18:30 – 20:00

Ballroom, Level 3

All participants and guests are welcomed.

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### Lunch

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**22 – 24 September 2008, Monday – Wednesday**

12:30 – 13:30

Ballroom, Level 3

Lunch ticket required.

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### Banquet Dinner

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**23 September 2008, Tuesday**

18:30 – 20:30

Shunxing Old Tea House: No. 198, Century City Road, Chengdu

Dress Code: Smart casual

Banquet ticket required.



## CONFERENCE PROGRAM OVERVIEW

	Sunday 21 September	Monday 22 September	Tuesday 23 September	Wednesday 24 September	
08:00 – 08:30		Registration <i>(Foyer, Level 3)</i>	Registration <i>(Foyer, Level 3)</i>		
08:30 – 09:00		Opening Ceremony <i>(Ballroom, Level 3)</i>			
09:00 – 09:30			Plenary Speech 1 <i>(Ballroom, Level 3)</i>	Plenary Speech 2 <i>(Ballroom, Level 3)</i>	Plenary Speech 3 <i>(Ballroom, Level 3)</i>
09:30 – 10:00					
10:00 – 10:30			Coffee/Tea break <i>(Foyer, Level 3)</i>		
10:30 – 11:00					
11:00 – 11:30				Technical Session TA	Technical Session WA
11:30 – 12:00				Technical Session MA	
12:00 – 12:30					
12:30 – 13:00				Lunch <i>(Ballroom, Level 3)</i>	
13:00 – 13:30					
13:30 – 14:00					
14:00 – 14:30			Technical Session TM	Technical Session WM	
14:30 – 15:00			Technical Session MM		
15:00 – 15:30					
15:30 – 16:00		Registration <i>(Foyer, Level 3)</i>	Coffee/Tea break <i>(Foyer, Level 3)</i>		
16:00 – 16:30				Technical Session TP	Technical Session WP
16:30 – 17:00			Technical Session MP		
17:00 – 17:30					
17:30 – 18:00					
18:00 – 18:30					
18:30 – 19:00	Welcome Reception <i>(Ballroom, Level 3)</i>				
19:00 – 19:30			Banquet Dinner <i>(Shunxing Old Tea House: No. 198, Century City Road, Chengdu)</i>		
19:30 – 20:00					
20:00 – 20:30					

## TECHNICAL PROGRAM OVERVIEW

PARALLEL SESSION		RAM – 1	RAM – 2	RAM – 3	CIS – 4	CIS – 5	CIS – 6	Interactive
LOCATION		Song Hall, Level 3	Tang Hall, Level 3	Han Hall, Level 3	Jin Sha Hall, Level 4	Long Quan Hall, Level 4	Jia Ling Hall, Level 4	Foyer, Level 3
<b>MONDAY</b> (22 September, 2008)	0830 – 0900 <i>Opening Ceremony (Ballroom, Level 3)</i> 0900 – 1000 <i>Plenary Speech 1: Mechatronics Considerations for Assisting Humans by Prof. Masayoshi Tomizuka, University of California, Berkeley, CA, USA (Ballroom, Level 3)</i>							
	Session 1 1030 – 1230	<u>MA1</u> (Invited Session) Emerging Technologies for Industrial Robots	<u>MA2</u> Control, Haptics, Teleoperation and Network Robotics	<u>MA3</u> Modeling, Planning and Control I	<u>MA4</u> Neural Networks I	<u>MA5</u> Computer Vision I	<u>MA6</u> Manufacturing Systems	
	Session 2 1330 – 1530	<u>MM1</u> (Invited Session) Intelligent Control Theory in Aerial Maintenance Engineering I	<u>MM2</u> Design Evaluation, Scheduling & Discrete Event Dynamic Systems	<u>MM3</u> Robotics and Automation Applications I	<u>MM4</u> Soft Computing, Fuzzy Systems I	<u>MM5</u> Image Processing I	<u>MM6</u> Quality / Reliability & Systems Engineering	<u>MMP</u> CIS Interactive Session I & RAM Interactive Session I
	Session 3 1600 – 1800	<u>MP1</u> (Invited Session) Intelligent Control Theory in Aerial Maintenance Engineering II	<u>MP2</u> Kinematics, Mechanics and Mechanism Design	<u>MP3</u> Medical Robots & Methodologies for Robotics	<u>MP4</u> Computational Intelligence I	<u>MP5</u> Pattern Recognition	<u>MP6</u> Data Mining and Management	<u>MPP</u> CIS Interactive Session II & RAM Interactive Session II
<b>TUESDAY</b> (23 September, 2008)	0900 – 1000 <i>Plenary Speech 2: Compliant Mechanisms for MEMS and Flexonics by Prof. Michael Y. Wang, The Chinese University of Hong Kong, NT, Hong Kong, China (Ballroom, Level 3)</i>							
	Session 1 1030 – 1230	<u>TA1</u> Dynamics, Motion Control	<u>TA2</u> Biologically-Inspired Robots & Petri Net	<u>TA3</u> Modeling, Planning and Control II	<u>TA4</u> Soft Computing, Fuzzy Systems II	<u>TA5</u> Computer Vision II	<u>TA6</u> Decision Support Systems I	<u>TAP</u> CIS Interactive Session III & RAM Interactive Session III
	Session 2 1330 – 1530	<u>TM1</u> (Invited Session) Robot Control I	<u>TM2</u> Sensor Design, Integration, and Fusion	<u>TM3</u> Robotics and Automation Applications II	<u>TM4</u> Neural Networks II	<u>TM5</u> Image Processing II	<u>TM6</u> Intelligent Transportation System	<u>TMP</u> CIS Interactive Session IV & RAM Interactive Session IV
	Session 3 1600 – 1720	<u>TP1</u> Control Architecture and Programming	<u>TP2</u> Teleoperation and Aerial Maintenance Engineering	<u>TP3</u> Scheduling and Control	<u>TP4</u> Decision Support Systems II	<u>TP5</u> Neuro-Fuzzy Systems	<u>TP6</u> Expert and Knowledge Base Systems	
<b>WEDNESDAY</b> (24 September, 2008)	0900 – 1000 <i>Plenary Speech 3: Knowledge Discovery from Networks, by Prof. Deyi Li, National Natural Science Foundation of China, China (Ballroom, Level 3)</i>							
	Session 1 1030 – 1230	<u>WA1</u> (Invited Session) Design and Control of Robot with Special Uses	<u>WA2</u> Maintenance & Manufacturing System Architecture	<u>WA3</u> Modeling, Planning and Control & Virtual Reality	<u>WA4</u> Neural Networks III	<u>WA5</u> Image Processing III	<u>WA6</u> Computational Intelligence II	<u>WAP</u> CIS Interactive Session V & RAM Interactive Session V
	Session 2 1330 – 1530	<u>WM1</u> (Invited Session) Robot Control II	<u>WM2</u> Computer Vision & Motion Control in Vehicles	<u>WM3</u> Robotics and Automation Applications III	<u>WM4</u> Neural Networks IV	<u>WM5</u> Evolutionary Computation	<u>WM6</u> Optimization	<u>WMP</u> CIS Interactive Session VI & RAM Interactive Session VI
	Session 3 1600 – 1800	<u>WP1</u> Control Architecture and Programming & Legged Robot	<u>WP2</u> Control, Wheeled Mobile Robots & Sensor Design	<u>WP3</u> Robotics and Automation Applications IV	<u>WP4</u> Sensor Based Robotics	<u>WP5</u> Genetic Algorithm	<u>WP6</u> Other Topics in CIS	

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## PLENARY SESSIONS

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### Plenary Speech 1

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Chair: Chee Meng Chew  
22 September 2008, Monday  
09:00 – 10:00  
Ballroom, Level 3

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### Mechatronics Considerations for Assisting Humans

Masayoshi Tomizuka, *University of California, Berkeley, CA, USA*

Mechatronics technologies are now steadily penetrating in our daily lives. We are surrounded by mechatronic products and interact with them in many ways. In particular, mechatronics devices may potentially improve the quality of life of elderly people and patients with impairments. In this talk, several key technologies that we have developed for assisting such people in walking are introduced. These technologies include sensing technologies for identifying the intent of human, decision making algorithms to decide the right amount of assistance to the human and actuation technologies to provide forces and torques to selected human joints. In the design of mechatronic devices interacting with humans, the dynamics of human is an important element and the compatibility between machine and human must be optimized. If the device is interacting with normal and healthy humans, the design may take advantages of robust and intelligent controllability of a human. In case of assistive devices for elderly and people with impairments, such approaches will not be appropriate, and the controller is required to be predictable, precise, robust and intelligent. It is desired to have zero impedance for actuators to realize an ideal force mode actuation. Otherwise, a human will have to make additional efforts to overcome the undesirable resistance. We will present how the Flexible Joint Actuators (FJA) may be controlled to act as a zero impedance actuator. Also, the assistive systems require a means for detecting human intention and monitoring the current status of health or safety. Various sensor technologies are available for this purpose, e.g. EMG sensors, joint angle sensors and so on. For patients and elderly people, however, it is desired that sensors are easy to use and yet reliable and capable to generate relevant information. We will present the idea of smart shoes, which measure the distribution of foot pressures for robust estimation of phases in a human gait and detection of abnormalities. Based on the estimated phase, the control algorithm is adapted for most effective assistance of the user. This talk is based on research by Kyoungchul Kong and Joonbum Bae.



*Masayoshi Tomizuka* holds the Cheryl and John Neerhout, Jr., Distinguished Professorship Chair in the Mechanical Engineering Department of the University of California at Berkeley. He received his B.S. and M.S. degrees in Mechanical Engineering from Keio University, Tokyo, Japan and his Ph.D. degree in Mechanical Engineering from the Massachusetts Institute of Technology in February 1974. He joined the faculty of the Department of Mechanical Engineering at the University of California at Berkeley in 1974. He served as Vice Chair of Mechanical Engineering from December 1989 to December 1991 and from July 1995 to December 1996. He also served as Director of Engineering Systems Research Center of the College of Engineering from July 1999 to August 2002. He served as Program Director of the Dynamic Systems and Control Program at the National Science Foundation from September 2002 to December 2004. At UC Berkeley, he teaches courses in dynamic systems and controls. His current research interests are optimal and adaptive control, digital control, signal processing, motion control, and control problems related to robotics, machining, manufacturing, information storage devices and vehicles. He has published more than 400 papers in archival journals and refereed conference proceedings. He has supervised about 80 Ph.D. students to completion. Many of his students teach at national and international academic institutions and others work as leaders in various industries. He served as Technical Editor of the ASME Journal of Dynamic Systems, Measurement and Control, J-DSMC (1988-93), Editor-in-Chief of the IEEE/ASME Transactions on Mechatronics (1997-99) and Associate Editor of the Journal of the International Federation of Automatic Control, Automatica (1993-99). He was General Chairman of the 1995 American Control Conference, and served as President of the American Automatic Control Council (AACC) (1998-99). He is a Fellow of the ASME, the Institute of Electric and Electronics Engineers (IEEE) and the Society of Manufacturing Engineers. He received the DSCD Outstanding Investigator Award (1996), the Pi Tau Sigma-ASME Charles Russ Richards Memorial Award (1997), the Oldenburger Medal (2002) and the John R. Ragazzini Award from AACC (2006).

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## Plenary Speech 2

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Chair: Louis Soo Jay Phee  
23 September 2008, Tuesday  
09:00 – 10:00  
Ballroom, Level 3

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### Compliant Mechanisms for MEMS and Flexonics

Michael Y. Wang, The Chinese University of Hong Kong, NT, Hong Kong, China

A continuum compliant mechanism transmits applied forces from specified input ports to output ports by elastic deformation of its comprising materials, fulfilling required functions analogous to a rigid-body mechanism. It has a large range of applications in both micro and macro domains. This presentation describes a level-set method for designing monolithic mechanisms with distributed compliance and/or made of multiple materials. Central to the method is a level-set model that precisely specifies the distinct material regions and their sharp interfaces as well as the geometric boundary of the structure, capable of performing topological changes and capturing geometric evolutions at the interface and the boundary. Techniques for eliminating de facto hinges and for geometric control in the design are discussed, aiming at producing more reliable compliant mechanism designs for MEMS devices. We further discuss the intrinsic deficiencies in the widely used "spring model" and propose a new formulation considering the "characteristic stiffness" of the mechanism. The result is a design with highly even-distributed compliance and a more desirable characteristic, which uniquely distinguishes our method. These methods are demonstrated with benchmark examples of both structure optimization and compliant mechanism optimization. The compliant mechanisms are intended for the use in automated assembly of hybrid MEMS with self-alignment techniques to eliminate tight positioning requirements.



*Michael Yu Wang* is a Professor at the Chinese University of Hong Kong, after ten years with the Department of Mechanical Engineering, University of Maryland. He has numerous professional honors—National Science Foundation Research Initiation Award, 1993; Ralph R. Teeter Educational Award from Society of Automotive Engineers, 1994; LaRoux K. Gillespie Outstanding Young Manufacturing Engineer Award from Society of Manufacturing Engineers, 1995; Boeing–A.D. Welliver Faculty Summer Fellow, Boeing, 1998; Distinguished Investigator Award of NSFC; Chang Jiang (Cheung Kong) Scholars Award from the Ministry of Education of China and Li Ka Shing Foundation (Hong Kong). He received the Kayamori Best Paper Award of 2001 IEEE International Conference on Robotics and Automation (with D. Pelinescu), the Compliant Mechanisms Award-Theory of ASME 31st Mechanisms and Robotics Conference in 2007, and Research Excellence Award

(07-08) of Faculty of Engineering of CUHK. He is a Senior Editor of IEEE Trans. on Automation Science and Engineering, and served as an Associate Editor of IEEE Trans. on Robotics and Automation and ASME Journal of Manufacturing Science and Engineering. He is a Distinguished Lecturer of IEEE Robotics and Automation Society (2006-2009). His research interests include computational design and optimization of solids, precision engineering, and electronic and photonic manufacturing, with over 200 technical publications in these areas. He received his Ph.D. degree from Carnegie Mellon University (1989). He is a Fellow of ASME, HKIE, and IEEE.

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## Plenary Speech 3

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Chair: Zhang Yi  
24 September 2008, Wednesday  
09:00 – 10:00  
Ballroom, Level 3

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### Knowledge Discovery from Networks

Deyi Li, *National Natural Science Foundation of China, China*

Nowadays, network becomes the engine of scientific research activities in 21st century. For example, a Web search engine is something to do with networked data mining and knowledge discovery from networks in deed. Networks interact with one another and are recursive. We have come to grasp the important knowledge of networks.

Network is the key to representing the complex world around us. Small changes in the topology, affecting only a few of the nodes, can open up hidden doors, allowing new possibilities to emerge. While network mining is considered in my talk, it is always stressed and focused on a kernel idea, i.e. topology first, mainly concerning the self-organization, self-similarity and emergency features.

Taking network topology as a novel approach of knowledge representation, we discuss how to mine typical topology patterns from real world networks at multi-scale, to evaluate node importance for node-ranking, to evaluate edge importance for edge-ranking, and to discover the membership for different communities in a network as well.

Brain science has achieved a great success on molecule-level and cell-level research; however, there is still a long way to go for cognitive function of a brain as a whole. How can we understand the non-linear function of a brain? How does the left brain (with the priority of logic thinking) cooperate with the right brain (with the priority of visual thinking)? How far away for "von-Neumann-style" computer architecture? May the future computer architecture consist of dual core, one for logic thinking and the other for visual thinking, which correlate each other all the time? May the future operating systems are developed under the mechanism of "growth by preferential attachment"? I am interested in all these questions in my talk.



*Deyi Li* was born in 1944 in Jiangsu, China. He graduated at the Electronic Engineering Dept., South East Univ. in 1967, received his Ph.D. in Computer Science Dept., Heriot-Watt Univ. Edinburgh UK in 1983. He was elected as the member of Chinese Academy of Engineering in 1999, the member of Euroasian Academy of Science in 2004 respectively. At present, he is a professor in Tsinghua Univ., the director at Dept. of Information Science, National Natural Science Foundation of China, the vice president of both Chinese Institute of Electronics and Chinese Association of Artificial Intelligence. He has published over 100 papers and 4 books, owned Premium Award given by IEE Headquarters 1984/85, and the IFAC world congress outstanding paper 1999, currently interested in data mining, artificial intelligence with uncertainty, soft computing, and cognitive physics.