



2nd IEEE International Conference on
Cybernetics & Intelligent
Systems (CIS)
Robotics, Automation &
Mechatronics (RAM)

7—9 June, 2006
The Twin Towers Hotel
Bangkok, Thailand

Final Program

<http://www.ntu.edu.sg/cis-ram/>



Organizers
IEEE SMC Society Singapore Chapter
IEEE R&A Society Singapore Chapter

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WELCOME

On behalf of the Organizing Committee, it is our greatest pleasure to welcome you to *2006 IEEE International Conference on Cybernetics and Intelligent Systems (CIS)* and *2006 IEEE International Conference on Robotics, Automation and Mechatronics (RAM)*. This is the second CIS and RAM conferences following the previous ones held in Singapore in 2004. 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 Robotics and Automation Society Singapore Chapter, IEEE Systems, Man and Cybernetics Society Singapore Chapter, and IEEE Singapore Section, and are supported by IEEE Thailand Section, Center for Intelligent Control of The National University of Singapore, Center for Intelligent Machines of Nanyang Technological University, School of Mechanical and Aerospace Engineering of Nanyang Technological University, Sripatum University, Chulalongkorn University and Mahidol University of Thailand, and Thailand Robotics Society.

This year, a total number of 520 papers for two conferences have been submitted from 44 different countries. These submissions include 54 invited session 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 Session Chairs. The International Program Committee has assembled a comprehensive technical program that covers a broad spectrum of topics in *Automation, Cybernetics, Intelligent Systems, Mechatronics, and Robotics*. For 2006 CIS, we received a total of 289 submissions (including invited and special sessions and contributed papers); and 180 papers have been selected for the conference proceedings, while for 2006 RAM, we received a total of 231 submissions (including invited and special sessions and contributed papers); and 169 papers have been selected for the conference proceedings. To promote submission of high quality papers, 2006 CIS-RAM will present the best conference paper and the best student paper awards to the finalists.

The technical program begins on Wednesday (June 7, 2006), and comprises 54 sessions in 6 parallel tracks (3 for CIS and 3 for RAM) 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 Joel Burdick (USA), Professor Atsuo Takanishi (Japan), and Professor Frank Lewis (USA) offering plenary lectures on robotic technology for neural rehabilitation, humanoid robotics, and wireless sensor networks. Paper sessions cover a broad spectrum of topics and emerging areas addressing informatics, intelligent transportation systems, human/computer interaction, RFID/wireless sensors, kinematics & mechanism design, 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 Tuesday evening (June 6), the conference banquet on Thursday (June 8), and the farewell dinner cum the spectacular Thai cultural show at the newly opened Siam Niramit in Bangkok on Friday (June 9).

Apart from attending the technical program, you are encouraged to explore the colorful and dynamic city of Bangkok. Bangkok is the capital of Thailand, one of the vibrant cities in South East Asia. It is locally known as "*Krung Thep*", which means "*The City of Angels*", established in 1782 by King Rama I as the capital of Siam at that time. It covers an area of more than 1,500 square kilometers, and it is home to approximately ten million people or more than 10% of the country's population. It offers to visitors not only the cosmopolitan amenities they would expect from other big cities, but also a unique treasure trove of cultural attractions. The city is dotted with 400 glittering Buddhist temples of great beauty and fascination, magnificent palaces, classical dance extravaganzas, numerous shopping centers and traditional ways of life, especially along the "Venice of the East" timeless canals and the Chao Phraya River of the "River of Kings" winding through the city. It is worth taking a trip along its waters before exploring further into different canals to take a glimpse of old Bangkok.

Finally, we would like to express our sincere gratitude to everyone involved in making the conference a success. Many thanks go 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 Bangkok!



A handwritten signature in black ink, appearing to read 'I-Ming Chen'.

I-Ming Chen, General Chair



A handwritten signature in black ink, appearing to read 'KC Tan'.

Kay Chen Tan, Program Chair (CIS)



A handwritten signature in black ink, appearing to read 'Abdullah Al Mamun'.

Abdullah Al Mamun, Program Chair (RAM)

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Kuanyi Zhu

ACKNOWLEDGEMENTS

The Conference and Organising Committee Chairs wish to thank all the international advisors and members of the Organising 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.

Organizers

IEEE Robotics & Automation Society Singapore Chapter
IEEE Systems, Man & Cybernetics Society Singapore Chapter

Technical Sponsor

IEEE Thailand Section

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Mechatronics Group, Singapore Institute of Manufacturing Technology
School of Mechanical & Aerospace Engineering, Nanyang Technological University
Sripatum University, Thailand
Chulalongkorn University, Thailand
Mahidol University, Thailand
Thailand Robotic Society

GENERAL INFORMATION

Conference Venue:	The Twin Towers Hotel 88 Rong Muang Patumwan, Bangkok 10330 Thailand Tel: +662 6730966 Fax: +662 2119656
Opening Ceremony:	Kasatsuk II, Level 4
Plenary Speeches:	Kasatsuk II, Level 4
Oral Presentation Rooms:	Bumrung Muang, Level 4 (CIS - A) Rong Muang, Level 4 (CIS - B) Charu Muang, Level 4 (CIS - C) Charoen Muang, Level 2 (RAM - D) Charas Muang 1, Level 2 (RAM - E) Charas Muang 2, Level 2 (RAM - F)
Internet Station:	Ming Muang, Level 4
Coffee/Tea Break(s):	Ming Muang, Level 4
Lunch:	Banthadathong, Level 3
Conference Contact:	CIS-RAM 2006 Conference Secretariat c/o Integrated Meetings Specialist Pte Ltd Blk 998 Toa Payoh North #07-18/19 Singapore 318993 Tel: (65) 6295 5791 Fax: (65) 6295 5792 Email: cisram@inmeet.com.sg

SESSION INFORMATION

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 either **Microsoft PowerPoint OR Overhead Projector (OHP)**. 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 from **07:30 – 08:15 hrs daily, 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.

TRAVEL INFORMATION

Airport Information

Bangkok's Don Muang international airport is located about 25km north of central Bangkok with one domestic and two international terminals. Please check your desired airlines of arrival and departure terminal.

After clearing customs and immigration, several modes of transportation may be found at the exits to the left. Prices may range from Baht 700 to 1,500 on private limos or Baht 350 – 400 for regular taxis (not including Toll or express way for another Baht 60).

Passengers departing the airport on an international flight are required to pay a Baht 500 per person airport departure tax (known as the 'Passenger Service Charge'). Payments are to be made at ticket machines in the terminal and only Thai baht would be accepted.

Value Added Tax (VAT) may be refunded at the tax refund counter located in the departure hall. The forms may be obtained at authorized shops displaying "Vat Refund for Tourists" signs in the city. The tax refund counter charges a service fee of Baht 100 to process the refund and may request to see the purchased merchandises. To qualify for tax refund, you must spend a minimum of Baht 5000 in each transaction at authorized shops or department stores.

1 USD \approx 40 Baht, 1 SGD \approx 25 Baht, 1 USD \approx 1.6 SGD.

Hotel & Vicinity

Ideally situated in the heart of the city's growing commercial district on Rama 6 Road, The Twin Towers Hotel is a charming international luxury hotel with first class services and accommodation. Built on a 14,000 square meter site and within walking distance to the city's major shopping centers and commercial areas. Added feature is its convenient access to different local destinations through BTS sky train and to the airport via the new expressway.

Walking Distance Area :

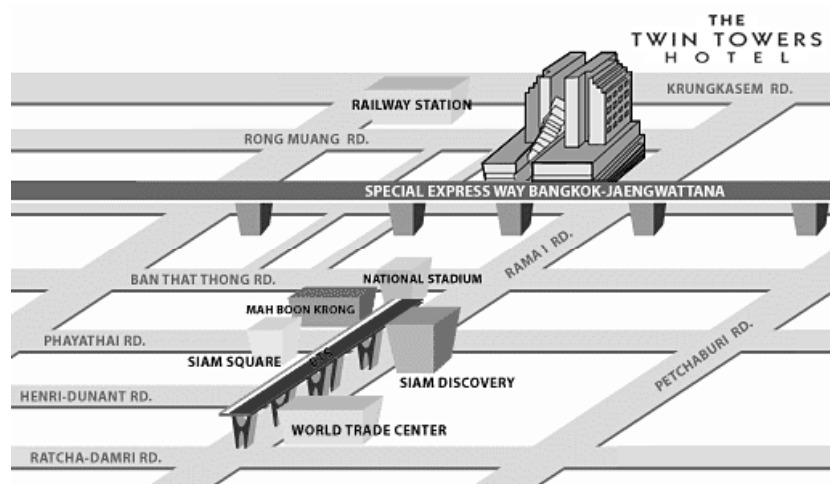
- Hua Lampong Railway Station (15 mins)
- National Stadium (15 mins)
- Mah Boonkrong Shopping Center (20mins)
- Jim Thomson's House (15 mins)
- Siam Square - Shopping Area (20 mins)

Transportation from Hotel to :

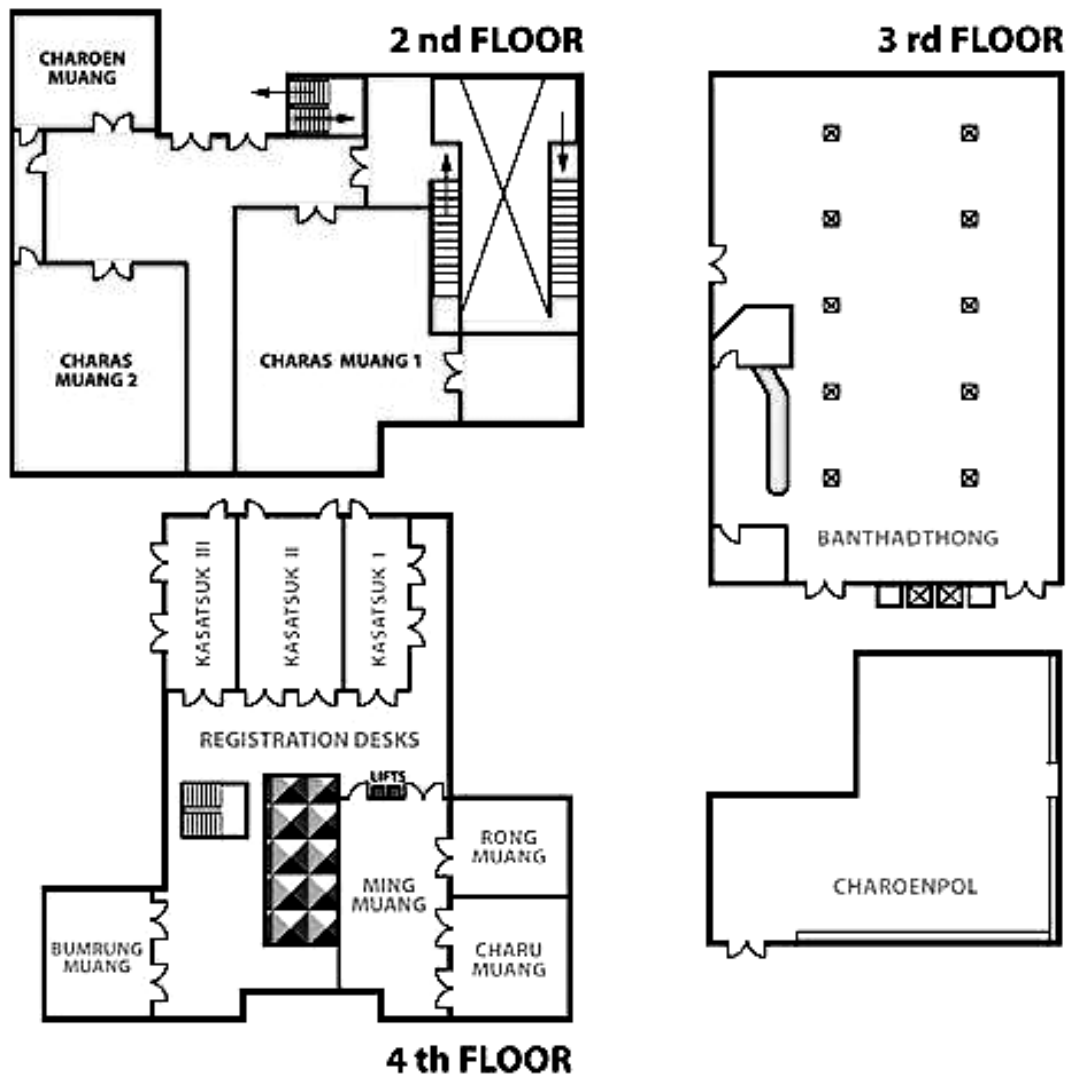
- Grand Palace (25mins)
- Marble Temple (20 mins)
- Wat Trimitr-Golden Buddha (15 mins)

Shopping Centers :

- Mah Boonkrong (5 mins)
- Siam Square (5 mins)
- World Trade Center (20 mins)
- Amarin Plaza (20 mins)
- Gasorn Plaza (20 mins)
- Central Department Store (20 mins)
- Lumpini Night Bazaar (15 mins)
- Patpong Night Market (10 mins)
- China Town (15 mins)
- Chatuchak Weekend Market (25 mins)
- Siam Paragon Shopping Mall (20 mins)



HOTEL FLOORPLAN



CONFERENCE ACTIVITIES

Conference Registration

6 June 2006, Tuesday
16:00 – 18:00
Bumrang Muang Foyer, Level 4

7 June 2006, Wednesday
07:00 – 15:00
Kasatsuk II Foyer, Level 4

8 – 9 June 2006, Thursday – Friday
08:00 – 12:00
Kasatsuk II Foyer, Level 4

Welcome Reception

6 June 2006, Tuesday
18:00 – 20:00
Bumrang Muang Foyer, Level 4
All participants and guests are welcomed.

Lunch

7 June 2006, Wednesday
12:15 – 13:30
8 – 9 June 2006, Thursday – Friday
12:00 – 13:30
Banthadathong, Level 3
Lunch ticket required.

Banquet Dinner

8 June 2006, Thursday
19:30 – 22:00
Kasatsuk II, Level 4
Dress Code: *Smart casual*
Banquet ticket required.

Additional conference banquet tickets can be purchased from the registration counter before 12:00 noon, 8 June 2006 (Thu) at USD40.00 (Baht 1,500) for each person.

Farewell Dinner & Cultural Show

9 June 2006, Friday

18:00 – 22:00

Siam Niramit, Bangkok

Dress Code: *Smart casual*

Event ticket required.

This is a show for the family and friends. Please sign up at the conference registration counter for additional tickets at Baht 1,100 for each person. Payment must be made in cash before 12:00 noon, 9 June 2006 (Fri).

The cost of the ticket includes: transportation between hotel & Siam Niramit, buffet dinner, and the Siam Niramit show.

Delegates and guests using the chartered transportation service are advised to assemble at the Hotel Lobby before 17:15. The last bus to Siam Niramit will leave The Twin Towers Hotel promptly at 17:30, as traffic is expected to be heavy during rush hours.

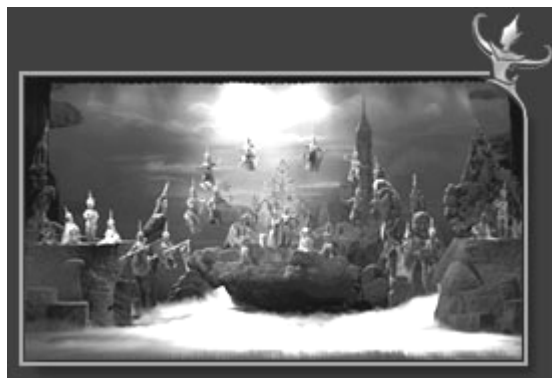
Siam Niramit

Siam Niramit is a World-class spectacular performance of traditional Thai arts and cultural show. This is a must see performance. The conference organizers have arranged this special viewing for the CIS RAM 2006 audience.

The Siam Niramit show encompasses 3 parts:

Part 1: Journey Back to History

For over seven centuries, Siam has been home of diverse cultures; A cross-road where civilizations met. Siam Niramit takes you back to the past to witness the grand procession of Lanna Kingdom in the North. You will see the colorful livelihood at the Southern peninsular where overseas traders blended in with the locals. And in the ancient empire of Khmer, the cheerful Northeastern folks blend song and dance into their daily life. You will also experience the the Kingdom of Ayutthaya, at the heart of the fertile land of Chao Phraya basin, that built farmers of all kinds and brave men of all times.



Part II: Journey Beyond Imagination:

The Three Worlds: Hell, the Forest of Himapaan and Heaven.

Despite the diverse cultures and livelihood, Thai people are all bound by common belief in religious principle of the Law of Karma. The good deeds or bad deeds in this world will result in merit or suffering in the next life. Hell depicts the souls whose former lives were indulged in greed, anger, and lust. Himapaan Forest, the boundary between human world and heaven, where mythical creatures exist. Paradise, home of heavenly beings all form a chorus of celestial dance praising the principle God; Lord Indra.

Part III: Journey Through Joyous Festival

Believing that to go to Heaven, one must gather merit in their present life. In this final act Siam Niramit will take you to enjoy all year round of merit making festivals, which combine religious ceremony with colorful and joyful celebration.

For more details, please visit: <http://www.siamniramit.com/>

Post Conference Excursion (Optional)

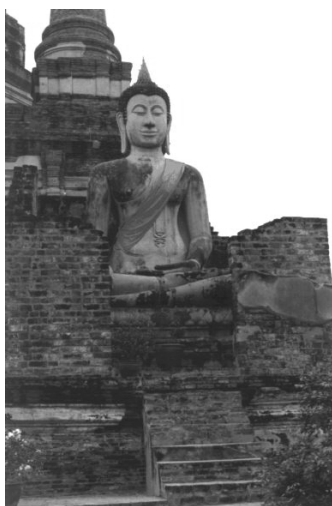
10 June 2006, Saturday
Ayudhaya River Cruise
08:00-16:00

An optional one-day excursion to nearby Thai attraction for CIS-RAM delegates.

Please sign up at the registration counter for tour tickets.

The ticket price is Baht 1,550 for each person. Payment must be made in cash before 12:00 noon, 9 June 2006 (Fri).

The cost of the ticket includes: transportation, cruise admission, lunch, and a private English speaking guide.



Ayutthaya was recently declared a UNESCO World Heritage Site, historic temples are scattered throughout this once magnificent city and along the surrounding rivers. River Cruise has selected the highlights of the site for your visit including Wat Maha That, Wat Lokayasutharam and Wat Na Phra Mane. Along the enchanting Chao Phraya River, you will experience the simple living of people, their homes and some of the historic buildings. You will see the lush green paddy fields contrasting with the growing industrial areas.

Lunch will be provided.

The tour will be conducted in English.

Please see <http://www.cs.ait.ac.th/wutt/ayuth.html> for more details.

CONFERENCE PROGRAM OVERVIEW

	Tuesday 6 June	Wednesday 7 June	Thursday 8 June	Friday 9 June	Saturday 10 June	
07:30 – 08:00		Registration (Kasatsuk II Foyer)			Post Conference Excursion - Ayudhaya River Cruise (Optional)	
08:00 – 08:30		Opening Ceremony & Plenary Session I (Kasatsuk II)	Registration (Kasatsuk II Foyer)			
08:30 – 09:00			Plenary Session II (Kasatsuk II)	Plenary Session III (Kasatsuk II)		
09:00 – 09:30			Coffee/Tea break			
09:30 – 10:00			Coffee/Tea break			
10:00 – 10:30		Technical Session W1	Technical Session T1	Technical Session F1		
1030: – 11:00						
11:00 – 11:30						
1130: – 12:00		Lunch (Banthadathong)				
12:00 – 12:30						
12:30 – 13:00						
13:00 – 13:30		Technical Session W2	Technical Session T2	Technical Session F2		
13:30 – 14:00						
14:00 – 14:30						
14:30 – 15:00						
15:00 – 15:30						
15:30 – 16:00		Coffee/Tea break				
16:00 – 16:30	Pre-Conference Registration (Bumrang Foyer)	Technical Session W3	Technical Session T3	Technical Session F3		
16:30 – 17:00				Transportation		
17:00 – 17:30						
17:30 – 18:00						
18:00 – 18:30	Welcome Reception (Bumrang Foyer)			Farewell Dinner & Cultural Show (Siam Niramat, Off Conference Hotel)		
18:30 – 19:00						
19:30 – 20:00			Banquet Dinner (Kasatsuk II)			
20:00 – 22:00						

TECHNICAL PROGRAM OVERVIEW							
PARALLEL SESSION		CIS – A	CIS – B	CIS – C	RAM – D	RAM – E	RAM – F
LOCATION		Bumrang	Rong	Charu	Chroen	Charas I	Charas II
Wednesday 7 June	0815 – 0845 <i>Opening Ceremony (Kasatsuk II)</i> 0845 – 0945 <i>Plenary I: Robotic Technology for Neural Rehabilitation by Prof Joel W. Burdick, Caltech, USA (Kasatsuk II)</i>						
	Session 1 1015 – 1215	W1A Informatics	W1B Vehicle Systems Control (RAM)	W1C Human/Computer Interaction	W1D Robotics & Automation in Unstructured Environment I	W1E Biologically-inspired Robots and Systems	W1F Wheeled, Legged and Underwater Robots I
	Session 2 1330 – 1530	W2A Intelligent Systems I	W2B Intelligent Transportation Systems	W2C Computational Intelligence	W2D Dynamics & Control I	W2E Wheeled, Legged and Underwater Robots II	W2F Modeling, Planning and Control I
	Session 3 1600 – 1800	W3A Intelligent Systems II	W3B Image Processing I	W3C Control and Manufacturing Systems	W3D Kinematics, Mechanics and Mechanism Design	W3E Methodologies for Robotics and Automation	W3F Fault Diagnosis
Thursday 8 June	0830 – 0930 <i>Plenary II: Humaniod Robotics and its Applications by Prof Atsuo Takanishi, Waseda Univ., Japan (Kasatsuk II)</i>						
	Session 1 1000 – 1200	T1A Optimization	T1B Computer Vision	T1C Neural Networks I	T1D Designs and Applications of Parallel Manipulators	T1E Sensor, Sensor Fusion & Sensor based Robotics	T1F Dyanmics and Control II
	Session 2 1330 – 1530	T2A Intelligent Systems III	T2B Cybernetics Applications I	T2C Genetic Algorithm	T2D Communications Technology & Optical Signal Detection	T2E Kinematics and Dynamics of Robotic Systems	T2F Modeling, Planning and Control II
	Session 3 1600 – 1800	T3A Cybernetics Applications II	T3B Networked Control System (RAM)	T3C RFID/Wireless Sensors	T3D Computer and Robot Vision	T3E Micro/Nano and Cellular Robots	T3F Intelligent Mobile Robots
Friday 9 June	0830 – 0930 <i>Plenary III: Wireless Sensor Networks, by Prof Frank L. Lewis, Univ. of Texas Arlington, USA (Kasatsuk II)</i>						
	Session 1 1000 – 1200	F1A Evolutionary Computation I	F1B Data Mining and Management	F1C Neural Networks II	F1D Electro-hydraulic System Control	F1E Spherical Actuator and Manipulator	F1F Dynamics and Control III
	Session 2 1330 – 1530	F2A Evolutionary Computation II	F2B Pattern Recognition	F2C Soft Computing I	F2D Robotics & Automation in Unstructured Environment II	F2E Medical Robots and Systems	F2F Modeling, Planning and Control III
	Session 3 1600 – 1700	F3A Adaptive Computing Systems	F3B Soft Computing II	F3C Image Processing II	F3D Production and Manufacturing Systems	F3E Decision Support Systems (CIS)	F3F Haptics, Teleoperation and Network Robotics

PARALLEL SESSION		CIS – A	CIS – B	CIS – C	RAM – D	RAM – E	RAM – F
LOCATION		Bumrang	Rong	Charu	Chroen	Charas I	Charas II
Wednesday 7 June	0815 – 0845 <i>Opening Ceremony (Kasatsuk II)</i> 0845 – 0945 <i>Plenary I: Robotic Technology for Neural Rehabilitation by Prof Joel W. Burdick, Caltech, USA (Kasatsuk II)</i>						
	Session 1 1015 – 1215	W1A Informatics	W1B Vehicle Systems Control (RAM)	W1C Human/Computer Interaction	W1D Robotics & Automation in Unstructured Environment I	W1E Biologically-inspired Robots and Systems	W1F Wheeled, Legged and Underwater Robots I
	Session 2 1330 – 1530	W2A Intelligent Systems I	W2B Intelligent Transportation Systems	W2C Computational Intelligence	W2D Dynamics & Control I	W2E Wheeled, Legged and Underwater Robots II	W2F Modeling, Planning and Control I
	Session 3 1600 – 1800	W3A Intelligent Systems II	W3B Image Processing I	W3C Control and Manufacturing Systems	W3D Kinematics, Mechanics and Mechanism Design	W3E Methodologies for Robotics and Automation	W3F Fault Diagnosis
Thursday 8 June	0830 – 0930 <i>Plenary II: Humaniod Robotics and its Applications by Prof Atsuo Takanishi, Waseda Univ., Japan (Kasatsuk II)</i>						
	Session 1 1000 – 1200	T1A Optimization	T1B Computer Vision	T1C Neural Networks I	T1D Designs and Applications of Parallel Manipulators	T1E Sensor, Sensor Fusion & Sensor based Robotics	T1F Dyanmics and Control II
	Session 2 1330 – 1530	T2A Intelligent Systems III	T2B Cybernetics Applications I	T2C Genetic Algorithm	T2D Communications Technology & Optical Signal Detection	T2E Kinematics and Dynamics of Robotic Systems	T2F Modeling, Planning and Control II
	Session 3 1600 – 1800	T3A Cybernetics Applications II	T3B Networked Control System (RAM)	T3C RFID/Wireless Sensors	T3D Computer and Robot Vision	T3E Micro/Nano and Cellular Robots	T3F Intelligent Mobile Robots
Friday 9 June	0830 – 0930 <i>Plenary III: Wireless Sensor Networks, by Prof Frank L. Lewis, Univ. of Texas Arlington, USA (Kasatsuk II)</i>						
	Session 1 1000 – 1200	F1A Evolutionary Computation I	F1B Data Mining and Management	F1C Neural Networks II	F1D Electro-hydraulic System Control	F1E Spherical Actuator and Manipulator	F1F Dynamics and Control III
	Session 2 1330 – 1530	F2A Evolutionary Computation II	F2B Pattern Recognition	F2C Soft Computing I	F2D Robotics & Automation in Unstructured Environment II	F2E Medical Robots and Systems	F2F Modeling, Planning and Control III
	Session 3 1600 – 1700	F3A Adaptive Computing Systems	F3B Soft Computing II	F3C Image Processing II	F3D Production and Manufacturing Systems	F3E Decision Support Systems (CIS)	F3F Haptics, Teleoperation and Network Robotics

PLENARY SESSIONS

Plenary I

7 June 2006, Wednesday

08:45 – 9:45

Kasatsuk II, Level 4

Robotic Technology for Neural Rehabilitation

Joel W. Burdick, *California Institute of Technology, USA*

This talk will focus on two research efforts that are aimed at developing new robotic technology and algorithms to assist in the recovery of function by patients suffering from neural deficits

The first part of the talk will focus on novel multi-electrode systems that can autonomously position neural recording electrodes inside cortical tissue so as to isolate and then maintain optimal extra cellular signal recording quality. Autonomous micro drives such these can be used to improve the quality and efficiency of acute recordings that are needed for basic research in neurophysiology. They also offer the potential to increase the longevity and quality of chronic recordings that serve as the front end of emerging neuroprosthetic systems that aid the handicapped. The autonomous positioning algorithms and novel miniature robot micro drives will be described. We present data from the use of this technology in monkeys and rats. This part of the talk will conclude with a snapshot of our current efforts to miniaturize this technology using MEMS fabrication methods.

The second part of the talk will focus on the use of robotic devices and drug therapy to recover locomotion after spinal cord injury (SCI). We have developed specialized robotic devices to aid in the step and stand training of spinalized mice models. Coupled with administration of quipazine (a serotonin agonist), we show that the use of these training devices can significantly improve the function of the intact nervous system.



Joel W. Burdick is the Professor of Mechanical Engineering and BioEngineering, California Institute of Technology. He is also the Option Representative for BioEngineering and the Deputy Director of Center for Neuromorphic Systems Engineering. He received his undergraduate degrees in mechanical engineering and chemistry from Duke University and M.S. and Ph.D. degrees in mechanical engineering from Stanford University.

Dr Joel Burdick has been with the department of Mechanical Engineering at the California Institute of Technology since May 1988, where he has been the recipient of the NSF Presidential Young Investigator award, the Office of Naval Research Young Investigator award, and the Feynman fellowship. He has also received the ASCIT award for excellence in undergraduate teaching and the GSA award for excellence in graduate student education. He has been a finalist for the best paper award for the IEEE International Conference on Robotics and Automation in 1993, 1999, 2000 and 2005. He was the plenary speaker at the

National Academy of Engineering's annual meeting in 1999. He was promoted to Associate professor with tenure in 1994, and Professor in 2000. He was appointed Professor of BioEngineering in 2002.

Dr Joel Burdick's research interests lie mainly in the areas of robotics, kinematics, and mechanical systems. His current research interests include neural prosthetics, rehabilitation of spinal cord injuries, robotic locomotion, sensor based robot motion planning, multi-fingered robotic hand manipulation, and applied nonlinear control theory.

Plenary II

8 June 2006, Thursday

08:30 – 9:30

Kasatsuk II, Level 4

Humanoid Robotics and Its Applications

Atsuo Takanishi, Waseda University, Japan

Even though the market size is still small at this moment, the applied fields of robots are gradually spreading from the manufacturing industry to the others in recent years. One can now easily expect that applications of robots will expand into the first and the third industrial fields as one of the important components to support our society in the 21st century.

There also raises strong anticipations in Japan that robots for the personal use will coexist with humans and provide supports such as the assistance for the housework, care of the aged and the physically handicapped, since Japan is one of the fastest aging societies in the world. Consequently, humanoid robots and/or animaloid robots have been treated as subjects of robotics researches in Japan such as a research tool for human/animal science, an entertainment/mental-commit robot or an assistant/agent for humans in the human living environment.

Over the last couple of years, some manufactures including famous global companies have started to develop prototypes or even to sell mass production robots for the purposes mentioned above, such as SONY, TMSUK, ZMP, TOYOTA, HONDA, Mitsubishi Heavy and etc. Most of those robots have some lifelikeness in their appearances and behaviors. On the other hand, Waseda University, where we belong to, has been one of the leading research sites on humanoid robot research since the late Prof. Ichiro Kato and his colleagues started the WABOT (WAseda rObOT) Projects and developed the historical humanoid robots that are WABOT-1 and WABOT-2 done in the early 70s and 80s respectively.

One of the most important aspects of our research philosophy is as follows:

By constructing anthropomorphic/humanoid robots that function and behave like a human, we are attempting to develop a design method of a humanoid robot having human friendliness to coexist with humans naturally and symbiotically, as well as to scientifically build not only the physical model of a human but also the mental model of it from the engineering view point.

Based upon the philosophy, my colleagues and I have been doing researches on humanoid robots, such as the Biped Walking Robots, Emotion Expression Robots, Mastication Robots, Flute Player Robots, Speech Production Robots and etc.

In this talk, I will introduce the research philosophy of humanoid robotics, the design concept of the humanoid robots and its applications with the robots mentioned above as examples.



Atsuo Takanishi is a Professor of Department of Mechanical Engineering, Waseda University. He is also the concurrent Professor and one of the core members of HRI (Humanoid Robotics Institute, Waseda University). He received the B.S.E. degree in 1980, the M.S.E. degree in 1982 and the Ph.D. degree in 1988, all in Mechanical Engineering from Waseda University. He is a member of Robotics Society of Japan (a board member in 1992 and 1993), Japanese Society of Biomechanisms, Japanese Society of Mechanical Engineers, Japanese Society of Instrument and Control Engineers and Society of Mastication Systems (a major board member from 1996 to current), IEEE and other medicine and dentistry related societies in Japan. He received the Best Paper Award from Robotic Society Japan (RSJ) in 1998, the ROBOMECH Award from RSJ and Japanese Society of Mechanical Engineers in 1998, the Finalist of Best Paper Award in ICRA1999 from IEEE and RSJ in 1999 and the Best of Asia Award from BusinessWeek Magazine in 2001,

JSME Distinguished Research Activity Award in Robotics and Mechatronics in 2003, the Best Paper Award - Application in IROS2003 from IEEE and RSJ in 2004, etc.

Dr Atsuo Takanishi's current researches are related to Humanoid Robots and Cyborgs, such as the biped walking robots for modeling human biped walking as bipedal humanoid robots WABIAN (WAseda Blpedal humANoid) series, the biped locomotors for carrying handicapped or elderlies as WL(Waseda Leg) series, the mastication robots WJ(Waseda Jaw) series to mechanically simulate human mastication for clarifying the hypotheses in dentistry, the jaw opening-closing trainer robots WY(Waseda Yamanashi) series for patients having difficulties in jaw opening and/or closing, the flute playing robots WF(Waseda Flutist) series to quantitatively analyze human flute playing by collaborating with a professional flutist, the upper body humanoid robots WE(Waseda Eye) series which emotionally behave like a human based upon the "Equations of Mind" including emotion, the anthropomorphic talking robots WT(Waseda Talker) series which mechanically speak Japanese vowels and consonant sounds, and the other themes related to his research area. Especially, his latest humanoid robot WABIAN-2 was exhibited in the 2005 World Exposition, Aichi, Japan to demonstrate the knee extended walking using the human-like pelvis and seven DOF leg mechanisms.

Plenary III

9 June 2006, Friday

08:30 – 9:30

Kasatsuk II, Level 4

Wireless Sensor Networks

Frank L. Lewis, *University of Texas at Arlington, USA*

Wireless Sensor Networks represent the next evolutionary development step in environmental monitoring, secure area assurance, intelligent machinery maintenance, and utilities, home, and transportation systems automation. The WSN is an extended and physically disconnected-body system that should, under proper decision-making and control, behave as a single feedback organism. Like any sentient organism, the WSN relies first and foremost on sensory data from the real world. Sensory data comes from multiple sensors of different modalities in distributed locations.

The challenges in the hierarchy of: detecting the relevant quantities, monitoring and collecting the data, assessing and evaluating the information, formulating meaningful user displays, and performing decision-making and alarm functions are enormous. The importance of sensor networks is highlighted by the number of recent funding initiatives, including the DARPA SENSIT program, military programs, and NSF Program Announcements.

The study of wireless sensor networks is challenging in that it requires an enormous breadth of knowledge from an enormous variety of disciplines. In this talk we outline network topology, communication networks, smart sensors, physical transduction principles, commercially available wireless sensor systems, self-organization, signal processing and decision-making.

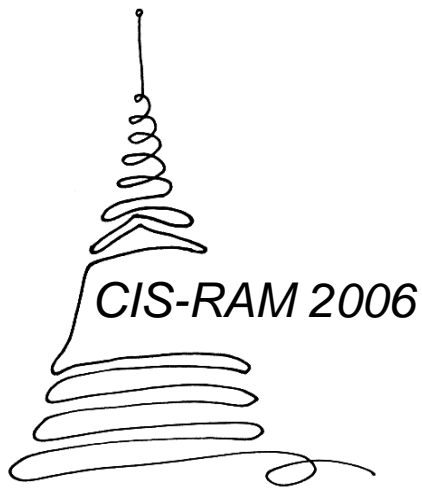
A unified approach to decision-making, mission programming, task sequencing, and dynamics resource assignment will be presented. Hybrid WSN with combined unattended ground sensors and mobile sentry nodes are included. The proposed approach allows one to program multiple missions into a WSN with the same ease that one today programs a PC. Applications will be discussed including secure area denial, environmental monitoring, and condition-based machinery monitoring. Discussion will be made on adaptive sampling and navigation, sensor localization, and MEMS sensor development.



Frank L. Lewis is the head of Advanced Controls & Sensors Group, Automation & Robotics Research Institute, the University of Texas at Arlington, Texas. He obtained the Bachelor's Degree in Physics/Electrical Engineering and the Master's of Electrical Engineering Degree at Rice University in 1971. He spent six years in the U.S. Navy, serving as Navigator aboard the frigate USS Trippe (FF-1075), and Executive Officer and Acting Commanding Officer aboard USS Salinan (ATF-161). In 1977, he received the Master's of Science in Aeronautical Engineering from the University of West Florida. In 1981, he obtained the Ph.D. degree at The Georgia Institute of Technology in Atlanta, where he was employed as a professor from 1981 to 1990 and is currently an Adjunct Professor. He is a Professor of Electrical Engineering at The University of Texas at Arlington, where he was awarded the Moncrief-O'Donnell Endowed Chair in 1990 at the Automation & Robotics Research Institute. He is a Fellow of the IEEE, a member of the New York Academy of Sciences, and a registered Professional Engineer in the State of Texas. He is a Charter Member (2004) of the UTA

Academy of Distinguished Scholars and Senior Fellow of the Automation & Robotics Research Institute.

Dr Frank Lewis's current interests include intelligent control, neural and fuzzy systems, microelectromechanical systems (MEMS) control, wireless sensor networks, nonlinear systems, robotics, condition-based maintenance, and manufacturing process control. He is the author/co-author of 4 U.S. patents, 162 journal papers, 23 chapters and encyclopedia articles, 239 refereed conference papers, and nine books. He was selected to the Editorial Boards of International Journal of Control, Neural Computing and Applications, and Int. J. Intelligent Control Systems. He served as an Editor for the flagship journal Automatica. He is the recipient of an NSF Research Initiation Grant and has been continuously funded by NSF since 1982. Since 1991, Dr Frank Lewis has received \$5 million in funding from NSF and other government agencies, including significant DoD SBIR and industry funding. His SBIR program was instrumental in ARRI's receipt of the SBA Tibbets Award in 1996. He has received a Fulbright Research Award, the American Society of Engineering Education F.E. Terman Award, three Sigma Xi Research Awards, the UTA Halliburton Engineering Research Award, the UTA University-Wide Distinguished Research Award, the ARRI Patent Award, various Best Paper Awards, the IEEE Control Systems Society Best Chapter Award (as Founding Chairman of the DFW Chapter), and the National Sigma Xi Award for Outstanding Chapter (as President of the UTA Chapter). He was selected as Engineer of the year in 1994 by the Ft. Worth IEEE Section and is listed in the Ft. Worth Business Press Top 200 Leaders in Manufacturing. He was appointed to the NAE Committee on Space Station in 1995 and to the IEEE Control Systems Society Board of Governors in 1996. In 1998, he was selected as an IEEE Control Systems Society Distinguished Lecturer. He is a Founding Member of the Board of Governors of the Mediterranean Control Association.



TECHNICAL PROGRAM

Wednesday
7 June 2006

Session 1
10:15 – 12:15

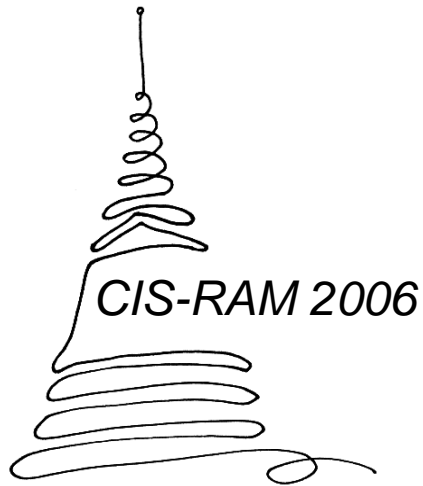
Cybernetics & Intelligent Systems					Wed 7 June 10:15–12:15	
	W1A Bumrang	Informatics Chair(s): Ali Siadat Prasong Praneetpolgrang	W1B Rong	Vehicle Systems Control (RAM) Chair(s): Chidchanok Lursinsap Dikai Liu	W1C Charu	Human/Computer Interaction Chair(s): Wei Tech Ang Kun-Chieh Wang
10:15 – 10:35	A User - Adaptive Self-Proclamative Multi-Agent Based Recommendation System Design for E-Learning Digital Library <i>Ponnusamy R, Gopal T. V., Anna University, INDIA</i> E-learning, the most modern recent web application for dissemination of information caters to the needs of different learning communities. Web digital library is an instrument that provides various types of information required for e-learning. It is necessary to formulate a new technique, by taking into account various user communities and their personal requirements. This paper describes a new technique for design and development of a user-interface system called "A user adaptive self-proclamative multi-agent based recommendation system design" for e-learning digital libraries. This system is mainly designed for research people to collect the research literature. Basically this is a multi-agent based recommendation system that provides necessary suggestions by learning user-personal profiles and actions.		Heading System Design of MAV <i>Song Wang, Tianmiao Wang, Jianhong Liang, Xiaoyu Li, Li Pu</i> Beihang University, CHINA This article puts forward a new heading system (including heading measurement and heading control) framework of Micro Air Vehicle (MAV) starting from practical application, then designs a plan in which three most popular heading measurement methods, magnetic heading, strapdown heading and GPS heading, are implemented in a mini system, analyzes their strong and weak points one by one, and provides a way to obtain a practical heading based on data fusion. The advantages of this way are appropriately accuracy, little calculation amount, no system model needed, and dynamic online self-calibration. The article also designs a plan for heading control of MAV on the basis of heading measurement, which has been realized in the IFly30 MGNC (Micro Guidance, Navigation and Control) system. ...		Usability Analysis of Mobile Phone Camera Software Systems <i>Yuan-Fu Qiu, Yoon Ping Chui, Martin G Helander, Nanyang Technological University, SINGAPORE</i> The usability of the software system for capturing picture is important factor for the mobile phone's interface design, which will partly determine customers' appreciation of the value of the service. Review from a human factors perspective, there are various methods for evaluating usability. However, there are no definite criteria for testing the usability of mobile phone camera software systems. This study presents a new framework for usability testing based on a typical human information processing. Usability is classified into four dimensions for testing: perception, learning/memorization, control/action and evaluative feeling. Furthermore, the criteria for testing the four dimensions of usability are defined for mobile phone camera software systems. Three different camera mobile phones are studied and compared....	
	The RD-tree: Allowing Data in Interior Nodes of the R-tree <i>Tanin Na Nakorn, Jaruloj Chongstitvatana, Chulalongkorn University, THAILAND</i> The RD-tree is a dynamic spatial access method which is a variant of the R-tree. The major difference between the R-tree and the RD-tree is the use of the RD-tree's interior nodes, which contains not only index entries but also data entries whenever possible. When an appropriate data object is stored in an interior node, instead of a leaf node in the subtree, the expansion of the minimum bounding rectangles (MBRs) in the subtree can be avoided. Thus, the overlapping area between MBRs can be reduced. As a result, the number of disk accesses in the RD-tree can be improved, compared to the R-tree. From the experiment, it is shown that the RD-tree clearly outperforms the R-tree when minimum bounding rectangles of the data are markedly oblong.		Linear Subsystem Model for Real-time Control of Vehicle Stability Control System <i>Liang Li, Jian Song, Huiyi Wang, Chunyu Xue, Tsinghua University, CHINA</i> Research focusing on the vehicle stability control system has resulted in many strategies for active yaw control based on the anti-lock brake system and traction control system. The controller prototype is brought forward to control the vehicle under extreme steer maneuvers and with uncertain road. The linear models, including the linear four-wheel vehicle model, and the simplified tire model, the hydraulic model, are studied for the real time control of vehicle stability control system, then are verified by the HILS simulation.		An Intelligent Guiding System using Face Information and Vision-based Mouse-Interaction User Interface <i>Cheng-Yu Chang, Pau-Choo Chung, Yu-Sheng Yeh, Jar-Ferr Yang, National Cheng Kung University, TAIWAN</i> A guiding system is a specific mechanism that is used for providing key responses or information for the visitors. However, traditional guiding systems certainly have several disadvantages such like without real-time interaction with users and monotonous. This paper presents an intelligent guiding system, which allows a user to real-time interact with it without any additional auxiliaries. At first, a real-time front-view face detection using Harr-like features is used to decide when the guiding system should wake up and become interactive with the user. After system initialization, we keep on finding some feature points within the detected face area. Then we estimate the orientation of user's head via pyramidal Lucas-Kanade optical flow tracking. The performance of vision-based mouse-interaction in our system ...	
	An Automatic Text Summarization Approach using Content-Based and Graph-Based Characteristics <i>Ohm Sornil, Kornnika Gree-Ut, National Institute of Development Administration, THAILAND</i> The continuing growth of World Wide Web and on-line text collections makes a large volume of information available to users. Automatic text summarization allows users to quickly understand documents. In this paper, we propose an automated technique for single document summarization which combines content-based and graph-based approaches and introduce the Hopfield Network algorithm as a technique for ranking text segments. A series of experiments are performed using the DUC collection and a Thai-document collection. The results show the superiority of the proposed technique over reference systems, in addition the Hopfield Network algorithm on undirected graph is shown to be the best text segment ranking algorithm in the study.		Traveling Wave Characteristic Analysis of Arc Short Circuit and Metal Short Circuit Fault in DC Traction Power Supply System <i>Xiaqing Li, Li Zuo, Shuyou Guo, *Shengtao Fan, Beijing Institute of Petrochemical Technology, CHINA, *Beihang University, CHINA</i> To catch the information of the faults and to distinguish them as well is a challenging problem in the intelligent auto-reclosing sets of the direct current traction power supply system. The transient fault and the permanent fault can be equivalent to the arc short and the metal short. Based on transmission line theory and the difference of the energy attenuation speed under the two states, the theoretical method to distinguish the transient fault and the permanent fault is established. By B-spline binary wavelet, the characteristics of the faults are found out, and the result is satisfactory.		Efficient Generalized Colored Image Enhancement <i>Syed Mashhood Murtaz, Jahanzeb Ahmad, Usman Ali, COMSATS Institute of Information Technology, Abbottabad, PAKISTAN</i> Hue preservation is an essential requirement for color image enhancement, but preserving hue introduces the gamut problem. A fast technique is proposed which can be applied to generalize any linear or non-linear gray-scale contrast enhancement function to the color domain. The technique provides hue preserved, gamut problem free color contrast enhancement in accordance with the gray-scale contrast enhancing function it generalizes. Results for the proposed color image enhancement technique are better than the currently available techniques.	
10:35 – 10:55						
10:55 – 11:15						

Cybernetics & Intelligent Systems					Wed 7 June 10:15–12:15	
	W1A Bumrang	Informatics Chair(s): Ali Siadat Prasong Praneetpolgrang	W1B Rong	Vehicle Systems Control (RAM) Chair(s): Chidchanok Lursinsap Dikai Liu	W1C Charu	Human/Computer Interaction Chair(s): Wei Tech Ang Kun-Chieh Wang
11:15 – 11:35	The Performance Assessment on Universities' Informatics using Balanced Scorecard <i>Prasong Praneetpolgrang, *Ubonsin Poprom, *Preang Kitratporn, Sripatum University, *Phranakhon Rajabhat University, THAILAND</i> <p>This research was conducted with three objectives; 1)evaluated the effectiveness of Informatics management or ICT management of public universities in Thailand which based on Balanced Scorecard(BSC), 2)created Key Performance Indicators (KPIs) of informatics developing, and 3)developed a new informatics strategic model (or ICT strategic model) for informatics management. This was to confirm that informatics could give an extreme benefit to universities and stakeholders. This proposed model provided some guidelines to improve investment and worthwhile informatics governance. In order to reach these objectives, qualitative and quantitative research methodologies were approached. The researchers investigated on 40 public universities in Thailand as a case study. The findings of this ...</p>		Research on Fault Diagnosis and Protect Model for DC Traction Power Supply System based on Traveling Wave Theory <i>X Li, S Guo, Y Zhou, *Y Li, **S Fan, Beijing Inst of Petrochemical Tech., *Beijing Univ. of Aeron. & Astron., **Beihang Univ., CHINA</i> <p>The paper analyses the limitation of the differentiation i'Cdelta I protection method. It puts forward traveling wave protection method for the DC power supply system that is based on interrelated characteristics of the traveling wave and the unit impedance of the transmission line. The traveling wave protection method overcomes the disadvantage of the traditional method in which the protection action is affected by the overall impedance of the circuit, and thus improves the reliability and sensibility of the relay protection system. A great number of field tests are carried out and the research results are satisfactory.</p>		A Study of Emotional Motion Description by Motion Modification and Adjectival Expressions <i>Atsushi Yamaguchi, Yoshikazu Yano, Shiniji Doki, Shigeru Okuma, Nagoya University, JAPAN</i> <p>Emotion expression through motion is meaningful communication process between humans and robots. Automatic emotion expression generation is desired to robots which communicate with humans. Proposed technique generate the emotional motion by modifying the base motion pattern with the combination of adjectival expressions. In order to generate emotional motion, emotion modification rule must be prepared, which represents intensity and corresponding the relationship between emotion expression and the adjectival expressions. In this paper, emotion modification rule is obtained by organoleptic tests and generates the suitable emotional motion pattern from base motion pattern.</p>	
11:35 – 11:55	A Framework for using a Case Based Reasoning System Applied to Cost Estimation <i>Alexandre Thibault, Ali Siadat, Patrick Martin, Ecole Nationale Supérieure d'Arts et Metiers, FRANCE</i> <p>In the context of the cost estimation, the use of a case based reasoning system is an interesting solution. However the creation of case corresponding to a mechanical part to estimate a more general problem resolution doesn't require the opinion of only one expert, but a consensus of several experts and for extended enterprises it may be difficult since the experts aren't necessary at the same place. Traditionally the filling of a case base is done with several interviews of experts. We thus defined a case creation method by obtaining consensus of a group of experts, as well as the procedures which would make it possible to associate it with a case based reasoning system.</p>		Design of High Quality Controller to be Advantage over PI with Low-Pass Controllers <i>Zhibing Shu, Caizhong Yan, Nanjing University of Technology, CHINA</i> <p>In this paper, an advanced PI control method was analyzed. The analysis of Bode plot in frequency domain, and the experiment show that advanced controller is better than the existing PI controllers. They can achieve higher bandwidth, lower settling time and better disturbance rejection ability. The increased performance costs little in sensor noise amplification. We show using true-life design examples that advanced control algorithms improve equally well both speed and position controllers.</p>		Adaptive, Language Independent Spell Checking using Intelligent Traverse on a Tree <i>Behrang Qasemizadeh, *Ali Ilkhani, Amir Ganjei, Iran University of Science and Technology, IRAN, *Digital Clone Corp., IRAN</i> <p>This paper introduces an adaptive, language independent, and 'built-in error pattern free' spell checker. Proposed system suggests proper form of misspelled words using nondeterministic traverse of 'Ternary Search Tree' data structure. In other words the problem of spell checking is addressed by traverse a tree with variable weighted edges. The proposed system uses interaction with user to learn error pattern of media. In this way, system improves its suggestions as time goes by.</p>	
11:55 – 12:15	Management and Selection of Visual Metaphors for Courseware Development in Web Based Learning <i>Ramadoss Balakrishnan, *S. Balasundaram Ramakrishnan, National Institute of Technology, *National Institute of Technology, INDIA</i> <p>Metaphors are widely seen in the user interfaces of today's web based applications. Some of the major features of metaphors are their ability to organize information related to any concept and to provide better understanding of the information. The traditional teaching and learning activities of educational systems have enjoyed the benefits of metaphors in several ways. This includes representing metaphors in various forms such as text, graphics, animated images etc. One of the challenges for Web Based Learning (WBL) courseware developer is to design the appropriate metaphors relevant to the context of information presented in the courseware. This paper focuses on the method of selecting one or more metaphors constructed already by the courseware developers that will help in understanding as well ..</p>				A Joint Controller-Simulator Programming by Demonstration Method for PLC Devices <i>Phissanu Changsakol, *Nopporn Chotikakamthorn, Olarn Wongwirat, King Mongkut's Institute of Technology, Ladkrabang, THAILAND</i> <p>In this paper, a problem of visual programming for PLC (programmable logic controller) devices is described. A programming by demonstration method is developed so that a problem-domain expert can program such devices without programming knowledge. The method is novel in the sense that, unlike other programming-by-demonstration methods, it requires little a priori knowledge of the control system simulation model, nor it needs to interact with a real system. A simulation model, which captures the laws of nature that govern the system behavior, is jointly programmed with a control device (PLC), under the joint controller-simulator programming by demonstration paradigm. A PLC programming tool developed based on the proposed method can generate a high-level ST (Structure Text) program code, from ...</p>	

Robotics, Automation & Mechatronics					Wed 7 June 10:15–12:15	
	W1D Chroen	Rob. & Auto. in Unstructured Environment I Chair(s): Wai-Kiang Yeap Wail Gueaieb	W1E Charas I	Biologically-Inspired Robots and Systems Chair(s): Peraphon Sophatsathit Dugan Um	W1F Charas II	Wheeled, Legged and Underwater Robots I Chair(s): Stefan Jakubek Atsushi Fujimori
10:15– 10:35	Active Vibration Suppression of a Flexible Link using Ionic Polymer Metal Composite <i>Dibakar Bandopadhyaya, Dileep K Bhogadi, Bishakh Bhattacharya, Ashish Dutta</i> , Indian Institute of Technology, Kanpur, INDIA Polymers labeled as EAPs (Electro-active Polymer) have a mechanical response to electrical stimulation and produce an electric change in response to mechanical stimulation. The high strains of ionic polymer metal composite (IPMC) make them attractive as mechanical actuators for applications requiring large motion but little force. This paper describes the results an application of IPMC as active damper for a flexible link. IPMC is studied experimentally to find out material loss factors and damping characteristics. A single link rotary flexible manipulator with IPMC as smart patches was studied for attenuation of vibration actively. Modeling of the flexible rotating beam with IPMC has been done using modal approach to determine the fundamental modes of vibration. ...		Analysis of Neural Oscillator for Bio-inspired Robot Control <i>D G Zhang, Kuanyi Zhu, Li Lan</i> , Nanyang Technological University, SINGAPORE This paper presents some theoretical analysis for the neural oscillator, which is widely applied in the robot and biped control. The methods adopted here include stability theory, describing function, and linear piecewise analysis. Some prime properties of the neural oscillator such as the frequency determining, boundness, and stability are exploited. The insightful results will strengthen the foundation of the neural oscillator and enhance its efficient application for the bio-inspired robot control.		Conception of Wheeled Mobile Robots with Reconfigurable Control using Interface Prototyping <i>J. M. Rosario, *R. Pegoraro, *H. Ferasoli, D. Dumur</i> , SUPELEC, FRANCE, *Universidade Estadual Paulista, BRAZIL With the fast innovation of the hardware and software technologies using rapid prototyping devices, with application in the robotics and automation, more and more it becomes necessary the development of applications based on methodologies that facilitate future modifications, updates and increments in the original projected system. This paper presents a conception of mobile robots using rapid prototyping, distributing the several control actions in growing levels of complexity and using resources of reconfigurable computing proposal oriented to embed systems implementation. Software and the hardware are structuralized in independents blocks, with connection through common bus. The study and applications of new structures control that possibility good performance in relation to the parameter variations. ...	
	Use-dependent Synaptic Connection Modification in SNN Generating Autonomous Behavior in a Khepera Mobile Robot <i>Fady Alnajjar, Murase Kazuyuki</i> , University of Fukui, JAPAN In this paper, we propose self-organization algorithm of spiking neural network (SNN) applicable to autonomous robot. We also examine the relation between neural dynamics in SNN and the robot behavior. First, we formulated a SNN model whose inputs and outputs were analog. Next, we implemented it into a miniature mobile robot Khepera. In order to see whether or not a solution(s) for the given task(s) exists with the SNN, the robot was evolved with the genetic algorithm in the environment. The robot acquired the obstacle avoidance and navigation task successfully, exhibiting the presence of the solution. After that, a self-organization algorithm based on a use dependent synaptic potentiation and depotentiation was formulated and implemented into the robot. ...		Modeling and Control of Human Motor System with Generalized Predictive Control <i>Li Lan, Kuanyi Zhu, D G Zhang</i> , Nanyang Technological University, SINGAPORE Many patients suffer from the spinal cord diseases, a proper modeling and control of human motor system will help to improve the prognosis of them. This paper presents an integrated model to describe the static and dynamic characters of spinal neuro-musculoskeletal system based on the currently accepted theories and hypothesis in biological motor control. Then a new control system with Generalized Predictive Control and neural network is designed to control the former model.		Stability Evaluation of Mobile Robotic Systems using Moment-Height Measure <i>S Ali A Moosavian, Khalil Alipour</i> , K. N. Toosi University of Technology, IRAN Due to excessive maneuverability, mobile manipulators which consist of one or more manipulators mounted on a mobile base have attracted much of interest. Tipping-over is one of the most important problems in such systems especially when manipulating heavy objects, also during maneuvers in unknown environment or in rugged terrains. Therefore, estimation and evaluation of dynamic stability with appropriate easy-computed measure throughout the motion of such systems is a challenging task. In this study, various dynamic stability measures are investigated and compared with each other. Next, a new effective measure named as Moment-Height Stability (MHS) measure is presented for wheeled mobile manipulators. The proposed metric is physically meaningful based on principal concepts, and ...	
10:55 – 11:15	Modelling the Environment of a Mobile Robot using Feature Based Principal Component Analysis <i>Tahir Yaqub, Jayantha Katupitiya</i> , University of New South Wales, AUSTRALIA We present a method of classifying the robots environment according to the sensor perception. Our approach combines both the feature based and statistical approaches. We use laser scans at few (nearly five percent) of all the possible poses in a static indoor environment. Then we extract some vital features of lines and corners with attributes such as slope of lines and distance between corners from the raw laser data and compute the associated probabilities of detection. Bootstrap method is used to get a robust correlation of features and finally Principal Component Analysis (PCA) is used to model the environment. In PCA, the underlying assumption is that data is coming from a multivariate normal distribution. ...		Contribution of Charge to the Control of Selemion Bending <i>Hirohisa Tamagawa, Fumio Nogata</i> , Gifu University, JAPAN One of ion exchange polymer membranes (IEPM's) called Selemion (Asahi glass, Co. Ltd., Japan) exhibits a large bending upon an applied voltage. Previously, Selemion curvature was found to have an intimate correlation with charge given to it. This study suggests that the charge created by the occurrence of redox reaction of silver layers on Selemion surfaces brings about such a intimate correlation between charge and curvature. It can be interpreted as the curvature can be precisely controlled with the control of charge (or current).		A New Adaptive Tracking Control for Wheeled Mobile Robot <i>R. Barzamini, *A R Yazdizadeh, **A H Rahmani</i> , Tehran South Univ, IRAN, *Power and Water Univ, IRAN, **Islamic Azad Univ, IRAN Wheeled Mobile Robots are considered as the most widely used class of Mobile Robots. This is due to their fast maneuvering, simple controllers, and energy saving characteristics. A new adaptive algorithm for tracking control of these robots is presented in this paper which is robust against external and internal disturbances. A combination of model reference adaptive control and gain scheduling is used to control the robot motion. The simulation results indicate that the designed controller will preserve the robot on its desired track A New Adaptive Tracking Control For Wheeled Mobile Robot R. Barzamini Islamic Azad University Dezfoul Branch Iran barzamini@aut.ac.ir even though the disturbance level is of high value.	

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11:15 – 11:35	A Novel Approach for Multiple Mobile Robot Path Planning in Dynamic Unknown Environment <i>Taixiong Zheng, Xiang Yang Zhao</i> , Chongqing University of Posts and Telecommunications, CHINA Multiple mobile robot path planning in dynamic unknown environment is challenging. In this paper a novel artificial potential field (APF) based approach is proposed. In this approach, a robot will be pulled to the goal position with the influence of the goal and static obstacles. When two or more robots meet at the range of safe distance, those robots will be prioritized according to the priority of the task they undertake, velocity and their size. The robot with higher priority will pass the intersection first. If they have the same priority, they will generate a priority order randomly to each other. By this way, they will avoid collision between each other. Simulation results are provided to validate the concepts and analyses are made to show the effectiveness of the approach.		A Facial Expression Model for Human-Like Agent <i>Bin Yang, Peifa Jia</i> , Tsinghua University, CHINA A major unsolved problem in human-like agent is the construction and application of realistic human facial expression models. Human-like agents should interact with human by recognizing human facial expression and synthesizing facial expressions to show their emotional states. However there is no a uniform model for both recognition and synthesis of facial expression. In this paper, we present a model for solving this challenging task. First, we setup a muscle-based facial model and use muscles' contraction as controlling factors because all the facial actions are driven by the muscles. An orthogonal facial expression space is constructed by regarding each controlling factor as a dimension. Then muscles' contractions are calculated from facial images to construct the facial vector. ...		Proprioceptive Navigation, Slip Estimation and Slip Control for Autonomous Wheeled Mobile Robots <i>Martin Seyr, Stefan Jakubek</i> , TU Vienna, AUSTRIA For a two-wheeled differentially driven mobile robot a navigation and slip control algorithm is developed. The presented concept for purely proprioceptive navigation combines state estimation via extended Kalman filter from inertial sensor data (i.e. gyro and acceleration sensors) and odometric measurements (i.e. wheel angular encoders). The advantages of both types of sensors are exploited by selective mixing. Tangential slip detection and side-slip angle measurement enable slip control by transiently overriding a pre-planned trajectory. Experimental results demonstrating the performance of the proposed system are presented.	
	11:35 – 11:55	A Modular Sliding Mode Controller for Cooperative Closed-Chain Manipulators with Uncertain Dynamics <i>Wail Gueaieb, *Salah Al-Sharhan</i> , University of Ottawa, CANADA *Gulf University for Science and Technology, KUWAIT This article presents a decentralized sliding mode control scheme for the complex problem of simultaneous position and internal force control in cooperative multiple manipulator systems. The proposed controller is composed of a sliding mode control term and a force robustifying term to simultaneously control the payload's position/orientation as well as the internal forces induced in the system. This is accomplished independently of the manipulators dynamics. Unlike most controllers that do not require prior knowledge of the manipulators dynamics, the suggested controller does not depend on fuzzy logic inferencing and is computationally inexpensive. Numerical experiments confirm the controller's robustness in the face of varying unknown system's dynamics. ...		Determination of Optimal Contact Points for Constraining a Prismatic Object by a Group of Mobile Robots <i>Pankaj Sharma, Ashish Dutta, Anupam Saxena</i> , Indian Institute of Technology, Kanpur, INDIA This paper proposes a novel approach to determine the optimal contact points for constraining a prismatic object by a group of mobile robots. The optimal contact points are found such that the twin objectives of minimum number of robots required for form closure and the least force required for grasping are satisfied. The mobile robots are assumed to be able to apply a normal force without friction, on the objects. Genetic Algorithms have been used to solve the problem. The advantages of the proposed method are that as the object is in form closure it can resist all external forces and moments. A simulation has been made in Matlab that shows that the proposed algorithm works for objects of different shapes.		A Cascaded Nonlinear Heading Control with Thrust Allocation: An Application on an Underactuated Remotely Operated Vehicle <i>Cheng Siong Chin, Micheal Wai Shing Lau, Eicher Low, Gerald Gim Lee See</i> , Nanyang Technological University, SINGAPORE In this paper, we propose a new pipeline tracking control of an underactuated remotely operated vehicle (ROV) based on a thruster allocation and a nonlinear PD heading control for inner and outer loops respectively. The thruster allocation control without constraint uses the vehicle's velocity feedback to detect the change in thrust required for the thrusters used in ROV's maneuvering. Generalized ROV models for decoupled horizontal and vertical plane motions are derived that based on small roll and pitch angles that are self-stabilizing during operations. When compared with the Proportional-Derivative (PD) controller for all motions, the proposed cascaded controller is proven to render the tracking error dynamic globally k-exponentially stable with a lower control effort needed. ...
11:55 – 12:15		Computing a Network of ASRs using a Mobile Robot Equipped with Sonar Sensors <i>Chee Kit Wong, Wai-Kiang Yeap, Jochen Schmidt</i> , Auckland University of Technology, NEW ZEALAND This paper presents a novel algorithm for computing absolute space representations (ASRs) [1]-[2] for mobile robots equipped with sonar sensors and an odometer. The robot is allowed to wander freely (i.e. without following any fixed path) along the corridors in an office environment from a given start point to an end point. It then wanders from the end point back to the start point. The resulting ASRs computed in both directions are shown.				Distributed Control System for Small-sized RoboCup <i>Jugkree Palakawong Na Aduthaya, Chirot Charitkhuan, Janjai Bhuripanyo</i> , Sripatum University, THAILAND The development of embedded technology has rapidly captured the attention of the sensor manufactures around the world, various sensing devices are being developed with embedded controller which simplify the concept of old style integration into the data communication between controllers. The main controller sends command and retrieves data/status from the slave controllers and acts accordingly, as the result, the software development cycle has decreased drastically. The paper is an example of an effort to implement distributed control concept into a small-sized robocup which in turn simplify the design and allow the designer to easily add more features to the robot.

NOTES



TECHNICAL PROGRAM

Wednesday
7 June 2006

Session 2
13:30 – 15:30

Cybernetics & Intelligent Systems					Wed 7 June 13:30–15:30	
	W2A Bumrang	Intelligent Systems I Chair(s): B John Oommen Chun Che Fung	W2B Rong	Intelligent Transportation Systems Chair(s): Joel W. Burdick Louis S. J. Phee	W2C Charu	Computational Intelligence Chair(s): Guisheng Yin Jirapa Vitayapirak
13:30 – 13:50	Determining Optimal Polling Frequency using a Learning Automata-based Solution to the Fractional Knapsack Problem <i>Ole-Christoffer Granmo, *B. J. Oommen, S. A. Myrer, M. G. Olsen,</i> Agder University College, NORWAY, *Carleton University, CANADA Recent approaches to resource allocation in web monitoring target optimal performance under restricted capacity constraints. The resource allocation problem is generally modelled as a knapsack problem with known deterministic properties. However, for practical purposes the web must often be treated as stochastic and unknown. Unfortunately, estimating unknown knapsack properties (e.g., based on an estimation phase) delays finding an optimal or near-optimal solution. Dynamic environments aggravate this problem further when the optimal solution changes with time. In this paper, we present a novel solution for the nonlinear fractional knapsack problem with a separable and concave criterion function. To render the problem realistic,...		Shadow and Highlight Invariant Colour Segmentation Algorithm for Traffic Signs <i>Hasan Fleyeh,</i> Dalarna University, SWEDEN Shadows and highlights represent a challenge to the computer vision researchers due to a variance in the brightness on the surfaces of the objects under consideration. This paper presents a new colour detection and segmentation algorithm for road signs in which the effect of shadows and highlights are neglected to get better colour segmentation results. Images are taken by a digital camera mounted in a car. The RGB images are converted into HSV colour space and the shadow-highlight invariant method is applied to extract the colours of the road signs under shadow and highlight conditions. The method is tested on hundreds of outdoor images under such light conditions, and it shows high robustness; more than 95% of correct segmentation is achieved.		Sincerity and User Avatar Research based on Binocular Vision in Virtual Reality <i>Guisheng Yin, Dongmei Yang, Qi Wen, Churong Lai, Jie Shen,</i> Harbin Engineering University, CHINA Based the theory of binocular vision, user avatar is constructed dynamically by many pictures with different angles, regulating the view point position adaptively according to the purpose of user interactive operation to receive the accurate sense of distance and direction; Based on the video's modeling of user avatar sincerity and long-distance reappearance in real-time, it is important for the virtual user avatar with the help of interactive museum presence of robot avatar. The realization of real-time visual feedback among users interaction in distributed virtual environment is help to realize the sincere merge between virtual scenes and true scenes and the realization of the interaction between human and computer based on virtual avatar.	
13:50 – 14:10	Development of Soft Sensor for Sensorless Automatic Gantry Crane using RBFN Neural Networks <i>Mahmud Iwan Solihin, Wahyudi Martono, Abdulgani Albagul,</i> International Islamic University Malaysia, MALAYSIA To attain a good control performance of automatic gantry crane system, sensors are indispensable instrument for feedback signals. However, sensing the payload motion of a real gantry crane, particularly swing motion, is not easy and sometimes costly. Therefore, a sensorless automatic gantry crane system is developed and proposed in this paper. A soft sensor based on artificial neural network is introduced to eliminate the real sensor. Instead, a sensor measuring armature current of DC motor driving the cart is used to provide dynamic information for the soft sensor. A simulation study using dynamic model of lab-scale automatic gantry crane is carried out to evaluate the effectiveness of the proposed soft sensor. The results show that the soft		Collaborative Dispatching of Commercial Vehicles <i>Asvin Goel, Volker Gruhn,</i> Universitat Leipzig, GERMANY Collaborative dispatching allows several dispatchers to view the routing solution as a dynamic model where changes to the vehicle routes can be made in real-time. In this paper we discuss implications of collaborative dispatching on real-time decision support tools for motor carriers. We present a collaborative dispatching system which uses real-time information obtained from a telematics system. Messages sent from the vehicles are automatically analysed and actual data, such as exact arrival and departure times, as well as discrepancies between actual and planned data are identified. The collaborative dispatching system not only allows several dispatchers to concurrently modify the schedule, but also a dynamic optimisation method. The optimisation method is capable of taking into...		Computational Approach for Processing of Control Engineer Text: Applications for Corpus Lexicography <i>Jirapa Vitayapirak, Phornsuk Ratiroch-Anant</i> King Mongkut's Institute of Technology, Ladkrabang, THAILAND This research project reflects an increased awareness of the need to improve the flow of information on control engineering technology and the current lack of bilingualized (English-Thai-English) dictionary in this field. The central aim of this project is to develop a corpus of control engineering text. It starts with a survey of users' needs in control engineering English from 3 areas, i.e. control systems, automation and instrumentation, extracted from textbooks and journals. The corpus comprises 2,141,293 words (tokens) of running text. The linguistic data of the corpus provides insights into the sublanguage of control engineering. The corpus was then analysed by concordance program named WordSmith Tools Package to discover the frequency list of individual words, ...	
14:10 – 14:30	An Intelligent SPAM Filter - GetEmail5 <i>Tarek Hassan, Peter Cole, Chun Che Fung,</i> Murdoch University, AUSTRALIA As the increasing reliance on electronic mail (email) continues, unsolicited bulk email (SPAM) also continues to grow because it is a very cheap way for advertising. These unwanted emails are now causing a serious problem in clogging the internet traffic and filling up the email inboxes thereby leaving no space for legitimate emails to pass through. In addition, dealing with SPAM messages is costly to the users as it requires time and effort to examine them individually. In this paper, we propose an intelligent and trainable SPAM filter called GetEmail5. We have also evaluated the proposed filter against two commercial Filters, EmailProtect and SpamEater		A Study on the Performance of Uncooperative Collision Mitigation Systems at Intersection-like Traffic Situations <i>Joerg Hillenbrand, *Kristian Kroschel,</i> DaimlerChrysler AG, GERMANY, *University of Karlsruhe, GERMANY Collision mitigation systems are important driver assistance systems which promise to improve traffic safety in terms of reducing the number of road accidents and accident severity. Increasing research effort has been devoted to these systems within the past few years and first systems have recently been introduced into the market. However, these systems clearly focus on avoiding or mitigating rear-end collisions. This is mainly due to the fact that the use case of cross-traffic requires advanced environmental perception and decision making. In this paper, we investigate the performance of a practical, uncooperative collision mitigation system capable of handling cross-traffic on a variety of intersection-like situations where two vehicles cross each other at different velocities and distances by means of stochastic dynamic simulations..		Evaluation of a Case-based Facial Action Units Recognition Approach <i>Shangfei Wang, Jia Xue, Xufa Wang,</i> University of Science and Technology of China, CHINA In this paper, we evaluate the performance of a case-based automatic facial action units recognition approach using interactive genetic algorithm (IGA). First, the case-based facial action units recognition approach is introduced. This method retrieves the most similar case image from case database using IGA and reuses the action units of the matched case image to the test face image. Second, to evaluate the effectiveness of our approach, comparison experiments with eigenface method on simple test images are done. The experimental results show that, for our method, the average recognition rate is about 77.5% on single AUs and average similarity rate is 82.8% on AU combinations, which are both higher than those of the eigenface method. Third, experiments of the case-based automatic facial action units ...	

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14:30 – 14:50	Intelligent Lighting System using Visible-Light Communication Technology <i>Mitsunori Miki, Emi Asayama, Tomoyuki Hiroyasu</i> , Doshisha University, JAPAN In recent years, various types of equipment have become more intelligent. In this research, we propose an intelligent lighting system using visible-light communication technology for direct communication between lighting fixtures and illuminance sensors in order to provide the necessary illuminance to a desired location. We actually constructed an experiment simulator based on this concept and verified the effectiveness of the newly developed control method. Verification tests were conducted using an optimization algorithm specialized for lighting control, and the results showed that the various illuminance sensors converged to the preset target illuminance in a very short time. We also confirmed that the system can respond adaptively to the movement of illuminance sensors.		A Multi Agent System to Control Complexity in Multi Modal Transport <i>S.Bernaer, *E.Burke, **P. Causmaecker, G.V. Berghe, T.Vermeulen, K.S. Lieven,*Univ. of Nottingham, **Katholieke Universiteit, BELGIUM</i> In this paper we present a multi agent system for communication in the transport sector. It is part of an 'Intelligent Communication Platform for Multi Modal Transport' that is called MamMoeT. The motivation for a communication platform stems from the observed need for support in maintaining evolving partnerships as well as for the establishment of new partnerships. We observed a lack of commonly accepted tools to obtain quantifiable and live information. Examples include the position of freight and vehicles, the expected arrival and waiting times as well as alternative routes and transport modes. We show that a multi agent system is appropriate for practical application. In the transport sector (which is distributed by nature) a system in which each logistic party has a representative autonomous agent matches ...		A Learning Algorithm for Local Linear Neuro-Fuzzy Models with Self-construction through Merge & Split <i>Atiye Sarabi Jamab, *Babak N. Araabi</i> , Malek Ashtar University of Technology, IRAN, *Tehran University, IRAN A self-constructing version of LOcally Lnear MOdel Tree (LOLIMOT) algorithm for structure identification in neuro-fuzzy models is proposed in this paper. LOLIMOT is an incremental tree-construction learning algorithm that partitions the input space by axis-orthogonal splits. In each iteration, LOLIMOT splits a local model into two models in a way that a local classification error is minimized. As a result, during the training procedure some of the formerly made divisions may become suboptimal or even superfluous. In this paper, the LOLIMOT is improved in two ways: (1) the ability to merge previously divided local linear models is added, and (2) a simulated annealing stochastic decision process is responsible to select a local model for splitting. Comparing to the LOLIMOT, our proposed	
14:50 – 15:10	Decoupling Adaptive Fuzzy Sliding-Mode Control with Rule Reduction for Nonlinear Systems <i>Lon-Chen Hung, Hung-Yuan Chung</i> , National Central University, TAIWAN In this paper, adaptive fuzzy sliding-mode controller design approach with decoupling method is proposed. The decoupling method provides a simple way to achieve asymptotic stability for a class of fourth-order nonlinear system. The adaptive fuzzy sliding-mode control system is comprised of fuzzy controller and a compensation controller. The compensation controller is designed to compensate for the difference between the ideal computational controller and the fuzzy controller. Using this approach, the response of system will converge faster than that of previous reports. The simulation results for a ball-beam system presented to demonstrate the effectiveness and robustness of the method.		An Intelligent Model based on Fuzzy Bayesian Networks to Predict Astrocytoma Malignant Degree <i>Chun-Yi Lin, Jun-Xun Yin, Li-Hong Ma, *Jian-Yu Chen</i> South China University of Technology, *SUN Yat-sen Hospital, CHINA A modified fuzzy Bayesian network (FBN) is proposed in this study, which integrates fuzzy logic into Bayesian networks (BN) by using Gaussian mixture models (GMM). The GMM make a fuzzy procedure to do a soft discretization of continuous variables, when dealing with continuous inputs with fuzzy and uncertain nature. Based on the FBN, the fuzzy reasoning model for prediction and diagnosis can be designed. To validate the method, an intelligent model is built and used to classify the astrocytoma malignant degree. Experiment results show that the model achieves an accuracy of 83.33%. It outperforms the Bayesian network-based model using k-nearest neighbor classifiers (K-NN) to make a crisp discretization. This study provides a novel objective method to quantitatively assess the astrocytoma malignant level that can be used to assist doctors to ...		Personal Best Oriented Constriction Type Particle Swarm Optimization <i>C. Huang Chen, *S. Nian Yeh</i> , Tung-Nan Institute of Technology, *National Taiwan University of Science and Technology, TAIWAN In this paper, a new search strategy for constriction type particle swarm optimization is presented. The modification is based on the observation that personal past best experience is helpful for searching optimal result. As a result, instead of moving particle to the vicinity of current position, by letting the particle to explore the proximity of personal best position, a great improvement in computation efficiency and quality is achieved. The results are verified through testing on benchmark functions. The advantage of this new scheme is that no extra mathematic operation is introduced compared to those modifications proposed in literature.	
15:10 – 15:30	Modelling of Thermal Power Plant using Full Factorial Design Based ANFIS <i>Mrinal Buragohain, Chitralkha Mahanta</i> , Indian Institute of Technology, Guwahati, INDIA Adaptive network based fuzzy inference system (ANFIS) is an intelligent neuro-fuzzy technique used for modelling and controlling ill-defined and uncertain systems. ANFIS is based on the input-output data pairs of the system under consideration. The size of the input-output data set is very crucial when the data available is very less and the generation of data is a costly affair. Under such circumstances, optimization in the number of data used for learning is of prime concern. In this paper we have proposed an ANFIS based system modeling where the number of data pairs employed for training is minimized by application of an engineering statistical technique called Full Factorial Design. Our proposed method is experimentally validated by applying it to the data obtained from the thermal power plant of North ...		Fuzzy CBR based on Pattern Recognition and its Application <i>Quanming Zhao, Lingling Li, Zhigang Li, Jiannan Wang, Fengguo Liu</i> Hebei University of Technology, CHINA Case-based reasoning (CBR) has been widely applied in expert systems. This method can find out the solution of the problem to be solved in terms of the former experience by analyzing the similarity of information between the problem to be solved and the existing cases. However, among the information from the problem, some data are fuzzy. In order to find out the similar cases successfully, a method of fuzzy CBR based on pattern recognition is presented in this paper. According to this method, all the relative existing cases in the case database are fuzzed and each can be regarded as typical pattern. And then a new general closeness degree algorithm was constructed to deal with general and fuzzy data by combining two kinds of closeness degree algorithm and is used as the similarity degree function between the cases and the problem ...		Learning Ensemble Performance for String Quartet by Practice <i>Satoru Morita, Sayaka Tokunou</i> , Yamaguchi University, JAPAN We introduce the ensemble practice of the string quartet. The music performance is studied recently, and most of the research aims at a computer and a human being playing together so far. On the other hand, the purpose of our research is to simulate the process that progress is made in the performance in accordance with the practice. Generally a player acquires performance through the practice. But, the research of simulating performance practice does not exist. We simulate the process that progress is made in the performance by the ensemble practice. Reinforcement learning is used for by this research. In the simulation, individual practice and ensemble practice are done by using 'Kanon' composed by Pachelbel. The player's performance is getting better by the practice, and each player modifies the ...	

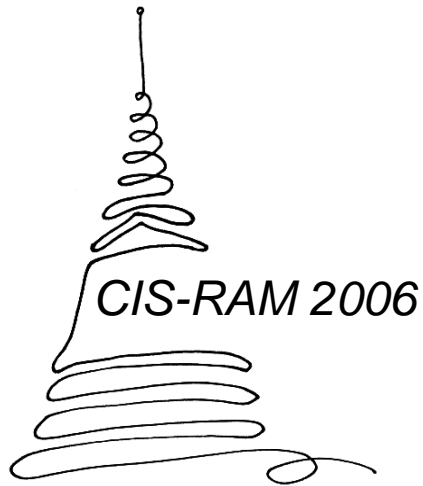
Robotics, Automation & Mechatronics

Wed 7 June 13:30–15:30

	W2D Chroen Dynamics and Control I Chair(s): Jing-Sin Liu Surasak Munsing	W2E Charas I Wheeled, Legged and Underwater Robots II Chair(s): Sangyoon Lee Atsushi Fujimori	W2F Charas II Modeling, Planning, & Control I Chair(s): Byoung-Ho Kim Wei Tech Ang
13:30 – 13:50	Inversion-Based Nonlinear End-Tip Control of Flexible Arm in Presence of Large Model Uncertainties <i>Ehsan Soltani, Mahyar Naraghi</i> , Amirkabir University of Technology, IRAN Achieving suitable performance in end-tip trajectory tracking while saving suitable margin of stability for flexible-arm system in presence of large model uncertainties is a very complicated task, because moving new output toward the end-tip, while using output-redefinition method, in order to increase tracking quality decreases system's margin of stability. So large model uncertainties or large controller gains causes the system to leave the local region of stable internal dynamics. In this paper, power limiter system (PLS) is combined with time-delay controller (TDC) to guarantee stability of system in presence of large unstructured model uncertainties. The proposed controller is also compared with indirect adaptive linearizing controller.	Design of Hierarchical Fuzzy Logic Control for Mobile Robot System <i>Lon-Chen Hung, Hung-Yuan Chung</i> , National Central University, TAIWAN This paper studies the problem of motion and control law design for a mobile robot that moves inside a partially unknown environment, under the assumption of parametric uncertainty in the model that describes the motion of the robot. This paper deals with a fuzzy-based intelligent mobile robotic system by hierarchical structure that requires various capabilities normally associated with intelligence. The proposed method is applied for a path planning problem of a mobile robot; the effectiveness of the method is illustrated through some experiment.	Implementation of Novel Maximum-Power-Extraction Algorithm for PMSG Wind Generation System without Mechanical Sensors <i>Rong-Jong Wai, Chung-You Lin</i> , Yuan Ze University, TAIWAN This study focuses on the implementation of a novel maximum-power-extraction algorithm (MPEA) including a maximum-power error driven (MPED) mechanism and a maximum-power differential speed (MPDS) control for a wind generation system with a permanent-magnet synchronous generator (PMSG). In the proposed MPEA scheme, the MPED mechanism operating like a traditional hill-climbing method drives the output power gradually increasing to its maximum value by regulating the direction of voltage command according to the power variation trend. Moreover, the MPDS control produces an additional step of voltage command based on the instantaneous difference of generator speeds so that it can prevent the wind turbine from stalling at the suddenly dropping wind speed and achieve the object of maximum power ...
13:50 – 14:10	On the Position/Force Control of Robot Manipulators with Model Uncertainty and Random Disturbances <i>H. Wang, K. H. Low, *M. Y. Wang</i> , Nanyang Technological Univ., S'PORE, *The Chinese Univ. of Hong Kong, HONG KONG S.A.R. This paper first investigates the force tracking performance by impedance control subjecting to model uncertainties and random external disturbances. A simple joint impedance/direct control structure is then proposed. The resulted controller has higher robustness to the environment and model uncertainties, and external disturbances. Furthermore, it does not require to switch the control modes for all task executions. Therefore, the proposed control structure combines the advantages of both the hybrid position/force control and the impedance control. Computer simulations are performed to verify the analysis of the impedance control and the effectiveness of the proposed control structure.	A Cockroach-Inspired Hexapod Robot Actuated by LIPCA <i>Abdul A Yumaryanto, Jaebum An, Sangyoon Lee</i> , Konkuk University, KOREA In this paper we present the design and prototype of a six-legged walking robot which uses Lightweight Piezoceramic Composite curved Actuator (LIPCA) as its actuator. LIPCA consists of multiple layers of glass/epoxy and carbon/epoxy that encapsulate a unimorph piezoelectric ceramic actuator. It uses lightweight fiber-reinforced plastic layers, and it is a lighter structure and generates a higher force and a larger displacement than other conventional piezo-composite type actuators. Like most six-legged walking insects including cockroaches, our robot uses the alternating tripod gait where the front and rear legs on the same side move together with the middle leg on the other side for its locomotion. Two LIPCA strips in different phases are used for actuating each tripod so that only one tripod may touch the ground. ...	Torque Ripples Minimization in PMSM using Variable Step-Size Normalized Iterative Learning Control <i>Jong Pil Yun, Chang Woo Lee, Sung-Hoo Choi, Sang Woo Kim</i> , Pohang University of Science and Technology, KOREA Periodic torque ripples exist due to non-perfect sinusoidal flux distribution, cogging torque and current measurement errors in permanent magnet synchronous motor (PMSM). These ripples are reflected as periodic oscillations in the motor speed and deteriorate the performance of application of PMSM as a high-precision tracking applications. In this paper, we propose a variable step-size normalized iterative learning control (VSS-NILC) scheme to reduce periodic torque ripples. VSS-NILC is combined to existing PI current controller and generates compensated reference current iteratively from cycle to cycle so as to minimize the mean square torque error. VSS-NILC scheme alter the step-size of the update equation to reduce the conflict between speed of convergence and minimum mean square error (MSE). Consequently ...
14:10 – 14:30	Reference Trajectory Generation for Force Tracking Impedance Control by using Neural Network-based Environment Estimation <i>H. Wang, K. H. Low, *M. Y. Wang</i> , Nanyang Technological Univ., S'PORE, *The Chinese Univ. of Hong Kong, HONG KONG S.A.R. This paper presents a reference trajectory generation approach for impedance control by using neural networks to estimate the environment dynamics. In this method, the environment dynamics is estimated by a neural network (NN1), which constructs the relationship between the environment deformation and its first and second derivatives, and the interaction force. Another network (NN2) is then used to approximate the statics of the environment, which is the relationship between the interaction force and the deformation. The major advantage of the proposed method is that no exact environment model is required, so that it suites for operations on any unstructured environments. Furthermore, the neural networks ...	A Real Time Control Method for Humanoid Robot to Walk Stably on Uneven Ground <i>Mei Shuai, *Chenglong Fu, **Ken Chen</i> , Beijing University, CHINA, *Tsinghua University, CHINA, **Tsinghua University, CHINA To solve the problem that a humanoid robot is prone to tip over while walking on uneven ground, this paper presents an online regulating control algorithm based on the Kane collision theory. The algorithm, which introduces a new physical quantity named "generalized speed", can reduce second-order differential equation to first-order ordinary differential equation, and shorten the time of calculation. We adopt the offline gait pattern generated by Lagrange dynamic model to control the humanoid walking on level ground. When the robot lands on uneven ground surfaces, we first calculate the foot impact force using the Kane regulating algorithm and then use this information to adjust the gait of the legs and the torso in order to ensure a stable walk on the uneven ground. ...	A Bio-Mimetic Inter-Articular Coordination Model for Humanoid Grasplings <i>Byoung-Ho Kim</i> , Kyungshung University, KOREA Analyzing the motion behavior of human fingers is a very important aspect to modulate a human-like motion of humanoid fingers handling an object. Based on this concept, this paper analyzes the joint trajectories of human fingers for an operation of hand opening and closing, and identifies an empirical relationship that coordinates the inter-joint actuation of human fingers doing the motion. For the application of its feature to robotic fingers, a suitable model that is possible to prescribe a relative joint motion of humanoid fingers is also suggested. It is expected that the proposed inter-articular coordination model is applicable for humanoid fingers to implement various natural human-like grasplings.

Robotics, Automation & Mechatronics					Wed 7 June 13:30–15:30	
	W2D Chair(s): Chroen	Dynamics and Control I Jing-Sin Liu Surasak Munsing	W2E Chair(s): Charas I	Wheeled, Legged and Underwater Robots II Sangyoon Lee Atsushi Fujimori	W2F Chair(s): Charas II	Modeling, Planning, & Control I Byoung-Ho Kim Wei Tech Ang
14:30 – 14:50	Exact Collision Detection of Scaled Convex Polyhedral Objects with Inner Ellipsoidal Bounds <i>Jing-Sin Liu, Academia Sinica, TAIWAN</i> For collision detection between identically scaled convex polyhedral objects (i.e. objects deformed with shape unchanged but size changed), we have presented an accuracy-tunable collision detector based on inner-outer ellipsoidal deformation bounds [5]. This paper explores further the possibility of exact collision detection based only on approximate closest points, in which a special design of exact collision detector tailored to identically scaled convex polyhedral objects is detailed. The collision detector is parametric distance difference in the direction of shortest path between inner ellipsoids, which measures how far the current configuration from the configuration of objects assumed touching each other externally without overlapping.		Formatted Navigation of Mobile Robots with Obstacle Avoidance <i>Atsushi Fujimori, Tomoya Saito, *Gabor Bohacs, Shizuoka University, JAPAN, *Budapest University of Technology, HUNGARY</i> This paper presents a formatted navigation with obstacle avoidance in which a modified leader-follower technique is combined with reactive collision avoidance behaviors. This paper indicates a couple of problems in which the obstacle avoidance is embedded in formatted navigation: one is the singularity of the leader robot on the tracking control and another is the avoidance behavior of the follower robot. This paper proposes techniques for solving them and demonstrates the effectiveness in simulation and experiment.		Strategy for the Control of a Double-Stage Nano-positioning System with a Single Metrology <i>Yvan Michellod, Philippe Mullhaupt, Denis Gillet, Ecole Polytechnique Federale de Lausanne, SWITZERLAND</i> A double-stage feedback control structure for a double-stage mechanical system, with a single optical metrology is developed to reach nanometer accuracy at high bandwidth over large displacements. A piezoelectric stack actuator is used for fine positioning, while a permanent magnet (PM) stepper motor handles the coarse positioning. Two different control approaches are compared for driving the PM stepper motor, while a classical PID controller is designed to drive the piezoelectric actuator. Since only a single measurement device is used, the references for both control loops (fine and coarse) must be appropriately obtained. An adequate control structure including a partial observer is designed so as to take into account the influence of the fine actuator on the position estimation of the coarse actuator. The complete ...	
14:50– 15:10	Discrete Time Multi-Channel Learning Controller <i>Y. Q. Ye, D. W. Wang, X. C. Wang, Nanyang Technological University, SINGAPORE</i> In this paper, a discrete time multi-channel learning controller is proposed. This multi-channel method aims to extend the learnable frequency band of a learning control system and thus improve the learning performance. In each channel, a simple learning controller is used. More channels with such imple learning controllers produce wider learnable band. Two illustrative design approaches are demonstrated via an example of robot joint control. Experimental results verify the effectiveness of the multi-channel approach and the discrete time control design.		Proving Asymptotic Stability of Dynamic Walking for a Five-Link Biped Robot with Feet <i>Chenglong Fu, *Mei Shuai, **Ken Chen, Tsinghua University, CHINA, *Beijing University, CHINA, **Tsinghua University, CHINA</i> During the dynamic walking of biped robots, the underactuated rotating DOF emerges between the support foot and the ground. This makes the biped model hybrid and dimension-variant. In this paper, we present the definition of orbit stability for dimension-variant hybrid systems (DVHS). Based on the work of Grizzle et al. (2001), we generalize Poincare theorem to a class of DVHS, and this result is then used to study asymptotically stable dynamic walking for a five-link planar biped robot with flat feet. Time-invariant gait planning and nonlinear control strategy, which is organized around the hybrid zero dynamics of Westervelt et al. (2003), is also introduced to realize dynamic walking with feet. Simulation results indicate that an asymptotically stable limit cycle of dynamic walking is achieved, and the effectiveness ...		An Efficient Path Planner for Large Mobile Platforms in Cluttered Environments <i>Tarek Taha, *Jaime Valls Miro, Dikai Liu, University of Technology, Sydney, AUSTRALIA, *Centre for Autonomous Systems, AUSTRALIA</i> This paper presents a one step smooth and efficient path planning algorithm for navigating a large robotic platform in known cluttered environments. The proposed strategy, based on the generation of a novel search space, relies on non-uniform density sampling of the free areas to direct the computational resources to troubled and difficult regions, such as narrow passages, leaving the larger open spaces sparsely populated. A smoothing penalty is also associated to the nodes to encourage the generation of gentle paths along the middle of the empty spaces. Collision detection is carried out off-line during the creation of the configuration space to speed up the actual search for the path, which is done on-line. Results prove that the proposed approach considerably reduces the search space in a meaningful and practical manner, improving ...	
15:10– 15:30			Experimental Study for FIBO Humanoid Robot <i>Hataitep Wongsuwarn, Djitt Laowattana, King Mongkut's University of Technology, Thonburi, THAILAND</i> This paper presents the progress of the FIBO Humanoid Robot (FHR-1) called "Somjuk". The project, involved four years, is aimed at the realization of the lower part of an anthropomorphic humanoid robot. The robot included two legs, two feet ad a trunk. This paper describes the mechanism, controller architecture, foot force torque sensor and walking strategy of the developed biped robot. An experimental result shows that the robot is capable of keeping its ZMP at its stabilized region in spite of suppressing the inherent vibration due to a mechan ical structure and also impact force during contacting ground floor.		Replanning of Multiple Autonomous Vehicles in Material Handling <i>Gavin Paul, Dikai Liu, University of Technology, Sydney, AUSTRALIA</i> The fully automated docks in Australia present opportunities for applications of autonomous vehicles and engineering innovation. When planning tasks to be done by multi-autonomous vehicles in an enclosed area with a known dynamic map (i.e. bi-directional path network), there are many issues that have not yet been comprehensively solved. The real world presents more complexity than the initial algorithms addressed. There are problems that occur due to interaction with the real-world. This means autonomous vehicles can stop, are affected, or face problems, and hence tasks and vehicles' paths and motion need to be replanned. In order to replan, a greater understanding of the state of vehicles, the state of the map, and importantly the importance of tasks and vehicles is definitely needed. This paper explores the improvements made ...	

NOTES



TECHNICAL PROGRAM

Wednesday
7 June 2006

Session 3
16:00 – 18:00

Cybernetics & Intelligent Systems

Wed 7 June 16:00–18:00

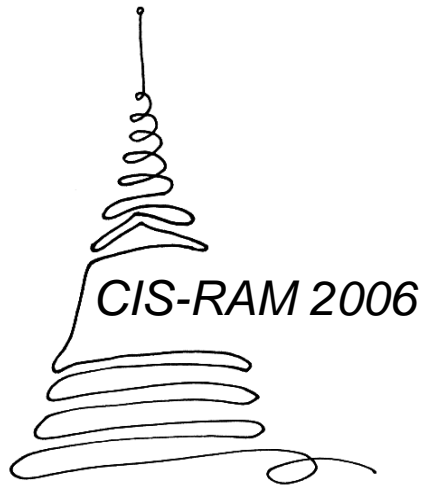
	W3A Bumrang	Intelligent Systems II Chair(s): Joel W. Burdick Dikai Liu	W3B Rong	Image Processing I Chair(s): Andries P Engelbrecht Ching Seong Tan	W3C Charu	Control and Manufacturing Systems Chair(s): Zengqi Sun Oliver Sawodny
16:00 – 16:20	OWL/XDD: A Formal Language for Application Profiles <i>P. Ratanajaipan, *E.Nantajeewarawat, **V. Wuwongse</i> , Shinawatra University, *Thammasat University, **AIT, THAILAND <p>An application profile specifies a set of terms, drawn from one or more standard namespaces, for annotation of data, and constrains their usage and interpretations in a particular local application. An approach to defining an application profile using the OWL and OWL/XDD languages is proposed—the former is a standard Web ontology language and the latter is a definite-clause-style knowledge representation language that uses XML expressions as their underlying data structure. Constraints are defined in terms of rules, which are represented as XDD clauses. As an illustration, application of the approach to defining Dublin Core Metadata Initiative's library application profile (DC-Lib), along with the possibility of extending it by describing finer-grained semantic constraints, is demonstrated. A prototype catalog validation system has been</p>		Nonlinear Diffusion Driven by Local Features for Image Denoising <i>Peng Liu, Yan Zhang, Zhigang Mao</i> , Harbin Institute of Technology, CHINA <p>We propose a nonlinear diffusion algorithm that takes into account the local features in an extended neighborhood for the image denoising. In the conventional linear or nonlinear diffusion algorithms, the change of intensity value of a pixel is considered only in a small neighborhood, and the relationship between pixels in larger region is neglected. Our proposed algorithm overcomes this limitation. Moreover, it is not simply generalization of the conventional diffusion algorithms. In order to remove the noise, simultaneously, preserve edges in an image, the local central moment in an extended neighborhood is extracted, and the appropriate diffusion coefficient is established, such that the diffusion speed is properly controlled according to the characteristic of each image local region. The divergence of the new ...</p>		Multi-layer Control Strategy of Dynamics Control System of Vehicle <i>Huiyi Wang, Jian Song</i> , Tsinghua University, CHINA <p>Dynamics Control System (DSC) is a new active safety chassis system for the vehicle. It enhances the safety of vehicle, especially when the driver turns the steering wheel rapidly to avoid an obstacle, or drives the car go through a turn road in a high speed, for example, driving a car in high way. A DSC system was designed for an experimental 1.8T Brilliance passenger car firstly. A 2-layer control strategy of DSC was designed and evaluated. The 1st layer control module monitored the attitude of the vehicle and the 2nd layer module monitored the situation of the 4 separate wheels, the thresholds triggered the control action by the calculated parameters. Hardware-in-the-loop simulation showed that the DSC designed helped the vehicle to succeed the maneuver of fishhook successfully.</p>	
16:20 – 16:40	New Concepts for the Identification of Dynamic Takagi-Sugeno Fuzzy Models <i>Christoph Hametner, Stefan Jakubek</i> , TU Vienna, AUSTRIA <p>Takagi-Sugeno Fuzzy Models have proved to be a powerful tool for the identification of nonlinear dynamic systems. Recent publications have addressed the problems of local versus global accuracy and the identifiability and interpretability of local models as true linearisations. The latter issue particularly concerns off-equilibrium models. Well-established solution approaches involve techniques like regularisation and multi-objective optimisation. In view of a practical application of these models by inexperienced users this paper addresses the following issues: 1. Unbiased estimation of local model parameters in the presence of input- and output noise. At the same time the dominance of the trend term in off-equilibrium models is balanced. 2. The concept of stationary constraints is introduced. ...</p>		Measuring Linearity of a Finite Set of Points <i>Milos Stojmenovic, Amiya Nayak, *Jovisa Zunic</i> , University of Ottawa, CANADA, *University of Exeter, CANADA <p>It is often useful to measure how linear a certain set of points is. Our goal is to design algorithms that give a linearity measurement in the interval [0, 1]. There is no explicit discussion on linearity in literature, although some existing shape measures may be adapted. We are interested in linearity measures which are invariant to rotation, scaling, and translation. These linearity measures should also be calculated very quickly and be resistant to protrusions in the data set. The measures of eccentricity and contour smoothness were adapted from literature, the other five being triangle heights, triangle perimeters, rotation correlation, average orientations, and ellipse axis ratio. The algorithms are tested on 30 sample curves and the results are compared against the linear classifications of these curves by human subjects. It is found that humans ...</p>		Adaptive Inverse Control under (h,ö)- Entropy Criterion <i>Badong Chen, Jinchun Hu, Hongbo Li, Zengqi Sun</i> , Tsinghua University, CHINA <p>Recent research suggested that the error entropy (EE) criteria could be used to achieve a better error distribution in estimation, adaptation and learning. In this paper, we formulate the adaptive inverse control under a generalized error entropy criterion, i.e. (h,ö)-entropy criterion, and derive the associated error-entropy minimization algorithm. Several detailed schemes of adaptive filtering and inverse control under (h,ö)-entropy criterion are also presented. Finally, a simple simulation example has illustrated the effectiveness and advantages of this new method.</p>	
16:40 – 17:00	Multi-Agent Instructional Resource Planning <i>Umashankar N., Karthik V. N.</i> , King Mongkut's Institute of Technology, North Bangkok, THAILAND <p>This paper studies the research in the area of multi-agent, instructional resource planning and enterprise eLearning management system, which resulted in the development of the II-RPS. This paper also introduces how a multi-agent instructional resource planning process can be modeled, constructed, explored and explained. It is not only to promote the automatic learning process through a systematic framework of instructional resource planning, but also to increase the performance of courseware production and to highly benefit the pioneer who uses this approach.</p>		Fractal Color Image Compression on a Pseudo Spiral Architecture <i>Nileshsingh Thakur, *O. G. Kakde.</i> , Shri Ramdeobaba Kamla Nehru Engineering College, INDIA, *Nagpur University, INDIA <p>This paper presents a new approach for fractal color image compression on Pseudo Spiral Architecture. Fractal coding is a relatively recent method for still-image compression. However, fractal coding is used for gray level images through rectangular domain and range blocks. Although new approaches have been proposed that compress gray level and color images. The proposed approach, firstly, determine the pixel's trichromatic coefficients within the homogeneous blocks formed by hierarchical partitioning method. Then, each block is represented by its mean value of the pixel's trichromatic coefficient ratios, and just a one-plane image is composed. One-plane image in traditional square structure is represented in Pseudo Spiral Architecture for compression. ...</p>		A Study of Distributed Scheduling Problem with Machine Maintenance <i>Felix T S Chan, S H Chung, L Y Chan</i> , The University of Hong Kong, HONG KONG S.A.R. <p>In this paper, we study the influence of machine maintenance to distributed scheduling problems. Distributed scheduling is aiming to maximize the system efficiency by simultaneously solving two problems: (i) allocation of jobs to suitable factories, and (ii) determination of the corresponding production scheduling in each factory. Scheduling of machine maintenance problems aim to reduce the effect of breakdown and maximize the facility availability at minimum cost. However, in many distributed scheduling problems, machine scheduling assumes that machines are available all the time. In fact, every machine requires maintenance, and the maintenance policy directly affects the machine's availability. Consequently, it interrupts the production scheduling ...</p>	

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	W3A Bumrang	Intelligent Systems II Chair(s): Dikai Liu	W3B Rong	Image Processing I Chair(s): Andries P Engelbrecht Ching Seong Tan	W3C Charu	Control and Manufacturing Systems Chair(s): Zengqi Sun Oliver Sawodny
17:00 – 17:20	Use of Key Performance Indicators in Production Management <i>Vladimir Jovan, Sebastjan Zorzut, Jozef Stefan Institute, SLOVENIA</i> Improving production performance requires the definition of global production objectives with a proper implementation strategy and suitable closed-loop control for their achievement. Closed-loop control structures for simple systems like temperature or velocity control are well defined, but a synthesis of plant-wide control structures is still recognised as the most crucial production management design problem in process industries. One vital issue to be resolved is how to translate implicit operating objectives, such as the minimisation of production costs into a set of measurable variables that can be then used in a feedback-control. A promising solution is the use of the Key Performance Indicator (KPI) approach. To verify the idea of production feedback control using production KPIs as referenced controlled variables...		A Novel Lossless Image Compression Algorithm using Arithmetic Modulo Operation <i>Sunil Pattanaik, K. K. Mahapatra, Ganapati Panda, National Institute of Technology, Rourkela, INDIA</i> Based on some simple arithmetic calculation, an efficient Lossless Image Compression technique is proposed. This technique is designed for high quality still image compression, especially PSNR value above 34. This algorithm is most applicable for those images where lossy compression is avoided such as medical and scientific images. The encoding and decoding procedure is very fast.		A Hybrid Discrete Particle Swarm Optimization Algorithm to Solve Flow Shop Scheduling Problems <i>Chandrasekaran S, Ponnambalam SG, Suresh RK, N Vijayakumar, R. Vidyalaya, ASE, ACERV, INDIA, Monash University, MALAYSIA</i> This paper presents a method of applying Particle Swarm Optimization (PSO) algorithm to a flow shop scheduling problem. Permutation encoding of job indices is used to represent particles. One particle of the initial swarm is generated using NEH heuristic and the remaining particles are generated randomly. A continuous swap mechanism is used to improve the performance of the discrete particle swarm optimization (DPSO) algorithm. Performance of the proposed algorithm is evaluated using the benchmark flow shop scheduling problems given by Taillard [1993]. The computational results show that the hybrid approach is more effective	
	Motion Coordination of Multiple Autonomous Vehicles in Dynamic and Strictly Constrained Environments <i>Dikai Liu, Xianghua Wu, Asela K. Kulatunga, Gamini Dissanayake, University of Technology, Sydney, AUSTRALIA</i> With the increasing applications of fully autonomous vehicles, efficient motion coordination of multi-autonomous vehicles becomes a very important problem as it significantly affects the productivity. This problem is even harder to solve with the increases of the number of autonomous vehicles employed in a dynamic changing environment and constraints to vehicle movement. This paper presents a simultaneous path and motion planning (SiPaMoP) approach to coordinate motions of multi-autonomous vehicles in dynamic and strictly constrained environments. This approach integrates the path planning, collision avoidance and motion planning into a comprehensive model, which has so far not attracted a lot of attention in the academic literature, and optimizes vehicles' path and speed to minimize the completion time of a set...		An Intelligent Restoration Method for Impulse Noise Highly-Corrupted Images <i>Thou-Ho (Chao-Ho) Chen, Chao-Yu Chen, Tsong-Yi Chen, *Ming-Kun Wu, National Kaohsiung University of Applied Science, TAIWAN</i> The paper is dedicated to the restoration of impulse noise highly-corrupted images by exploiting the characteristics of the local similarity and connectivity existed in most real-world images. The basic strategy of the proposed method is firstly to detect a noisy pixel and then restores the corrupted pixel, by the local features of similarity and connectivity in an image. A decision rule based on the number of similar and connective pixels, followed by a line-judgement procedure, is used to determine if it is a noise. A simple local-connectivity (decision-based median) filter based on the noise density level is designed to restore the noisy pixel. Experimental results show that the proposed noise reduction method can remove impulse noise better than other methods in highly corrupted images of noise ratio more than 15%.		Design and Implementation of Fuzzy Supervisory Controllers using Fuzzy c-Means Clustering Combined with Fuzzy Gain... <i>Kannawat Somsung, *Suvalai Pratishtananda, Nakornthai Strip Mill plc., THAILAND, *Chulalongkorn University, THAILAND</i> In this paper, fuzzy supervisory PI controllers are developed and implemented on a pilot plant binary distillation column. Fuzzy c-means clustering technique is used in selecting membership functions and fuzzy rules are determined using fuzzy gain scheduling technique. Thus, the need of heuristic method for designing fuzzy membership functions and rules from expert knowledge is omitted. Then, the fuzzy supervisors adapt the parameters of the PI controllers on line. The task of the controllers is to perform dual composition control of the top and bottom products when the disturbances enter the column in the form of changes in feed flow rate. The results show that the fuzzy supervisory PI controllers achieve much better performance than the fixed PI controllers.	
17:40 – 18:00	Predictive Control of an Electromagnetic Suspension System via Modified Locally Linear Model Tree with Merging Ability <i>Atiye Sarabi Jamab, Iman Mohammadzaman, Malek Ashtar University of Technology, IRAN</i> A predictive control algorithm based on modified locally linear model tree (LOLIMOT) with merging is implemented to control of an electromagnetic suspension system. A self-construction LOLIMOT is used to predict the response of the plant in a future time interval. This modified algorithm could improve the accuracy with reduced computational times and fewer rules which is important in real-time input optimization. An evolutionary programming (EP) is used to determine the optimized control variables for a finite future time interval. This method is applied to an Electromagnetic Suspension system (EMS) and simulation results show the effectiveness of the proposed predictive control strategy.		An Intelligent Surveillance System based on an Omnidirectional Vision Sensor <i>Ming-Liang Wang, Chi-Chang Huang, Huei-Yung Lin, National Chung Cheng University, TAIWAN</i> Video surveillance, object tracking and activity monitoring are some of the important issues for a home-care robotic system. In this work, an omnidirectional video camera is adopted to provide a 360 degree view angle of the indoor scene in a single image. Some basic functions for smart living and elderly care, such as motion detection, object tracking and target behavior analysis, are implemented. For the motion detection, a background model is first created and the CamShift algorithm is used for object tracking by extracting color information of the target. To make the motion detection and object tracking fully automatic and robust under different illumination conditions, an optical flow approach is cooperated to detect small changes of the mobile object. In addition, the camera is calibrated to obtain the one-to...		Evolutionary Fuzzy Logic Controller Schemes Suitable for the Simple Automatic Design <i>Kidchop Waiyasuri, Prabhas Chongstitvatana, Chulalongkorn University, THAILAND</i> This paper proposes three styles of the Evolutionary Fuzzy Logic Controller (EFLC) scheme, which are adapted from the Genetic-based Fuzzy Logic Controller (GFLC) proposed in [1]. The main idea of EFLC is the simple 4th order polynomial equation usages for input-output relationship calculations instead of fixed-membership function calculation style in the original GFLC. Although the usage of polynomial equations makes the proposed EFLC to have more parameters than the GFLC, the EFLC has more flexible adaptation/tuning capability and can be adapted to other applications, such as the fuzzy modeling problem. In addition, the proposed scheme still be suitable for simple automatic parameter tuning techniques, such as (1+1)-ES, and have low computation burden. The performance of the proposed scheme ...	

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	W3D Chroen	Kinematics, Mechanics & Mechanism Design Chair(s): Grigore Gogu Marco Ceccarelli	W3E Charas I	Methodologies for Robotics and Automation Chair(s): Jianwei Zhang Taming Shih	W3F Charas II	Fault Diagnosis Chair(s): Shaoping Wang Louis S. J. Phee
16:00 – 16:20	Devel. of a Robotic Carotid Blood Flow Measurement Sys. - A Compact US Probe Manipulator Consisting of a // Mechanism <i>YSadamitsu, AFujita, CARino, *AHarada, ATakanishi, **MSugawara, **KNiki, Waseda U., *Aloka Co., Ltd., **Tokyo Women's Med. U., Japan</i> <p>We developed a robot system for the wave intensity measurement of carotid blood flow using ultrasonic diagnostic equipment in order to reduce the inconvenience for the patient and doctor. The robot system has an ultrasonic probe manipulator consisting of a 6-DOF linear parallel link mechanism. There are two control modes for the robotic measurements: direct positioning by hand using virtual compliance control and remote control by using a 6-axis force/torque sensor. We confirmed that the probe manipulator works effectively to measure the blood flow by experiments using human subjects.</p>		Mechatronic Design Quotient Approach in Beam Vibration Suppression Design using Linear Dampers <i>J. Sun, A N Poo, G S Hong, C M Chew, *C W De Silva, National Univ. of Singapore, SINGAPORE, *Univ. of British Columbia, CANADA</i> <p>In using linear dampers for the vibration suppression of flexible structures, their mounting locations and the damping coefficients have to be chosen properly. In this paper, an approach based on the mechatronic design quotient (MDQ) is presented for the optimal design of linear dampers in the vibration control of flexible beams. This approach strives to make the optimal concurrent design of the dampers achieve the performance of an optimal sequential design of uncoupled subsystems as closely as possible. The MDQ approach provides a practical way to evaluate the performance of multi-criteria design. It also provides an insight into the performance degradation of various subsystems due to the dynamic coupling effects in the overall system. ...</p>		Fault Tolerant Control System in Critical Process based on Ethernet Network <i>Vittaya Tipsuwanporn, Jatuporn Rodkamtui, King Mongkut's Institute of Technology, Ladkrabang, THAILAND</i> <p>The purpose of this paper is to study and develop the redundant control system for the critical process. The critical process means a high priority process which is very essential to the global system. When a fault condition occurs on such process, it affects to other processes. In this paper, the gas pressure process is used as a case study. This system consists of dual redundant supervisory control system (HMI Station), dual redundant Ethernet network, triple redundant controller system and triple redundant filed signal. The experimental result is able to indicate some fault tolerance features. Our system can increase the reliability as well as the risk of fault of a whole system and apply to any high priority process appropriately.</p>	
16:20 – 16:40	An Incremental Method for Forward Kinematics of Parallel Manipulators <i>Yunfeng Wang, The College of New Jersey, UNITED STATES</i> <p>This paper presents a simple numerical method for forward kinematics of a general 6-DOF parallel manipulators, which can generate a unique solution directly. This method utilizes the trivial nature of the inverse kinematics of parallel manipulators, and derives a straightforward linear relationship between the small change of joint variables (leg lengths) and the resulting small motion of the platform. The solution to the forward kinematics is then achieved through a series of small changes in joint variables. Numerical examples validate and confirm the efficiency of the method.</p>		Tracing Manipulation by Robot Grippers Equipped with Gear Tips <i>Khairul Salleh, Hiroaki Seki, Yoshitsugu Kamiya, Masatoshi Hikizu Kanazawa University, JAPAN</i> <p>Edge tracing is considered important for deformable object manipulation in order to reveal the original shape of the object, for example during pattern recognition. This paper proposes a unique tracing method for towel spreading which is a deformable object using two robot arms with sensors equipped grippers and a fixed CCD camera. Development of special tools for deformable object manipulation is also considered to be important as well and must consider the properties of the deformable objects. This paper also proposes the development of a unique pair of grippers with gear at the tips for fabric manipulation purposes. The new gripper will allow more flexibility towards fabric manipulation.</p>		Research on Workflow Patterns based on Petri Nets <i>Liang Zhang, Beihang University, CHINA</i> <p>Workflow patterns systematically address workflow requirements, from basic to complex. Some complicated patterns of it were not supported directly by existing workflow management systems and workflow languages. Petri nets perform better when it comes to state-based workflow patterns. However, some patterns are also not easy to map onto Petri nets. This inspired us to develop a new extended workflow net (EWF_net) based on Petri nets for formalizing workflow patterns. EWF_net extended WorkFlow net (WF_net) by adding some mechanisms. EWF_net improved the power of describing dynamic workflow model of WF_net. Control variable was introduced in EWF_net for describing the relevant data of workflow model. In EWF_net, a special transition was introduced for supporting dynamic ...</p>	
16:40 – 17:00	Fully-isotropic T3R2-type Parallel Robotic Manipulators <i>Grigore Gogu, French Institute of Advanced Mechanics, FRANCE</i> <p>The paper presents a special family of fully-isotropic T3R2-type parallel robotic manipulators (PMs) with five degrees of freedom called Isoglide5-T3R2-D. The mobile platform has three independent translations (T3) and two rotations (R2). A one-to-one correspondence exists between the actuated joint velocity space and the external velocity space of the moving platform. The Jacobian matrix mapping the two vector spaces of fully-isotropic T3R2-type PMs presented in this paper is the 5×5 identity matrix throughout the entire workspace. The condition number and the determinant of the Jacobian matrix being equal to one, the manipulator performs very well with regard to force and motion transmission capabilities</p>		Control Hierarchy Realization and Cleaning Trajectory Evaluation of a Wall Cleaning Robot <i>Houxiang Zhang, *Wei Wang, Jianwei Zhang, *Guanghua Zong, Uni-Hamburg, GERMANY, *Beihang University, CHINA</i> <p>Aimed at cleaning the curved glass wall of Shanghai Science and Technology Museum, a fully pneumatic climbing robot is presented to meet the requirements of cleaning efficiency and simple operation. After an overview of the robotic system, this paper emphasizes the software hierarchy realization and path planning evaluation. The hierarchy of the control function is studied in detail, which consists of path planning and task planning. Then a mathematic model is proposed to describe the features of the work target. Considering the movement security, cleaning efficiency and the percentage of cleaning coverage, a new approach to path planning for wall-cleaning robots is presented. In the end, the successful on-site test confirms the principles described above and the robot's ability.</p>		Fault Diagnosis based on Improved Elman Neural Network for a Hydraulic Servo System <i>Hongmei Liu, Shaoping Wang, Pingchao Ouyang, Beijing University of Aeronautics and Astronautics, CHINA</i> <p>Due to the nonlinear, time-varying, ripple coupling property existed in the hydraulic servo system, and slow convergence speed and the instability of BP network, a two-stage improved Elman neural network model is developed to realize failure detection. The first-stage Elman network is adopted as a failure observer to realize the failure detection. The trained Elman observer, working concurrently with the actual system, accepts the input voltage signal to the servo valve and the measurements of the ram displacements, then rebuilds the system states. The output of the system is accurately estimated. By comparing the estimated output with the actual measurements, residual signal is generated and then analyzed to report the occurrence of faults. ...</p>	

Robotics, Automation & Mechatronics					Wed 7 June 16:00–18:00	
	W3D Chroen	Kinematics, Mechanics & Mechanism Design Chair(s): Grigore Gogu Marco Ceccarelli	W3E Charas I	Methodologies for Robotics and Automation Chair(s): Jianwei Zhang Taming Shih	W3F Charas II	Fault Diagnosis Chair(s): Shaoping Wang Louis S. J. Phee
17:00 – 17:20	Dynamic Performance Enhancement Design of Robot based on Dynamically-Coupled Driving and Joint Stop <i>Chunquan Xu, Aiguo Ming, Makoto Shimojo</i> , The University of Electro-Communications, JAPAN A new design method based on the utilization of dynamically-coupled driving and joint stops is proposed for high dynamic performance robots, such as the robot performing high-speed dynamic motions. In the method, the desired dynamic performance and the boundary conditions of the dynamic motion are combined to be a design index (DI) first. Then the robot is initially designed by selecting light actuators and links under an assumption of utilizing dynamically-coupled driving and joint stops. By increasing the actuator capabilities step by step, an iterative process of minimizing DI is implemented to yield a robot that is lighter than conventional robots and capable of performing dynamic motions more efficiently by utilizing dynamically-coupled driving and joint stops. ...		A Heuristic Approach for Computing Frictionless Force-Closure Grasps of 2D Objects from Contact Point Set <i>Nattee Niparnan, Attawith Sudsang</i> , Chulalongkorn University, THAILAND For a set of n contact points on the boundary of a 2D object together with their contact normals, we present an output sensitive heuristic algorithm for computing a large number of combinations of four points from this set that achieve force closure under the frictionless contact assumption. The proposed algorithm runs in $O(n^2 \lg n + K)$ where K is the number of different solutions. Our algorithm is capable of computing significant portion of the solutions in various test cases. Preliminary implementation is described along with experimental results showing efficiency of the algorithm.		Fuzzy Petri Nets Reasoning for Application of Electric Control System Fault Diagnosis <i>Haiwen Yuan, Haibin Yuan, Xingshan Li</i> , Beihang University, CHINA In order to deal with the condition of inadequate and uncertain information in the fault diagnosis process of electric control system, fuzzy petri net (FPN) reasoning model is investigated and developed. Based on fuzzy production rule, the improved fuzzy petri net reasoning model is achieved by matrix parallel computation, and existing diagnosis knowledge are combined together to form a function matrix that is used to describe transfer of places and transitions in the fuzzy petri net. Analytic hierarchy process (AHP) is employed to determine the initial certainty factor for intermediate places, which allows multiple objective factors to be considered in the fuzzy petri net reasoning model. Matrix based fuzzy petri net reasoning process is deduced and application example is used to validation the method. ...	
17:20 – 17:40	A Robot Actuator Development with High Backdrivability <i>Tatsuho Ishida, Atsuo Takanishi</i> , Waseda University, JAPAN We propose a new robot actuator, especially a robot actuator gear which has a very effective feature of backdrivability. We show the study of the new definition of backdrivability of an actuator gear which has the quantitative definition. From this definition we propose the method of making the gear which has a good backdrivability. Based on this method, the actuator gear was developed and we show the result from the experiment. The comparisons with the other types of actuator gear which are Harmonic drive gear and normal planetary gear are described. Finally the comparison has proved that the developed actuator gear has very effective backdrivability.		Probabilistic Distributed Energy for Long-lived Group of Mobile Robots <i>Trung Dung Ngo, *Henrik Schioler</i> , Aalborg University, DENMARK * Aalborg University, DENMARK Autonomous mobile robot is usually equipped a finite amount of energy, it can accordingly work in finite time. Inspired from swarm behavior of collecting and sharing food of natural animals, e.g. honey-bee, game theory and mobile agents in multi-agent systems we issue a novel approach to distribute energy for multi-task autonomous mobile robots in order to keep group of mobile robot long-lived. In this paper we describe practical deployment of a group of mobile robot with possibility of carrying and then exchanging fuel cell, e.g. battery to other robot. The battery exchange solution is basically based on probabilistic model of total energy of each robot in its local vicinity. Early implementation that includes modular hardware and control architecture to demonstrate possibility of the approach is presented.		An Integrated Platform for Collaborative Simulation and Fault Diagnosis <i>Rusheng Zhou, Zongxia Jiao, Shaoping Wang, Zhongming Li, Jian Sun</i> , Beijing University of Aeronautics and Astronautics, CHINA Before application to real manufacturing, thorough evaluation of working performance and the fault diagnosis strategy is absolutely necessary. A comprehensive multifunctional simulation platform based on collaborative simulation and fault diagnosis is presented. Based on virtual prototype, database, network communication and fault diagnosis technologies, the platform allows users to model in a structural and hierarchical way, study the behaviors of individual components and the interaction of subsystems, as well as adjust the fault diagnosis solutions in a simulation environment. An integrated framework is developed to manage the model databases, assemble the models, run the simulation application and display the simulation result. ...	
17:40 – 18:00	Practical Limitations of an Algorithm for the Singular Value Decomposition as Applied to Redundant Manipulators <i>Hanlei Wang, Jiawei Li, *Hong Liu</i> , Harbin Institute of Technology, CHINA, *German Aerospace Center, GERMANY The singular value decomposition has been largely used in analyzing kinematics and the dynamic characteristics of robot manipulators. Generally, it needs to find the singular value decomposition of corresponding Jacobian matrix of a robot manipulator, which usually involves a considerable amount of computations. In some cases, this hinders the method from real-time applying. An algorithm proposed by Maciejewski which takes advantage of the nature of robotics matrix calculations is analyzed and improved in this paper. We still obtained the standard SVD of Jacobian in some abnormal cases through our method. A simulation experiment is given to show the effectiveness of our approach.		The Motion Analysis and Control of a Three-Degree-of-Freedom Parallel Mechanism <i>Taming Shih, Chihnan Ni, Jin-Long Chang, Ching-Chung Li</i> , Chung Cheng Institute of Technology, TAIWAN The purpose of this research is to study the motion analysis and control of a 3-d.o.f parallel mechanism by confining a 6-d.o.f Stewart platform. The pitch, roll and length of the upper platform are assumed be movable. The relationships between the rod length and platform are derived and verified by numerical simulation, and then by using the Lagrange equation, the roll and pitch equations of motion are derived. Based on the advantages of high response speed, robustness to varying system parameters and high control precision, a sliding mode controller is added to control the mechanism. The cylinder length is adjustable to control the pitch and roll posture of upper platform following the sliding mode criterion and showed satisfactory results.		Fault Diagnosis of a Wheel Loader by Artificial Neural Networks and Fuzzy Logic <i>Zheng Zhang, Xinyu Shao, Daoyuan Yu</i> , Huazhong University of Science and Technology, CHINA This paper employs both the technologies of neural network and fuzzy theory so that they can make up the deficiencies of each other. A hierarchy model, which employs a sub-ANN neural network deals with the tasks first then applies fuzzy treatment later, has been set up to fulfill the requirements of quick response, strong self-learning and clear expression hierarchical diagnostic. Memberships in the fuzzy part would update themselves automatically and the sub-ANN network part enables rapid and accurate learning. Diagnosis datum originate from various state parameter sensors, for instance, pressure sensors, temperature sensors, fluid level sensors, and gearbox vibration sensors, etc. These parameters would be periodically updated and sent to a remote diagnosis center via Internet where ...	

NOTES



TECHNICAL PROGRAM

Thursday
8 June 2006

Session 1
10:00 – 12:00

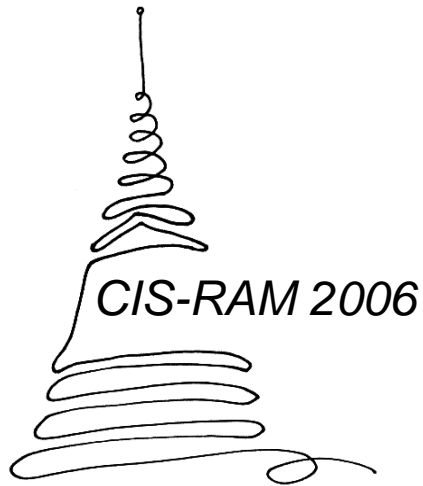
Cybernetics & Intelligent Systems					Thu 8 June 10:00–12:00	
	T1A Bumrang	Optimization Chair(s): Palanisamy Narayanasamy Busaba Phruksaphanrat	T1B Rong	Computer Vision Chair(s): Jose A Calderon-Martinez Ching Seong Tan	T1C Charu	Neural Network I Chair(s): Galip Cansever Chun Che Fung
10:00 – 10:20	Simulated Annealing using an Adaptive Search Vector <i>Mitsunori Miki, *Satoru Hiwa, Tomoyuki Hiroyasu, Doshisha University, JAPAN, *Doshisha University, JAPAN</i> It is reported that simulated annealing (SA), which changes one design variable at a time, is effective when applied to high-dimensional continuous optimization problems. However, if a correlation exists among the design variables, it is not efficient to search each dimension. In this paper, we propose SA with a mechanism to determine an appropriate search direction according to the landscape of the given problems. Its effectiveness is verified for high-dimensional problems with correlation among design variables.		Computer Vision Based Methods for Detecting Weeds in Lawns <i>Ukrit Watchareeruetai, Yoshinori Takeuchi, Tetsuya Matsumoto, Hiroaki Kudo, Noboru Ohnishi, Nagoya University, Japan</i> In this paper, two methods for detecting weeds in lawns using computer vision techniques are proposed. The first is based on an assumption about the differences in statistical values between the weed and grass areas in edge images and using Bayes classifier to discriminate them. The second also uses the differences in texture between both areas in edge images but instead applies only simple morphology operators. Correct weed detection rates range from 77.70 to 82.60% for the first method and from 89.83 to 91.11% for the second method. In addition, the proposed methods together with a chemical weeding system as well as a non-chemical weeding system based on pulse high voltage discharge are simulated and the efficiency of the overall systems are evaluated theoretically. With a chemical based system, more than		A Neural Network Based Adaptive Autopilot for Marine Applications <i>M. J. Khan, *M. Usman Keerio, *Atta Ullah Khawaja, *Ali Raza Jafri, Tsinghua University, *Beijing Institute of Technology, CHINA</i> Due to varying dynamics of sea-going vessels with changes in gross tonnage, speed of the vessel and depth of water, the key factor limiting the performance of current autopilot systems using PID/PD controllers, is the wide range of vessels' dynamical behavior. Recent research proposes adaptive controllers to overcome these difficulties, but such systems can also suffer from disadvantages such as potential instabilities. This paper investigates the application of artificial neural networks to automatic yaw control of mine sweepers at various speeds, where the practical issues like speed of response relevant to this particular class of ship are carefully considered. The proposed networks are trained offline to capture the controllers' dynamics and use it in the control loop thus incorporating the ...	
10:20 – 10:40	A Comment on the Formulation of an Aggregate Production Planning Problem <i>Busaba Phruksaphanrat, *Ario Ohsato, Pisal Yenradee, Thammasat University, THAILAND, *Nagaoka University of Technology, JAPAN</i> Conventionally, a revenue function, a cost function and a profit function are selected to be the objective function for Aggregate Production Planning (APP) problems. The theory of constraints (TOC) alternative consideration argues that instead of measuring by cost, factory should evaluate their performance by throughput. Even though, there are a lot of research works on formulations of APP problems, there has been no investigation, which formulation is the most appropriate for APP problems. In this research, the investigation of the formulation of existing APP problems is done. In order to clarify the difference of each objective function, a simple case study has been used to compare the performances of the APP problem with revenue, cost, and profit objective functions when resource constraints (limited processing time) are not included.		Pre-eliminating Features for Fast Training in Real Time Object Detection in Images with a Novel Variant of AdaBoost <i>Milos Stojmenovic., University of Ottawa, CANADA</i> Our primary interest is to build fast and reliable object recognizers in images based on small training sets. This is important in cases where the training set needs to be built mostly manually, as in the case that we studied, the recognition of the Honda Accord 2004 from rear views. We described a novel variant of the AdaBoost based learning algorithm, which builds a strong classifier by incremental addition of weak classifiers (WCs) that minimize the combined error of the already selected WCs. Each WC is trained only once, and examples do not change their weights. We proposed to pre-eliminate features whose cumulative error of corresponding best WCs exceeds a predetermined threshold value. We tested two straightforward definitions of cumulative error. In both cases, we showed that, when over 97% of the initial ..		Extrapolative Model of DGPS Corrections using a Multilayered Neural Network based on the Extended Kalman Filter <i>Seyed Mohammad Reza Mosavi, M. Mirzaeepour, H. Nabavi, Behshahr University of Science and Technology, IRAN</i> This paper presents an accurate DGPS land vehicle navigation system using a multilayered Neural Network (NN) based on the Extended Kalman Filter (EKF). The network setup is developed based on a mathematical model to avoid excessive training. The proposed method uses an EKF training rule, which achieves the optimal training criterion. The NN predicts the DGPS corrections for accurate positioning. The proposed method is suitable for DGPS systems sampled at different rates. The experimental results on collected real data demonstrate the suitability of this method in developing an accurate DGPS land vehicle navigation method. The experiments show that the prediction total RMS error is less than 1.65m and 0.67m, before and after SA, respectively. Also, tests with real data demonstrate that the prediction ...	
10:40 – 11:00	Optimizing the Performance of an Integrated Process Planning and Scheduling Problem: An AIS-FLC Based Approach <i>F T S Chan, V Kumar, *M K Tiwari, The Univ. of Hong Kong, HONG KONG S.A.R., *National Inst. of Foundry and Forge Tech., INDIA</i> The present market scenario demands an integration of process planning and scheduling to stay competitive with others. In the present work, an integrated process planning and scheduling model encapsulating the salient features of outsourcing strategy has been proposed. The paper emphasizes on the role of outsourcing strategy in optimizing the performance of enterprises in rapidly changing environment. In the present work authors have proposed an Artificial Immune System based AIS-FLC algorithm embedded with the fuzzy logic controller to solve the complex problem prevailing under such scenario, while simultaneously optimizing the performance. The authors have shown the efficacy of the proposed algorithm by comparing the results with other random search methods.		A Study on Automatic Recognition of Road Signs <i>Yok Yen Nguwi, *Abbas Kouzani, Glenayre Electronics, SINGAPORE *University of Newcastle, AUSTRALIA</i> An automatic road sign recognition system identifies road signs from within images captured by an imaging sensor on-board of a vehicle, and assists the driver to properly operate the vehicle. Most existing systems include a detection phase and a classification phase. This paper classifies the methods applied to road sign recognition into three groups: colour-based, shape-based, and others. In this study, the issues associated with automatic road sign recognition are addressed, the popular existing methods developed to tackle the road sign recognition problem are reviewed, and a comparison of the features of these methods is given.		Adaptive Neural Network Based Fuzzy Sliding Mode Control of Robot Manipulator <i>Ayca Gokhan Ak, *Galip Cansever, Ayca Gokhan Ak, *Galip Cansever, Marmara Univ., *Yildiz Technical University, TURKEY</i> A fuzzy sliding mode controller based on radial basis function neural network (RBFNN) is proposed. In the applications of sliding mode controllers the main problem is that a whole knowledge of the system dynamics and system parameters is required to be able to compute equivalent control. In this paper, a RBFNN is used to compute the equivalent control. The weights of the RBFNN are changed according to adaptive algorithm for the system state to hit the sliding surface and slide along it. The initial weights of the RBFNN set to zero, then tune online, no supervised learning procedures are needed. Computer simulations of three link robot manipulator for trajectory tracking verify the validity of the proposed adaptive neural network based fuzzy sliding mode controller in presence of uncertainties.	

Cybernetics & Intelligent Systems					Thu 8 June 10:00–12:00	
	T1A Bumrang	Optimization Chair(s): Palanisamy Narayanasamy Busaba Phruksaphanrat	T1B Rong	Computer Vision Chair(s): Jose A Calderon-Martinez Ching Seong Tan	T1C Charu	Neural Network I Chair(s): Galip Cansever Chun Che Fung
11:00 – 11:20	An Efficient MPC Algorithm based on a Priori Zone Control <i>Poo-Gyeon Park, Sung Hyun Kim, Jeong Hye Moon, Min Kyo Shin,</i> Pohang University of Science and Technology, KOREA <p>This paper presents an efficient MPC algorithm for uncertain time-varying systems with input constraints. The proposed algorithm adopts the method of increasing free control horizon in the dual mode (i.e., a free control mode in the first finite horizon and a state-feedback mode in the following infinite horizon) paradigm so as to enlarge the set of stabilizable initial states. In the method, however, since the number of LMIs growing exponentially with the free control horizon makes the corresponding optimization problems intractable even for small horizon, it is impracticable to blindly increase the free control horizon. The objective of this paper is to relax the restriction on increase of the free control horizon, incurred on computational burdens in the method. By choosing a combination of hyperboxes including a possible region of the initial states ...</p>		An Intelligent Video Noise Reduction Method using Adaptive Spatial and Motion-Compensation Temporal Filters <i>Thou-Ho (Chao-Ho) Chen, Chao-Yu Chen, Tsong-Yi Chen, *Ming-Kun Wu,</i> National Kaohsiung University of Applied Science, TAIWAN <p>In this paper, we propose an effective noise reduction method for image sequences corrupted by the Gaussian noise or impulse noise. The basic strategy is to combine the spatial just noticeable distortion (JND) with local image characteristics for spatial filtering and utilize the motion compensation for temporal filtering. For spatial filtering, an adaptive scheme composed of the harmonic mean filter, weighted arithmetic mean filter, alpha-trimmed mean filter, median filter and thresholding filter is dedicated to reducing noises on an image. Then, a motion-compensation based temporal filter is focused on refining the spatial-filtered image frame with the previous and following frames. Experimental results show that the proposed noise-reduction method is better than four previous methods with a PSNR improvement rate of 8.85% on ...</p>		Linguistic Knowledge Extraction from Neural Networks using Maximum Weight and Frequency Data Representation <i>Wiphada Wettayaprasit, Unitsa Sangket,</i> Prince of Songkla University, THAILAND <p>This paper presents a method of linguistic rule extraction from neural networks nodes pruning using frequency interval data representation. The method composes of two steps which are 1) neural networks nodes pruning by analysis on the maximum weight and 2) linguistic rule extraction using frequency interval data representation. The study has tested with the benchmark data sets such as Heart Disease, Wisconsin Breast Cancer, Pima Indians Diabetes, and Electrocardiography data set of Heart Disease patients from hospitals in Thailand. The study found that the linguistic rules received had high accuracy and easy to understand. The number of rules and the number of conjunction of conditions were small and the training time was also decreased.</p>	
11:20 – 11:40	Sensor Relevance Validation for Autonomous Mobile Robot Navigation <i>T. Gulrez, S. Challa, *T. Yaqub, *J. Katupitiya,</i> University of Technology, *University of New South Wales, AUSTRALIA <p>We have defined a new paradigm of robot navigation, by using sensors in the environment instead of onboard robotic platform. In this scenario, determining the output of the most relevant and validated sensor is of crucial importance when heterogeneous sensors are available for measuring a given process. We are using an IEEE 1451 TEDS (Transducer Electronic Data Sheets) compliant sensor model proposed earlier for heterogeneous sensor networks. The presented method computes at each time step the usefulness of sensor information from discovered sensors, based upon Kullback-Leibler divergence between the sources of information. The robotic application consequently can obtain the relevance of the sensor output and the robot can update its estimate of the environment. We present results of a real time implementation</p>		Gait Recognition Considering Directions of Walking <i>Xu Han, Jiwei Liu, Lei Li, Zhiliang Wang,</i> University of Science and Technology, Beijing, CHINA <p>Studies on Gait Recognition are mostly based on the assumption that walking direction is parallel to the camera, and the person's side view is extracted. Recently, walking direction has becoming one of the gait recognition challenge problems. In this work we explore gait recognition considering any directions of walking which is not definitely parallel to the camera. We propose a novel approach to computing the walking direction and extracting features by employing a human model. Furthermore, a Support Vector Machine (SVM) is performed allowing us to investigate and evaluate the recognition power of any walking directions. We applied our method to the real human walking video data, and achieved high recognition rate. Our approach finds out how changes in walking direction affect gait parameters in terms of recognition performance.</p>		Reduced Training for Hierarchical Incremental Class Learning <i>Chunyu Bao, Sheng Uei Guan,</i> National University of Singapore, SINGAPORE <p>Hierarchical Incremental Class Learning (HICL), proposed by Guan and Li in 2002, is a recently proposed task decomposition method that addresses the pattern classification problem. HICL is proven to be a good classifier but closer examination reveals areas for potential improvement. This paper presents an approach to improve the classification accuracy of HICL by applying the concept of Reduced Pattern Training (RPT). The procedure for RPT is described and compared with the original training procedure. RPT systematically reduces the size of the training data set based on the order of sub-networks built. The results from benchmark classification problems show much promise for the improved model.</p>	
11:40 – 12:00	A New Solution to Economic Emission Load Dispatch using Immune Genetic Algorithm <i>Hong-Da Liu, Zhong-Li Ma, Sheng Liu, Hai Lan,</i> Harbin Engineering University, CHINA <p>This paper introduces a kind of immune genetic algorithm which regards objective function as antigen, solution as antibody and updates the population using evolutionary strategy. After economic emission load dispatch which belongs to multi-objective constrained optimization problems is discussed, main processes of immune genetic algorithm to solve this matter is given. Through tests a power system model with five coal-burning generating units, feasibility and validity of this algorithm is proved. And by comparing with genetic algorithm and Hopfield neural network, optimization and quick constringency of this algorithm to solve similar problems are proved.</p>				Neural Network Ensembles using Interval Neutrosophic Sets and Bagging for Mineral Prospectivity Prediction and ... <i>P. Kraipeerapun, Chun Che Fung, *Brown Warick, Kok Wai Wong,</i> Murdoch University, *University of Western Australia, AUSTRALIA <p>This paper describes the integration of neural network ensembles and interval neutrosophic sets using bagging technique for predicting regional-scale potential for mineral deposits as well as quantifying uncertainty in the predictions. Uncertainty in the types of error and vagueness are considered in this paper. Each component in the ensemble consists of a pair of neural networks trained for predicting the degrees of favourability for deposit and barren. They are considered as the truth-membership and the false-membership values, respectively. Errors occurred in the prediction are estimated using multidimensional scaling and interpolation methods. Vagueness is computed as the difference between truth- and falseness values. In this study, uncertainty of type vagueness is ...</p>	

Robotics, Automation & Mechatronics					Thu 8 June 10:00–12:00	
	T1D Chroen	Designs & Appli. of Parallel Manipulators Chair(s): Marco Ceccarelli Tieshi Zhao	T1E Charas I	Sensor, Sensor Fusion & Sensor-based Rob. Chair(s): Frank L. Lewis Dugan Um	T1F Charas II	Dynamics and Control II Chair(s): Manop Wongssaisuwan Jing-Sin Liu
10:00 – 10:20	A Performance Analysis of a 4 Cable-Driven Parallel Manipulator <i>Erika Ottaviano, Marco Ceccarelli, Paolo Pelagalli</i> , University of Cassino, ITALY In this paper a performance analysis is presented for a low-cost parallel manipulator with 4 driven cables. Kinematics, Statics, and a method for monitoring and verifying positive cable tensions are presented. A prototype has been built and tests have carried out to verify the feasibility of the system design and its operation. Experimental tests have been carried out for monitoring the cables' tension for a spatial application of the manipulator.		Camera-based 3D Object Tracking and Following Mobile Robot <i>Nazim Mir-Nasiri</i> , Swinburne University of Technology, Sarawak Campus, MALAYSIA Camera-based systems are frequently used to track moving objects which are in the field of their view. This paper describes design and development of a camera-based tracking robot that can constantly track moving object without necessity of calibrating camera in real world units then control the two-wheeled moving platform to follow the object. The camera serves as a feedback sensor to guide robot constantly towards the object. The complexity of the system and processing time is less due to the unnecessary camera unit conversions and calibrations. The robot system consists of two subsystems: vision and motion. The vision subsystem consists of a two-motor pan-tilt camera driving mechanism with embedded potentiometer sensor, PCI image acquisition board, and PWM-based DC-motor driver board. The motion ...		Development of Levitation Control for Linear Maglev Rail System via Backstepping Design Technique <i>Rong-Jong Wai, Jeng-Dao Lee</i> , Yuan Ze University, TAIWAN The levitation control in a linear magnetic-levitation (maglev) rail system is a subject of considerable scientific interest because of highly nonlinear and unstable. This study mainly focuses on the sequential developments of backstepping-based control systems including a backstepping control (BSC), an adaptive backstepping control (ABSC) and an adaptive dynamic surface control (ADSC) for the levitated positioning of the linear maglev rail system. The effectiveness of the proposed control schemes for the levitation control of a maglev system is verified by numerical simulations, and the superiority of the ADSC system is indicated in comparison with the BSC and ABSC systems.	
	CaPaMan2bis as Trunk Module in CALUMA (CAssino Low-cost hUMANoid Robot) <i>Nestor Edoardo Nava Rodriguez, Giuseppe Carbone, Marco Ceccarelli</i> , University of Cassino, ITALY In this paper, CaPaMan2bis (Cassino Parallel Manipulator version 2bis) has been analysed as trunk sub-system in CALUMA (Cassino Low-cost hUMANoid) robot. Dynamic simulations have been developed for an operation of CaPaMan2bis as trunk module of CALUMA has been checked. Specifically, simulations for walking and grasping have been carried out to evaluate CALUMA performance. Simulations have given results that confirm the feasibility of the proposed design. The dynamic simulations have been also used for studying the movement characteristics of CaPaMan2bis parallel manipulator in a humanoid robot structure. Improvements have been illustrated for the trunk sub-system as suggested by simulation results.		A Novel Infrared Proximity Array Sensor for 3D Visual Sensing: Modeling and Applications <i>Dugan Um, *Wayne N. P. Hung</i> , Texas State University, UNITED STATES, *Texas A and M University, UNITED STATES In this paper, we propose a novel 3D vision sensor, namely Infrared Proximity Array (IPA), capable of detecting position and orientation of components or devices for automation and robotics applications. The IPA sensor utilizes infrared sensor technology to create 3D geometry of sensed objects. Unlike a stereo vision type sensor, it is essentially useful when calibration is a big issue. For instance, a stereo vision based multi-camera system requires submicron level accuracy in device calibration to accurately measure the position of micro parts and devices. Among many areas of applications, therefore, the IPA is most suitable for a micro-robotic workcell that is composed of a 3D realtime visual feedback sensor and a multiple degree of freedom (DOF) manipulator capable of handling 10 to 100 micron parts. ...		Self-Tuning Control for Rotation Type Inverted Pendulum using two Kinds of Adaptive Controllers <i>H Hirata, K Haga, *P Ratiroch-Anant, M Anabuki, S Ouchi</i> , Tokai U., JAPAN, *King Mongkut's Inst. of Techno., Ladkrabang, THAILAND This paper presents the self-tuning control method for the rotation type inverted pendulum that the momentum of inertia of the pendulum part changes widely. The control system prepares two kinds of adaptive controllers, and the stabilization of inverted pendulum is achieved by separating the control mode to two stages. The rotational angle of the pendulum is stabilized by VSS (Variable Structure System) adaptive control method to unknown parameter system at the first stage, and whole basic parameters are simultaneously estimated in the parameter estimation system. After the eigenvalue of the inverted pendulum system converge sufficiently, the controller is changed to LQ (Linear Quadratic) control at the second stage. It is verified by the practical experiment that ...	
10:40 – 11:00	A Novel Approach to Kinematic Characteristics Analysis of Parallel Manipulators with Fewer Than Six DOF <i>T Zhao, Y Zhao, Z Huang, *X Qi</i> , Yanshan University, CHINA, *Beijing University of Aeronautics and Astronautics, CHINA In this paper, a novel approach to the identification of instantaneous and continuous motions of a constrained rigid body is proposed by employing the concept of constraining-power rate. With the investigation into the constraining-power rate of a general constrained rigid body, the sufficient and necessary conditions of continuous motion of a general constrained rigid body are firstly presented. The conditions are then applied to distinguish continuous rotating axes of 3-RPS platform mechanism and 3-RPS pyramid mechanism. The corresponding physical and mathematical criteria are obtained, which gives a valid mathematic method for analyzing kinematic characteristics of parallel manipulators with fewer than six DOF. The presented approach is significant for the path planning of parallel manipulators.		A Robotic Opto-tactile Sensor for Assessing Object Surface Texture <i>Abdul M Mazid, Robin Andrew Russell</i> , Monash University, AUSTRALIA This paper presents the design construction and working principle of a newly developed opto-tactile sensor for object surface assessment in robotic applications. The sensor provides information about surface texture and this can be used to assist in quality assurance and object recognition tasks. Surface texture causes flexing of protrusions on the sensor surface which in turn rotates a small mirror within the sensor. This rotation is measured optically as a variation in light intensity transmitted between two optical fibers. A mathematical relationship between these light intensity changes and geometrical parameters of the surface texture has been developed. The sensor has been fabricated and tested on a number of different surface textures and preliminary results of sensor output for differing textures are ...		A Robot Prototype for Friction Stir Welding <i>Mikael Soron, Ivan Kalaykov</i> , Orebro University, SWEDEN To apply industrial robots in friction stir welding (FSW) for difficult-to-weld materials and alloys has until recently been a proposed task. However, yet the laboratory experiments did not provide a feasible industrial application. We describe our approach to modify and provide an industrial robot with FS-welding capacity by modifying a standard industrial robot through replacing its sixth axis with FSW related equipment. The emphasis is on achieving reasonable welding speed and path complexity in 3-D space. As significant force is needed for FSW and at the same time position precision has to be kept, the control problems become complicated. We demonstrate our first experiments, highlighting this problem and point some possible solutions.	

Robotics, Automation & Mechatronics					Thu 8 June 10:00–12:00	
	T1D Chroen	Designs & Appli. of Parallel Manipulators Chair(s): Marco Ceccarelli Tieshi Zhao	T1E Charas I	Sensor, Sensor Fusion & Sensor-based Rob. Chair(s): Frank L. Lewis Dugan Um	T1F Charas II	Dynamics and Control II Chair(s): Manop Wongssaisuan Jing-Sin Liu
11:00 – 11:20	A Novel Four-DOF Parallel Manipulator Mechanism and its Kinematics <i>Tieshi Zhao, Yanwen Li, Jiang Chen, Jiachun Wang, Yanshan University, CHINA</i> <p>A novel 4-UPU parallel manipulator mechanism that can perform three-dimensional translations and rotation about Z axis is presented. The principle that the mechanism can perform the above motions is analyzed based on the screw theory, the mobility of the mechanism is calculated, and the rationality of the chosen input joints is discussed. The forward and inverse position kinematics solutions of the mechanism and corresponding numerical examples are given, the workspace and the singularity of the parallel mechanism are discussed. The mechanism having the advantages of simple symmetric structure and large stiffness can be applied to the developments of NC positioning platforms, parallel machine tools, four-dimensional force sensors and micro-positional parallel manipulators.</p>		Localization of a Wireless Sensor Network with Unattended Ground Sensors and Some Mobile Robots <i>Koushil Sreenath, Frank Lewis, Dan O. Popa, University of Texas at Arlington, UNITED STATES</i> <p>A range-free approach for adaptive localization of un-localized sensor nodes employing a mobile robot with GPS is detailed. A mobile robot navigates through the sensor deployment area broadcasting its positional estimate and the uncertainty in its estimate. Distributed computationally-inexpensive, discrete-time Kalman Filters, implemented on each static sensor node, fuse information obtained over time from the robot to decrease the uncertainty in each node's location estimate. On the other hand, due to dead reckoning and other systematic errors, the robot loses positional accuracy over time. Updates from GPS and from the localized sensor nodes serve in improving the localization uncertainty of the robot. A Continuous-Discrete Extended Kalman Filter (CD EKF) running on the mobile robot fuses information from ...</p>		Implementation of Embedded Controller using SoPC Technology <i>Kuo-Huang Lin, Hsin-Sheng Lee, National Formosa University, TAIWAN</i> <p>SoPC stands for System on a Programmable Chip, it was first coined by Synopsys to describe any system implemented using a programmable Logic Device (PLD) which contains a computation engine. In this paper, based on the DSP Development Kit, issued by Altera corp., an embedded controller for the rotary inverted pendulum system was implemented. The LQR control scheme is used to achieve pendulum rod balancing control, and the swing up controller adopts the energy-based control scheme. The key features of this SoPC methodology is based in combining the DSP Builder toolbox into the MATLAB/Simulink environment, which achieves the goal of embedded control system fast prototype. The design flow has proved to be more effective in DSP/PLD application; it also is an easy-to-demo experimental ...</p>	
11:20 – 11:40	Parallel Manipulator Polman with Isotropic Properties Dedicated for Fast Manipulation <i>Mianowski Krzysztof, Zielinska Teresa, Warsaw University of Technology, POLAND</i> <p>This paper is introducing a prototype of a novel 6 DOF parallel robot POLMAN-3x2 dedicated for fast manipulation. In the manipulator design the special motion transmission mechanisms was applied bringing a dynamic decoupling. Robot has an unique kinematics structure. Adequate selection of link lengths and design of mass distribution resulted in good kinematic properties (e.g. large workspace) and high dynamic manipulability appropriately. All six heavy motors are located in the manipulator base, this needed an elaboration of a special solution concerning the motion transmission. POLMAN-3x2 consist of three identical parallel chains, with two active and six passive degrees of freedom each. Special chain geometry allows to obtain the linear displacements of the moving platform ...</p>		Sensor Relevance Validation for Autonomous Mobile Robot Navigation <i>T. Gulrez, S. Challa, *T. Yaqub, *J. Katupitiya, University of Technology, *University of New South Wales, AUSTRALIA</i> <p>We have defined a new paradigm of robot navigation, by using sensors in the environment instead of onboard robotic platform. In this scenario, determining the output of the most relevant and validated sensor is of crucial importance when heterogeneous sensors are available for measuring a given process. We are using an IEEE 1451 TEDS (Transducer Electronic Data Sheets) compliant sensor model proposed earlier for heterogeneous sensor networks. The presented method computes at each time step the usefulness of sensor information from discovered sensors, based upon Kullback-Leibler divergence between the sources of information. The robotic application consequently can obtain the relevance of the sensor output and the robot can update its estimate of the environment. We present results of a real time implementation</p>		An Architecture for Robot Force and Impact Control <i>Zotovic Ranko, Angel Valera, Pedro Garcia, Angel Llosa, Universidad Politecnica de Valencia, SPAIN</i> <p>An architecture for force and impact control is proposed. Its first objective is to control the robot in free motion until the contact with the environment is made. Next, it should make the transition to constrained as smooth as possible. Finally, it should switch to force control in order to assure the tracking of the force reference. An absolute priority is to protect the system against the dangerous peaks of force. Also, loss of contact should be avoided when possible. The performance is improved by taking care of the accumulation of elastic energy in the robot. Sampling period is changed depending on the state of the system. An experimental platform was developed in order to test the architecture.</p>	
11:40 – 12:00	The Research on the Redundant Actuated Parallel Robot with Full Compliant <i>Guangping He, *Zhen Lu, North China University of Technology, CHINA, *Beijing University of Aeronautics and Astronautics, CHINA</i> <p>In the field of MEMS, optical instruments and communication, the manipulation tasks such as mechanics property test of micro- material, micro-components assembling, and fibers connecting, are challenging for their minuteness and accuracy. It is measured in the scale of micro-meter or sub micro-meter. The full-compliant mechanisms are the best alternative—which are characteristically of their compliant hinge, and monolithic chip forming, and can be used for transmit a certain high-accuracy motion. Nevertheless, the full-compliant mechanisms have some shortages, for instance, small working space, nonlinear in large range motion, complicated in kinematics and mechanics etc. inherited from the parallel mechanisms that instructs the design of full-compliant mechanism generally. In this article, the redundant actuated parallel robot with full compliant is ...</p>		Infrared Thermal Sensing of Positive and Negative Affective States <i>Masood Mehmood Khan, *Robert Ward, *Michael Ingleby, American Univ. of Sharjah, UAE, *Univ. of Huddersfield, UK</i> <p>Useful information about affects and affective states can be extracted form the physiological signals, even under difficult lighting and pose conditions. Little work has been done on using physiological signals in automated affect recognition systems. We employed measurements of facial skin temperature variations for developing a non-intrusive automated facial expression classification system. Variances in thermal intensity values recorded at thermally significant locations on human faces were used to discern between normal, pretended happy and pretended sad facial expression of affective states. A three-step algorithmic approach was used to construct the classifier. Employed approach involved derivation of principal components, stepwise selection of optimal and most discriminating features, linear discriminant ...</p>		Adaptive Observers for a Class of Nonlinear Systems with Application to Induction Motor <i>Purnaprajna Mangsuli, *N J Rao, APC India Pvt Ltd, INDIA, *Indian Institute of Science, INDIA</i> <p>This paper presents an adaptive observer for a class of multi-input multi-output (MIMO) nonlinear systems. These systems are linear in unknown parameters, and system nonlinearities satisfy Lipschitz conditions. The implementation of observer does not require any coordinate transformation. However, the estimation convergence analysis is dependent on a nonlinear filtered coordinate transformation. Sufficient conditions for stability are derived in terms of H_{∞} like matrix Riccati equations. Further, the estimated states in original coordinates and estimated parameters converge to true values with persistency of excitation. In the end, the usefulness of the proposed observer is shown by an example. In this example, an adaptive observer is designed for induction motor to estimate its five states, rotor resistance ...</p>	

NOTES



TECHNICAL PROGRAM

Thursday
8 June 2006

Session 2
13:30 – 15:30

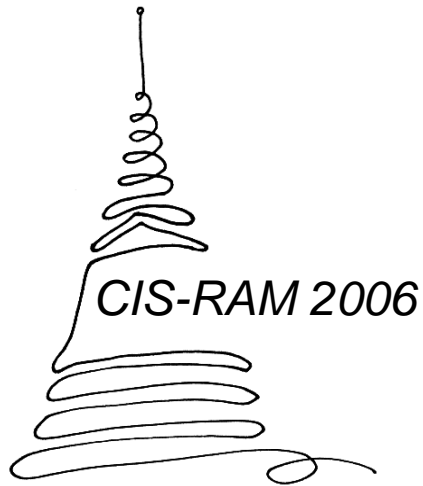
Cybernetics & Intelligent Systems					Thu 8 June 13:30–15:30	
	T2A Bumrang	Intelligent Systems III Chair(s): Ching-Cheng Lee Louis S. J. Phee	T2B Rong	Cybernetics Applications I Chair(s): Chang-Yung Kung Kun-Chieh Wang	T2C Charu	Genetic Algorithm Chair(s): Manop Wongssaisiwan Sam Ge
13:30 – 13:50	MultiLearner Based Recursive Supervised Training <i>Kiruthika Ramanathan, Sheng Uei Guan, Laxmi R Iyer</i> , National University of Singapore, SINGAPORE In supervised learning, most single solution neural networks such as Constructive Backpropagation give good results when used with some datasets but not with others. Others such as Probabilistic Neural Networks (PNN) fit a curve to perfection but need to be manually tuned in the case of noisy data. Recursive Percentage based Hybrid Pattern Training (RPHP) overcomes this problem by recursively training subsets of the data, thereby using several neural networks. MultiLearner based Recursive Training (MLRT) is an extension of this approach, where a combination of existing and new learners are used and subsets are trained using the weak learner which is best suited for this subset. We observed that empirically, MLRT performs considerably well as compared to RPHP and other systems on benchmark ...		The Development of Completed Grey Relational Grade Toolbox via Matlab <i>Chien-Wen Wang, Cheng-Kai Yeh, Kun-Li Wen, Wu-Shun Jwo</i> , Chienkuo Technology University, TAIWAN The software in engineering field, even in others filed become most important and more necessary in the 21 century, although there are many toolbox, such as fuzzy, chaos,..., etc., had been developed in the past, the grey toolbox still seldom and not quite completed. Therefore, in this paper, the focus is on the toolbox development of ordinal grey relational grade and cardinal grey relational grade by using Matlab, to development the completed grey relational grade toolbox. Firstly, we preview the whole mathematical foundation of grey relational grade in detail. Secondly, the mathematics model of ten kinds of grey relational grade, and two types of grey relational grades (ordinal and cardinal) are presented. Thirdly, based on the mathematics model, we use Matlab to develop the grey relational grade toolbox. As the results, in this paper, ten ..		Genetic-based Mobile Robot Path Planning using Vertex Heuristics <i>Yang Wang, David Mulvaney, *Ian Sillitoe</i> , Loughborough University, UNITED KINGDOM, *University of Boras, SWEDEN This paper presents a new genetic-based path planning method for a mobile robot in which the vertices of the obstacles, described as polygonal clusters, are encoded as genes. In comparison with other approaches that either map the robot's environment or need to consider the whole environment as the search space, the narrowing of the search to include only vertices is able to gear evolutionary progress, bringing potential benefits in terms of both calculation time and memory usage. The proposed vertex planning method is verified through experiments in a series of realistic simulated environments. Also, the efficiency and effectiveness of the proposed method are compared with the well-known Evolutionary Navigator/Planner.	
13:50 – 14:10	Power-Aware Data Management for Mobile Devices <i>Ching-Cheng Lee, Yipkei Kwok</i> , California State University at East Bay, UNITED STATES The popularity of mobile devices is growing rapidly. Due to the increase in application complexity, and the limited power supply in most mobile systems, energy optimization has become a popular research area. Different approaches have been used in lowering the energy cost. These include a variety of hardware and software techniques. In this research, we propose a novel technique that uses the Smart Caching approach cooperating with the Direct memory Access and the page caching mechanisms to keep process memory footprints small. More memory nodes thus can be put into a power-saving mode. As a result, the battery-powered supply of a mobile device can last longer. Experiments were conducted on a simulated operating system modified towards different energy-saving techniques. Analysis and ...		An Auto-tuning PID Regulator using Grey Predictor <i>Ching-Yi Hsu, Shuen-Jeng Lin, Wei-Liang Chien, Chia-Chang Tong</i> , Chienkuo Technology University, TAIWAN It is the purpose of this paper to introduce the advantages of Grey Predictor Controllers. We adopt grey prediction to obtain simple and effective estimated values, and, with the aid of first-order low-pass ? Filter, greatly improve the accuracy subsequently used in the prediction for system response. The result will be in turn used to predict error and furthermore automatically adjust the parametrical values of PID controller, and accordingly will be able to deal with the possible variation of system responses at the very first stage. It can not only actively promote the responses efficiency of transient response, but also passively prevent disturbance. As a matter of fact, the highest demand of "plug in and play" can be met without any need to adjust the parameter. This paper will give a detailed specification of the system structure, the design, and the ...		Lyapunov-based Genetic Algorithm Controlled Linear Piezoelectric Ceramic Motor Drive <i>Rong-Jong Wai, Ching-Hsiang Tu, Zhi-Wei Yang</i> , Yuan Ze University, TAIWAN This study presents a Lyapunov-based genetic algorithm control (LGAC) system for a linear piezoelectric ceramic motor (LPCM) driven by a hybrid resonant inverter. Since the dynamic characteristics and motor parameters of the LPCM are highly nonlinear and time varying, an LGAC system via backstepping design technique is therefore investigated based on direction-based genetic algorithm to achieve high-precision position control. In this control scheme, a genetic algorithm (GA) control system is utilized to be the major controller, and adaptation laws derived from Lyapunov stability analyses are manipulated to adjust appropriate evolutionary steps. Moreover, the system stability can be guaranteed directly without strict constraint conditions and detailed system knowledge. In addition, the effectiveness of ...	
14:10 – 14:30	An Empirical Comparison of Code Size Limit in Auto-Constructive Artificial Life <i>Adzni Abdul Rahim, Jason Teo, Azali Saudi</i> , University Malaysia Sabah, MALAYSIA This paper presents an evolving swarm system of flying agents simulated as a collective intelligence within the Breve auto-constructive artificial life environment. The behavior of each agent is governed by genetically evolved program codes expressed in the Push programming language. There are two objectives in this paper, that is to investigate the effects of firstly code size limit and secondly two different versions of the Push genetic programming language on the auto-constructive evolution of artificial life. We investigated these genetic programming code elements on reproductive competence using a measure based on the self-sustainability of the population. Self-sustainability is the point in time when the current population's agents are able to reproduce enough offspring to maintain the minimum population size...		LabVIEW Implementation of an Auto-tuning PID Regulator via Grey-predictor <i>Chien-Ming Lee, Yao-Lun Liu, Hong-Wei Shieh, Chia-Chang Tong</i> , Chienkuo Technology University, TAIWAN The purpose of this paper is to design and implement a Grey prediction controller (GPC) via LabVIEW as a test platform. Grey prediction model GM(1,1) is used with the aid of first-order, digital low-pass Æ filter to refine the estimation of the system response in advance. The prediction is then utilized to modify the parameters of PID controller. Hence, an autotuning PID controller according to the forecasting of system response is achieved. LabVIEW software programming with a data acquisition card (Model DAQPad-6015) from National Instruments Co. is chosen to provide a high-resolution, however, time-saving solution for developing this auto-tuning control system. One temperature regulation example is arranged and tested to confirm this auto-tuning controller scheme. Test results of this novel Grey prediction controller ...		Improved Genetic Algorithm to Economic Dispatch of Power Systems having Special Units <i>Chao-Lung Chiang, Chang-Wei Chai, Chia-An Wang</i> , Nan Kai Institute of Technology, TAIWAN This paper presents an improved genetic algorithm with multiplier updating method (IGAMUM) to solve the power economic dispatch problem (PEDP), constrained by reserve and prohibited operating zones (POZ). A genetic algorithm (GA) equipped with the improved evolutionary direction operator (IEDO) and migration called the improved genetic algorithm (IGA) is proposed, which can efficiently search and explore solutions. The multiplier updating method (MUM) is introduced to avoid deforming the augmented Lagrange function and resulting in difficulty of solution searching. The proposed method combining with the IGA and the MUM can use a wide range of penalty parameters and a small population size in evolutionary computation. Two examples are investigated, and the computational results...	

Cybernetics & Intelligent Systems					Thu 8 June 13:30–15:30	
	T2A	Intelligent Systems III	T2B	Cybernetics Applications I	T2C	Genetic Algorithm
	Bumrang	Chair(s): Ching-Cheng Lee Louis S. J. Phee	Rong	Chair(s): Chang-Yung Kung Kun-Chieh Wang	Charu	Chair(s): Manop Wongssaisuwan Sam Ge
14:30 – 14:50	A Framework for Semantic Web Service Discovery and Planning <i>Sukasom Chaiyakul, Kati Limapichat, Avani Dixit, Ekawit Nantajeewarawat</i> , Thammasat University, THAILAND With the expanse of internet, web programmers have wide choice of web services available to them. A need arises for automatic discovery of required web services and construction of an appropriate sequence of invocation thereof. In this paper, we present a framework for automation of this task based on currently emerging technologies such as ontological knowledge bases, OWL, OWL-S, WSDL, Description Logic (DL), etc. Background knowledge ontologies are created based on which semantic meanings of web services can be given through OWL-S. An agent employs OWL-S API to extract web service metadata, and applies a DL inference engine, called Racer, for reasoning with the metadata with respect to given background knowledge. Reasoning tasks performed by Racer include profile ...		Applying Grey Relational Analysis to Assess the Relationship among Service Quality Customer Satisfaction and Customer Loyalty <i>C.Y. Kung, T.M. Yan, S.C. Chuang, *J.R. Wang</i> , Chaoyang University of Technology, *Chienkuo Technology University, TAIWAN In this study, the mobile communications industries are taken by the researcher as the objects. The present study applied grey relational method to analyze the relationships among service quality, customer satisfaction and customer loyalty. As the research result reveals, high service quality may further promote customer satisfaction. In addition, customer satisfaction and customer loyalty are examined to be positively related. It is examined further that responsiveness and empathy play important roles in promoting customer satisfaction and customer loyalty. In terms of the research method, Grey relational analysis only needs small samples. Smaller data can obtain good results; moreover, calculating method is simple. It is also easy to manipulate Grey relational analysis, in that it can make up for drawbacks of conventional statistic method that needs larger samples.		Determination of Erroneous Velocity Vectors by Co-operative Co-Evolutionary Genetic Algorithms <i>K. Boonlong, K. Maneeratana, *N. Chaiyaratana</i> , Chulalongkorn University, *King Mongkut's Institute of Technology, THAILAND The effects of incorporating co-operative co-evolutionary strategy into a genetic algorithm (GA) for the identification of erroneous velocity vectors in particle image velocimetry (PIV) is studied. The search objective is to eliminate vectors that are dissimilar to their adjacent neighbors. A simulated cavity flow, which is modified to contain 20% erroneous vectors, is used as the case study. The co-operative co-evolutionary strategy is found to decisively improve the search effectiveness. When the effect of species size and arrangement are considered, the search rate improves with smaller species, reflecting the weak linkage between species due to the locality nature of the objective function. Best results are obtained with the 25-bit species under square arrangement. It is also observed that the current vector similarity calculation as the objective function needs further assessments	
	Web Pages Clustering and Concept Mining: An Approach towards Intelligent Information Retrieval <i>Fang Li, Martin Mehlitz, Li Feng, Huanye Sheng</i> , Shanghai Jiaotong University, CHINA The amount of information on the web is growing at an exponential rate. Information overload has brought a heavy burden for modern life. Keyword based search engines no long fill the needs of many people. This paper introduces an approach towards intelligent information retrieval by providing clustered web pages and minded concepts based on results of search engines. Web page clustering is based on SVD (Singular Value Decomposition), concepts mining is implemented with a revision of Apriori algorithm. Experiments on three different kinds of keyword as queries to information retrieval have showed a promising result.		Thermal Error Modeling of a Machining Center using Grey System Theory and HGA-Trained Neural Network <i>Kun-Chieh WANG</i> , Ling Tung University, TAIWAN The thermal effect on machine tools has become a well-recognized problem in response to the increasing requirement of product quality. The performance of a thermal error compensation system strongly depends on the accuracy of the thermal error model. This paper presents a novel thermal error modeling technique including two mathematic schemes: GM(1,N) model of the grey system theory and the hierarchy-genetic-algorithm (HGA) trained neural network in order to map the temperature ascent against thermal drift of the machine tool. First, the GM(1,N) scheme of the grey system theory was applied to minimize the numbers of the temperature sensors on machine. Then, the HGA method is incorporated into the neural network training to optimize its layer numbers and neurons in each layer. These two schemes provide an ...		On Approximating k-MPE of Bayesian Networks using Genetic algorithm <i>Nalerk Sriwachirawat, Surapong Auwatanamongkol</i> , National Institute of Development Administration, THAILAND This paper presents a new genetic algorithm that efficiently finds k-MPE of Bayesian networks. The algorithm is based on niching method and is designed to utilize multifractal characteristic and clustering property of Bayesian networks to improve a search toward solutions. Benchmark tests are performed to evaluate the effectiveness of the algorithm and compare its performance with other niching genetic algorithms. The results from the tests show that the new algorithm outperforms the others for both running time and accuracy.	
15:10 – 15:30	Multi-criteria Intelligent Dispatching Control of Automated Guided Vehicles in FMS <i>Umashankar N., Karthik V. N.</i> , Birla Institute of Technology and Science, Pilani , INDIA In Flexible Manufacturing Systems (FMS), automated guided vehicles (AGVs) are used for transportation of the processed materials between various pickup and delivery points. The assignment of an AGV to a workcentre from a set of workcentres simultaneously requesting the service for transport of a part is often solved in real-time with simple dispatching rules. This paper proposes an intelligent dispatching approach for the AGVs based on multi-criteria fuzzy logic controller, which simultaneously takes into account multiple aspects in every dispatching decision. The controller operates in two stages in which the second stage is constructed as a conflict resolving tool between two equally ranked AGVs for a particular workcentre. The control system is being implemented using MATLAB and its Fuzzy ...		Development of the Short-Circuit Capacities Curves for Distribution Systems Planning using Matlab <i>W. C. Lai, W.T.Huang, S.T. Chen, *H.K Chao</i> , Chienkuo Technology University, TAIWAN, *Aerospace Industrial Development Corp, CHINA The calculations of the short-circuit capacities (SCC's) along a primary feeder is essential for determining the ratings of protective devices of the distribution systems, especially in the planning stage. According to the calculation results, the interruption capacities (ICs) that shall be able to withstand the mechanical and thermal stresses resulting from maximum flow of short-circuit current through them of the protection devices were evaluated. Therefore, an easy, straightforward, rapid and systematic method, the complex short-circuit MVA method was employed to estimate the SCC's in this paper, the SCC's along a primary feeder dependent on the related parameters and network structure were represented by simple formulas and illustrated by curves that plotted in Matlab. It is more convenient for the distribution engineers to select ratings....		Recursive Self Organizing Maps with Hybrid Clustering <i>Kiruthika Ramanathan, Sheng Uei Guan</i> , National University of Singapore, SINGAPORE We introduce the concept of a neural network based recursive clustering which creates an ensemble of clusters by recursive decomposition of data. The work involves a hybrid combination of a global clustering algorithm followed by a corresponding local clustering algorithm. Evolutionary Self Organizing Maps are used to create clusters. A set of core patterns is isolated and separately trained using a SOM. The process is recursively applied to the remaining patterns to create an ensemble of clusters. The partition of each recursion is integrated with the partition of the previous recursion. The correlation of the clusters with ground truth information (in the form of class labels) is used to measure algorithm robustness. The paper shows that a hybrid combination of evolutionary algorithms and neural network based ...	

Robotics, Automation & Mechatronics					Thu 8 June 13:30–15:30	
	T2D Chroen	Comm. Tech. & Optical Signal Detection Chair(s): Guilin Yang Zhiwen Zhao	T2E Charas I	Kinematics & Dynamics of Robotic Systems Chair(s): Zengqi Sun Qiang Zhan	T2F Charas II	Modeling, Planning and Control II Chair(s): Oliver Sawodny Atsuo Takanishi
13:30 – 13:50	Integration of Microsensors on End-effector for Robotic Microsurgical Keratoplasty <i>Yida Hu, *Zhiwen Zhao, *Dazhai Li</i> , Beijing University of Aeronautics and Astronautics, CHINA, *Beijing Normal University, CHINA In order to improve the effect of robotic microsurgery for keratoplasty, force and position microsensors should be integrated on the end-effector of surgical robot. The mechanism for measuring the surgical information of punching force and cutting depth is discussed based on the requirements for integration design. The sensor data board is developed. To eliminate the interfering signal for transmission, the two digital filtering methods suitable for the PC and the sensor data board respectively are proposed by using the power spectral estimation of sensor data. On the basis of fuzzy sets, the sensor data fusion is studied for robotic control algorithm to have an accurate response of operational environments. The experimental results show that the integration of microsensors meets the design requirements and ...		Optimal Motion Generation of a Flexible Macro-micro Manipulator System using Genetic Algorithm and Neural Network <i>Yu Zhang, Zengqi Sun, Tangwen Yang</i> , Tsinghua University, CHINA In this paper, a new approach to solve the inverse kinematics of a flexible macro-micro manipulator system is proposed. The macro-micro manipulator system consists of a macro flexible manipulator, and a micro rigid manipulator which is used to compensate for the errors at the tip of the system. Apparently, such a macro-micro system is a redundant system, of which the inverse kinematics remains challenging, with no generic solution to date. Here, optimal joint motions, namely the manipulator system configuration, are generated using a genetic algorithm and a neural network. A fitness function is dedicated to the genetic algorithm to optimize the discrete solution of the inverse kinematics of the manipulator system. Then the discrete solution is further generalized by a forward neural network.		A Gaussian Error Model for Triangulation-Based Pose Estimation using Noisy Landmarks <i>Adam Easton, Stephen Cameron</i> , Oxford University, UNITED KINGDOM As multiple robot approaches to localisation become more prevalent, existing triangulation methods involving fixed location landmarks are inadequate to accurately determine a robot's pose. We present an error model for a robot's pose based on triangulation from three landmarks. The model represents each landmark position as a Gaussian distribution and, consequently, factors landmark positional uncertainty into robot pose error. We demonstrate the performance and accuracy of this model through a series of experiments and use the results to explain some of the inconsistencies in earlier results. We also present four metrics for analysing the output of any Gaussian-based localisation error model, demonstrating the metrics' particular applicability to multiple robot localisation problems.	
	13:50 – 14:10	Modeling the Radiated Compromising Emanations for Digital Channel <i>D Sun, W Q Huang, *Z Zhao</i> , The Institute of Beijing Information Application Technology, CHINA, *Beijing Normal University, CHINA The compromising emanations and receiver of VDU (Video Display Unit) signal has been studied, and basing on the model of radiated compromising emanations, the original signal can be reconstructed. For many kinds of digital channel, modeling an available radiated compromising emanation is very important, where a channel transfer function needs to be built in accordance with the environment. The mechanism of digital signal compromising emanations as well as the characteristics of multi-path fading channel are analyzed and discussed in the study. Furthermore, the channel transfer function of radiated compromising emanations in a complex environment is created, and an actual channel mathematical model is given and simulated. Some meaningful results are obtained from this simulation.		Study on Kinematics Optimization of Redundant Manipulators <i>P Ye, *H Sun, *Qingxuan Jia</i> , Beijing University of Aeronautics and Astronautics, CHINA, *Beijing Univ. of Posts and Telecom., CHINA This paper studies the kinematics optimization of redundant manipulators. Based on the relationship between self-motion variable and Jacobian null-space vector, a new method for choosing self-motion variable of redundant manipulators is proposed; Using linearization, a unified formulation of kinematics performance criterion is introduced and its analytical form in terms of self-motion variable is deduced. With the knowledge of nonlinear feedback control, an optimal control system using self-motion variable as system state is established. The proposed algorithm is characterized by less computation and great capability of optimization compared with least-norm solution and GPM etc. The feasibility of the proposed algorithm is demonstrated by computer simulation results.		Tracking Control of an Inverted Pendulum using Computed Feedback Linearization Technique <i>Ratchatin Chanchaen, Viboon Sangveraphunsiri, Supavut Chantranuwathana</i> , Chulalongkorn University, THAILAND The paper presents an output tracking technique for a balanced rod inverted pendulum based on computed feedback linearization. For any given trajectory of pendulum, which is the output, the trajectory of rod position, which is the internal state, is determined such that the system is input state linearizable without state transformation. Both output and state are used to stabilize and also linearize the system. Once the system is linear, the trajectory control effort can be superimposed such that the system tracks the trajectory. The trajectory control effort is determined from the inverse of the feedback linearized system and thus bounded. In this way, the tracking error is asymptotically decreasing. Both simulation and experiment based on the ECP 505 balanced rod inverted pendulum are used to ...
14:10 – 14:30		Behavior-driven Based Improving the Performance of Self-organized Ad Hoc Networks <i>Zhiwen Zhao, *Degang Sun</i> , Beijing Normal University, CHINA *The Institute of Beijing Information Application Technology, CHINA In this study, in order to enhance the performance of self-organized mobile Ad Hoc networks, a behavior-driven based mechanism is proposed according to the behavior of communications between nodes and the occurred events in mobile hosts. The features of the algorithm inclusive of the packet delivery ratio as well as stability of routing path in wireless Ad Hoc networks are analyzed and discussed. By this way, the solution for improving the capability of the network can be achieved when integrating the proposed algorithms with other typical algorithms. The simulation results indicate that the algorithms show better performances for the mobility of nodes and robustness in self-organized Ad Hoc networks.		Research on Evaluation of Path Planning with Span of Planet Detector <i>Liming Yin, *Xuewen Li</i> , China Academy of Space Technology, CHINA, *Beihang University, CHINA Our research is focused on cost evaluation of path planning with span through experiment and theoretical analysis. The evaluating plan is advised by combining safety, energy consumption and time consumption together and the optimal path is found from several paths. Based on the planning paths with search arithmetic, the cost evaluation of path planning with span researches the span of planet detector and do the cost evaluation for paths after considering every factor. Basing on span, considering lots of factors and suiting to many complex landform, it is an applied evaluating plan.		Flatness-based Feedforward and Feedback Control for Heat and Mass Transfer Processes <i>Alexander Kharitonov, Oliver Sawodny</i> , University of Stuttgart, GERMANY This paper deals with the control of heat and mass transfer processes. The mathematical model of these processes is presented by a distributed parameter system with a so called distributed control and described by an inhomogeneous parabolic partial differential equation in one space dimension. The actuators in these processes are located above the channel, through that the medium to be heated flows. The distributed control corresponding to the actuators in the one-dimensional mathematical model is presented by the right part of the equation, i.e. the source function. The approaches for design of the feedforward and feedback control for the purpose of exact output tracking are presented. The design of the feedforward control is based on the flatness approach and examination of an inverse system dynamics. ...

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14:30 – 14:50	The Optic Spectroscopic Analysis & Application in Rare Earth Doped Bismuth-Tellurite Glasses <i>Xunsi Wang, Qiuhua Nie, Tiefeng Xu, Xiang Shen, *Liren Liu</i> , Ningbo University, CHINA, *Chinese Academy of Science, CHINA Aim of outstanding optic characteristic in high infrared transmission and upconversion visible light emission, a new kind of bismuth-tellurite based glass and its application is described here. Firstly, the varying density and refractive index are drawn out with bismuth content increasing, then, some optic parameters are calculated with Judd-Ofelt and McCumber theory, lastly, the spectroscopic properties of the IR emitting fluorescence and upconversion emission are concluded here when pumped with 975nm LD laser. In conclusion, it can be drawn out that this kind of bismuth tellurite based glasses is suitable to using as upconversion optic laser material, as well as optic communication element.		Research on Theoretical Models of Synthetic Geckos' Adhesion Technology <i>Q-X Jia, J Liao, H-X Sun, J-Z Song, *Tao Cheng</i> , Beijing University of Posts and Telecommunications, CHINA, *Beihang University, CHINA The research on geckos' adhesion States that the force of geckos' foot hairs adhering to the substrate is van der Waals force. Based on the research of the geckos' hairs, we assure two of models: single gecko spatula adhesive dynamical model and single gecko spatula pulling-off adhesive surfaces' dynamical model. These theoretical models contribute to the synthetic geckos' foot hairs manufacturing and provide the theoretical instruction to the manufacturing. Using design of the robot foots which are used by the synthetic geckos' adhesion technology, the climbing performance for the robot will be improved greatly.		Robot Movement Planning and Control based on Equilibrium Point <i>Xue Gu, Dana H Ballard</i> , University of Rochester, UNITED STATES Despite those the inverse dynamics methods in traditional robotics, few are eligible to be applied to systems with as high Degrees of Freedom (DOFs) as humans. Few tackle the intricacies of the human musculoskeletal system itself. We propose a two-phase motor control model based on the Equilibrium Point Hypothesis, which takes advantage of the muscle spring system to control human movements. The motor planning algorithm calculates the solution in the joint space, given a simple or complex task in Cartesian space. Then the spring model simulating the muscles takes charge of the movement execution. This model greatly reduces the amount of computation, compared to the inverse dynamics. We demonstrate the model in various motions as reaching, walking, sitting and rising.	
14:50– 15:10	Erbium Doped Tellurite Glasses for Potential Infrared Sensor Applification <i>Xiang Shen, Qiuhua Nie, Tiefeng Xu, Shixun Dai, Xunsi Wang</i> , Ningbo University, CHINA The B2O3 was introduced into Er3+ doped TeO2-ZnO-Na2O glass to increase the phonon energy of the host. The effect of B2O3 on the lifetime of 4I11/2 level was investigated. The results show that the lifetime of 4I11/2 level is shortened ascribing to the increasing multiphonon decay rate between the 4I11/2 and 4I13/2 level. Accordingly, the green- and red-upconversion fluorescence decreases with increasing of B2O3 concentration. A five-level rate-equation model of the Er3+ population dynamics in tellurite glass is developed. The model suggests the green- and red-upconversion intensity is a quadratic dependence on the population density of the 4I11/2 level. The intense visible upconversion fluorescence observed in Er3+ doped TeO2-ZnO-Na2O glass indicates it can be used in infrared sensor applification.		Control System Design of an Autonomous Underwater Vehicle <i>Ming Chen, Qiang Zhan, Sanlong Cai</i> , Beijing University of Aeronautics and Astronautics, CHINA The structure of an autonomous underwater vehicle is introduced, its dynamic model is established and simulation result is presented. Its stable and reliable control system design is discussed in detail from main control unit, communication unit to motor driving unit. A double-server, warm-cold backup scheme is used to design the control system of the AUV in order to make it more tolerant and reliable, and a fuzzy-PI control method is used to realize the reliable control of the motors of the AUV.		Adaptive Controller Design for Anti-Slip System of EV <i>P Ratiroch-Anant, *H Hirata, *M Anabuki, *S Ouchi</i> , King Mongkut's Inst. of Technology, Ladkrabang, THAILAND, *Tokai Univ., JAPAN The design strategy of adaptive controller for anti-slip system of EV (electric vehicle) is proposed. The proposed system is constructed by preparing both systems of disturbance observer and parameter estimation. The load variation of the tire slip is observed as the equivalent disturbance of motor system by employing the adaptive disturbance observer, and the vehicle speed is estimated. The tire slip is appropriately controlled by means of the feedback of the speed deviation between wheel speed and estimated vehicle speed. It is proved by the numerical simulations that the proposed methods provide satisfactory performance. Furthermore, the practical DC motor experiment set, which can give various slips, is constructed in order to investigate the effect of proposed anti-slip control system. ...	
15:10– 15:30			Development of PCI-based Multi-Axis Controller for a 3-DOF Manipulator <i>W Chen, *X Wu, *S Yu, *Q Liu</i> , S'pore Inst. of Manufacturing Tech., SINGAPORE, *Beijing Univ. of Aeronautics and Astronautics, CHINA This paper introduces the characteristics of a multi-axis control system based on PCI bus. To reduce the workload from host computer and utilizing the intelligence of DSP efficiently for a complex task, the developed controller is designed with master-slave structure. The controller is also suitable for standalone application to satisfy user' requirements to some applications. The hardware development is focused on multi-axis controller chipset, PCI local bus control logic, and PCI bus design; these parts are key technologies for a PCI-based controller design. To verify the performance of the developed controller, a decoupled 3-DOF manipulator is used to follow a spatial screw trajectory and a plane circle trajectory respectively, the high position precision of plane trajectory has been tested by micrometer, it hints the developed multi-axis controller can realize a near-real-time coordinated ...		Cloud Model-based Controller Design for Flexible-Link Manipulators <i>Lingbo Zhang, Fuchun Sun, Zengqi Sun</i> , Tsinghua University, CHINA A cloud model-based controller which needs no mathematical models of plant is presented in this paper for the trajectory tracking control of a flexible-link manipulator with poorly known dynamics. Based on the singular perturbation method and the time-scale decomposition, the flexible-link manipulator model is decomposed into a slow subsystem of an equivalent rigid-link manipulator and a fast subsystem of flexible mode. A composite adaptive controller is proposed to implement the angle position control of the slow subsystem and simultaneous suppressing the tip vibration. In the proposed control strategy, the control experience qualitatively expressed by linguistic is transformed into the control rulers using the normal cloud models. Experiment studies on the test-bed of a ...	

NOTES



TECHNICAL PROGRAM

Thursday
8 June 2006

Session 3
16:00 – 18:00

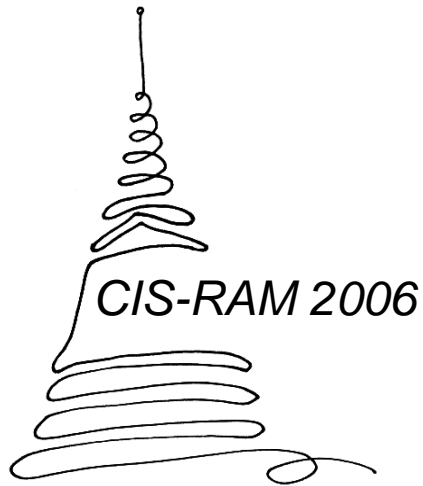
Cybernetics & Intelligent Systems					Thu 8 June 16:00–18:00	
	T3A Bumrang	Cybernetics Applications II Chair(s): Ting Cheng Chang Sam Ge	T3B Rong	Networked Control System (RAM) Chair(s): Shaoping Wang Weihai Chen	T3C Charu	RFID/Wireless Sensors Chair(s): Frank L. Lewis Bing-Ran Zuo
16:00 – 16:20	The Simulation Modeling about the Developments of GDP, Population & Primary Energy Consumption based on MATLAB <i>G. Li, *D. Yamaguchi, **H. Lin, ***M. Naga</i> , Teikyo Univ., *Kanagawa Univ., ***Kanagawa Univ., JAPAN, **YIST, TAIWAN <p>In this paper, we proposed a new grey model (GM) to realize the predictions and analyses of GDP structure, population structure and primary energy consumption structure from year 2004 to 2010 based on the data from 1995 to 2003. The improved GM is obtained by the following procedure: First, statistical method of linear regression is integrated into GM to enhance prediction capability. Second, residual error modification with Markov-chain sign estimation further improve the accuracy. By the above procedure, proposed GM is expected to have better prediction performance. We discussed the development relationship between GDP structure, population structure and energy consumption structure in the future. Furthermore, the experiment is realized based on MATLAB and we showed the results ...</p>		Reliability Analysis and Congestion Control on Network Nodes <i>Jian Shi, Shaoping Wang</i> , Beijing University of Aeronautics and Astronautics, CHINA <p>The reliability of computer network is related not only with the topology of the network and the reliabilities of the components, but also with the configurations of the nodes and the traffic flowing into the network. Nodes consist of two failure modes: congestive failure and failure related with inactivation of the software and hardware. The node's reliability related with the failure of hardware and software is obtained by modeling the node with general stochastic Petri net, and the node's reliability varied with the traffic is gotten by modeling the node as M/M/1/N and MX/M/1/N. In order to keep accordance with the specified reliability of the given node under condition of traffic and manage memory resource effectively, feedback control system theory is adopted to dynamically allocate memory resource changing with the traffic.</p>		RFID Data Collection and Integration based on Mobile Agent <i>Jinghao Ju, Dong Wang, Huanye Sheng</i> , Shanghai Jiaotong University, CHINA <p>In the future, the Network includes not only computers connected with one another, but also mobile phones, PDAs (Personal Digital Assistants), embedded computers in objects such as cars, and even objects with RFID (Radio Frequency Identification) tags. First, terabytes of RFID related data are managed in a distributed way and mountains of new data need to be synchronized, filtered, analyzed, managed, and acted upon, often in real-time or near real-time; Second, RFID components need to be configured, deployed and updated dynamically and flexibly; Third, RFID users are often mobile users with low-speed network and low-power environment mobile devices. Considering all these things, this paper puts forward a solution using mobile agent technology to implement RFID data collection and integration. ...</p>	
16:20 – 16:40	Analysis of Interconnected Distribution Feeders under Unbalanced Operation Conditions using OrCAD PSpice <i>W-C Yang, *W-T Huang, *Y-D Gu</i> , Northern Taiwan Insti. of Science & Technology, TAIWAN, *Chienkuo Technology Univ., TAIWAN <p>This work investigates the unbalanced operation conditions of two interconnected radial distribution feeders. To connect two radial distribution feeders is an important method of improving the reliability of a distribution system. However, it also impacts the operation of the system. In this work commercial software, OrCAD PSpice is used to build three-phase equivalent models of the sample distribution system with two radial primary feeders, and investigate the unbalanced operation conditions of two sample feeders before and after an interconnection is made. Data that include the voltages, currents, power losses and unbalanced ratios of the sample feeders are presented and discussed. They are anticipated to be a useful reference for personnel in electrical utilities, to help them understand the unbalanced problems ...</p>		A Class of Disturbance-estimated Sliding Mode Control Strategy for Uncertain Networked Control System <i>Liman Yang, *Yunhua Li</i> , Beihang University, CHINA, *Beijing University of Aeronautics and Astronautics, CHINA <p>Aiming at the uncertain NCS with bounded long time delay, the time-varying network-delay is translated into constant loop-delay by setting the proper network interface, and the augmented plant model implicating delay information is established. Then for the uncertain part of system, a disturbance estimator is designed. On the basis of the above mentioned studies, a class of disturbance-estimated sliding mode control strategy is presented. Simulation study shows that above-mentioned method can overcome effectively the concurrent parameter perturbation and exterior disturbance as well as delay's adverse influence, and has good control performance and robustness.</p>		Analysis of State Transition Diagrams for RFID-Based Two-Way Access Control <i>Yan-Shi Dong, Bing-Ran Zuo, Patricia D Mackenzie, Joseph J Salvo</i> GE Global Research, CHINA <p>The logic for determining the passing direction of a person through a two-way access control portal is rather complicated. This paper analyzes the state transition diagrams based on sensor fusion data to clarify the confusing decision making logic. An RFID-based access control system, coupled with infrared sensors, is implemented in a two-way portal to verify the proposed technique.</p>	
16:40 – 17:00	Stability of Networked Control Systems Subject to a Multiple-packet Transmission Policy <i>Shawn Hu, Wei-Yong Yan</i> , Curtin University of Technology, AUSTRALIA <p>This paper is concerned with stability analysis of discrete-time networked control systems under a multiple-packet transmission policy. The packet dropping probability of the communication network is assumed to be known, or bounded by a given constant. Necessary and sufficient conditions for stability are obtained for the above two cases. For the second case, a formula is derived for a measure of the robustness of a system against packet dropping, termed packet dropping margin. A design method is proposed for improving the margin subject to the constraint that the system has a set of prescribed nominal closed-loop poles.</p>		A Kind of Sliding Mode Control Strategy based on Delay Estimation Online for Networked Control System with Stochastic Less Delay <i>Yunhua Li, *Liman Yang</i> , Beijing University of Aeronautics and Astronautics, CHINA, *Beihang University, CHINA <p>Aiming at the NCS with stochastic less delay, a discrete sliding mode control strategy based on delay estimation on-line is presented. The delay iterative measuring and pretest parameters-based estimating methods are adopted, and a sliding mode controller with loop-delay estimation online is designed to overcome the adverse influence caused by time-varying delay. Simulation study indicates that the above-mentioned algorithm has good control performance and also avoids large numbers of on-line mean and variant operations in normal stochastic control.</p>		Design of RFID Middleware based on Complex Event Processing <i>Liang Dong, Dong Wang, Huanye Sheng</i> , Shanghai Jiaotong University, CHINA <p>This RFID technology has brought a revolution in data collection, thus putting forward real time constraints in middleware architectural design. This paper introduces Complex Event Processing, an emerging technology for building and managing information systems, to discover, understand and report the meaningful events within processing streams. It discusses core principles for middleware to apply for the real time actions and the implementation of these principles through technologies such as Event Processing Language (EPL), caching strategy and active database. Moreover, the CEP-oriented middleware architecture is based on the latest Application Level Event (ALE) Specification from EPCglobal.</p>	

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17:00 – 17:20	An Approach to the Cost Reduction for Software Systems <i>Makoto Yoshida, *Noriyuki Iwane</i> , Okayama University of Science, JAPAN, *Hiroshima City University, JAPAN Quality, cost and delivery are the most crucial factors to be managed in developing software systems in the industry. The @ management of these software systems includes not only resolving the necessarily technical problems but also the organizational problems and the business problems. Companies depending upon their environments decide their own strategies to solve these problems. This paper describes the way we experimented in these several years to reduce the cost for software systems at the company to meet some software development solutions. The efforts of web-based application developments by the toolkit, the source code generator we developed, are evaluated. The toolkit extended to the software product line systems is described. And, the cost for the software life cycle is estimated.		Development of ARM-based Embedded System for Robot Applications <i>S. Yu, *W. Chen, Li Li, J. Qin</i> , Beijing Univ. of Aeronautics & Astronautics, CHINA, *Singapore Inst. of Manuf. Tech., SINGAPORE Based on the combination of advanced RISC microprocessor (ARM), DSP and ARM-Linux, this paper introduces an approach for developing embedded robot control systems. The design of embedded control system includes four aspects, i.e., system structure, functions, hardware, and software design. In the development of the system, some features are included such as hierarchy structure, modular hardware, and structured software, to make the system suitable for a variety of robots applications through some hardware adjustment and software customization only. The effectiveness of proposed approach has been verified by a straight line motion demonstration of a 6-DOF series manipulator.		The Reconfigurable Flip Chip Assembly System <i>Chen Zhou, Yuehong Yin, Han Ding</i> , Shanghai Jiaotong University, CHINA The electronic industry developed and expanded explosively recent years. By increasingly using of Flip Chip (FC) packaging technology, the boundary between three levels of packaging of micro-electronic systems became indistinct. The trend towards portable and hand-held devices also enlarges the market share of FC packaging, which will be the major packaging technology. Rapidly changing micro-electronic market calls for reconfigurable micro-electronic assembly systems with product variability, Responsiveness, non-obsolescence, and cost-effectiveness. The introduction of FC technology and reconfigurability of assembly system are discussed in this paper, and a reconfigurable FC assembly system is presented.	
	17:20 – 17:40	A Forecasting Model of Dynamic Grey Rough Set and its Application on Stock Selection <i>Ting Cheng Chang, Chuen-Jiuan Jane, *Yuan-Piao Lee</i> , Ling Tung University, TAIWAN, *Chienkuo Technology University, TAIWAN The main purpose of paper is to establish a system, which combines Rough Set and Grey Theory. This model is used to let the time-serial, season-serial or regular data have the dynamic trend concepts by Grey prediction, then, select the data sets with trend value through rough set screening system. It mainly is applied for a portfolio prediction in the stock market. Our study first predicts each listed company;s attributes of condition and decision-making by Grey Prediction, secondly groups their attributes by K-means grouping tools, then filters and categorizes the groups with the classified capacity of Rough Set for uncertain and non-sufficient information and selects the stock portfolio. And then we evaluate the company shares from the portfolio according to their past EPS and ROE and elect the better ones again. ...		Hand Gesture Recognition and Tracking based on Distributed Locally Linear Embedding <i>Shuzhi Sam Ge, Yong Yang, Tong Heng Lee</i> , National University of Singapore, SINGAPORE Due to the variations of posture appearance, the recognition and tracking of human hand gesture remain a difficult problem. In this paper, an unsupervised learning algorithm, Distributed Locally Linear Embedding (DLLE), is proposed to discover the intrinsic structure of the data, such as neighborhood relationships and global distributions. These discovered properties are used to compute their corresponding low-dimensional embedding, and then Probabilistic Neural Network (PNN) is employed and a database is set up for static gesture classification. For dynamic gesture tracking, we make use of the similarity measures among the images, hand gesture motion from a sequence of images can be tracked and dynamically reconstructed according to the image's relative position in the corresponding motion database. Experimental...		Fuzzy Recognition of Offline Handwritten Numeric Characters <i>Rukshan Batuwita, Dharmapriya Bandara</i> , University of Peradeniya, SRI LANKA Offline handwritten character recognition involves the recognition of handwritten character patterns in digital images. This is a challenging computational problem mainly due to the vast differences associated with the handwritten patterns of different individuals. Fuzzy Logic plays a major role in both offline and online handwritten character recognition, since a fuzzy system with an automatically generated rule base possesses the features of flexibility, efficiency and online adaptability. This paper presents an online adaptable fuzzy method for offline handwritten numeric character recognition.
17:40 – 18:00		A Realization Algorithm of Grey Structural Modeling with MATLAB <i>D. Yamaguchi, *G. Li, *K. Mizutani, *T. Akabane, **M. Nagai, M. Kitaoka</i> , Kanagawa Univ., *Teikyo Univ., **Kanagawa Univ. , JAPAN Grey Structural Modeling (GSM in short) is a new approach of system modeling methods succeeding to ISM and FSM. GSM has two procedures: estimating a hierarchy of given elements, estimating paths among given elements. The former procedure is constructed from complex equations. In this paper we developed one realization algorithm of the GSM procedure. The main problem we should solve is how to group given elements into several classes and to decide their hierarchy. We are possible to group analyzing an error matrix which is obtained from the localized grey relational grade, and we are also possible to decide their hierarchy according to the localized grey relational grade. We used the topological-based grey relational analysis. These procedures are shown as a pseudo language with several figures, ...				

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	T3D Chroen	Computer and Robot Vision Chair(s): Jui Jen Chou Atsuo Takanishi	T3E Charas I	Micro/Nano and Cellular Robots Chair(s): Hunmo Kim Danwei Wang	T3F Charas II	Intelligent Mobile Robots Chair(s): Chyi-Yeu Lin Janjai Bhuripanyo
16:00 – 16:20	An Intelligent People-Flow Counting Method for Passing Through a Gate <i>Thou-Ho (Chao-Ho) Chen, Tsong-Yi Chen, Zhi-Xian Chen</i> , National Kaohsiung University of Applied Science, TAIWAN Based on area and color analyses, a cost-effective bi-directional people counter dedicated to the pedestrian flow passing through a gate or a door is proposed. Firstly, the passing people are roughly counted with the area of people projected on an image captured by a zenithal video camera. The moving direction of the pedestrian can be recognized by tracking each people-pattern with an analysis of its HSI histogram. To improve the accuracy of counting, the color vector extracted from the quantized histograms of intensity or hue is introduced to refine the early counting. Besides, the inherent problems of both people touching together and merge/split phenomenon can be overcome. Experimental results show that an 100% accuracy of bi-directional counting can be achieved if the people ...		Flow Control of Nano Fountain Pen using Active Membrane Pumping <i>Young-Kwan Lee, Suk-Han Lee, Youn-Jea Kim, Hunmo Kim</i> , Sungkyunkwan University, KOREA In this paper, flow control of nano fountain pen using active membrane pumping is investigated. This FPN has been integrated with pumping chambers, micro channels, and a high capacity reservoir for continuous ink feeding. The control of fluid injection using active membrane pumping in chambers is the answer of the problem. The flow rates in channels with the presence of capillary force are theoretically analyzed, including the cantilever deflection and the control of mass flow rates by deflection of membrane. Then, the above results are compared with numerical results based on the commercial code, FLUENT.		Multi-Functional Intelligent Robot <i>Chyi-Yeu Lin, Chang-Kuo Tseng, Po-Chia Jo</i> , National Taiwan University of Science and Technology, TAIWAN This paper presents a multi-functional autonomous intelligent robot, DOC-1, which actions are exclusively driven by programs of artificial intelligence. The mechanism of this robot was designed so as to fulfill the needs defined by various functions such as gripping the character cubes and teacups, playing Gobang, and rotating and stacking cubes. Furthermore, emphasis was also placed on load lifting capability, weight reduction, energy conservation, and performance reliability. The serial port of the minicomputer is used as the communication interface between the software and electromechanical components. A custom-made chip serves as the control kernel that controls the motions of servo motors that move arms and head of the robot, two DC motors driving wheels and, a number of lights. ...	
16:20 – 16:40	State Estimation of Micro Autonomous Helicopter based on Computer Vision <i>Meng Na, Danian Zheng, Peifa Jia</i> , Tsinghua University, CHINA In order to achieve autonomous flight, micro helicopter should have the ability to estimate its state information. In this paper, a special target used as a landmark is designed and the corresponding recognition algorithm is developed, which mainly relies on the color feature. Besides, three algorithms of state estimation, linear and nonlinear optimization algorithms based on four planar feature points and data fusion technology are compared and analyzed respectively. Finally data fusion method is chosen for state estimation. Actual flight experiments show our object recognition algorithm is robust, efficient and has higher correct recognition rate (about 99%). Moreover the state estimation algorithm is accurate and simple in actual applications by the fusion of other sensors' information.		Design and Control Structure of a Miniature Robot for Micro Operation Task <i>Yu Song, Mantain Li, Lining Sun, Lei Qin</i> , Harbin Institute of Technology, CHINA A newly developed five D.O.F. (degrees of freedom) miniature mobile robot system is presented. It consists of a moving positioning module with macro/micro dual driven modes and a three rotational D.O.F. spherical micromanipulator module. With the macro motion mode, the robot is a typical wheeled mobile robot, which is driven by two small size brushless DC motors. With the micro motion mode, based on the principle of inchworm, the robot can move with micron resolution. To carry out micro operation process with the robot, a high/low-level style control system is designed. High-level control system is decision-making level, which consists of visual sensors and a host computer. Low-level control system is motion execution level, which is an embedded control system. Communication between two levels is realized...		Global Localization of Mobile Robots for Indoor Environments using Natural Landmarks <i>S H-Alamilla, *E Morales</i> , Instituto Tecno. y de Estudios Superiores de Monterrey, *Inst. Nac.I de Astrofisica, Optica y Electron., MEXICO This paper introduces a global localization system based on natural landmarks for indoor mobile robots. The proposed approach is based on recognition of natural landmarks from laser scanner data. A previously built grid-based map is pre-processed off-line to obtain a model of landmarks and their attributes for each cell. The robot's position and orientation are calculated by finding correspondence between the identified landmarks from robot's current position and the landmarks associated to the model. This proposed approach called GL2 follows a two stage process. Initially a fast initial filter based on the number and type of landmarks is used to substantially reduce the search space. The second stage uses a modified discrete relaxation algorithm to perform a more detailed analysis and ...	
16:40 – 17:00	Selection of Cameras Setup Geometry Parameters in Binocular Stereovision <i>Junchuan Liu, Yuru Zhang, Zhen Li</i> , Beihang University, CHINA This paper presents a method to determine the cameras setup geometry parameters in binocular stereovision to achieve the best three-dimensional positioning accuracy. Firstly, the cameras setup geometry is described using three independent parameters. Then the three-dimensional positioning error of the binocular stereovision is defined and formulated through triangulation. A graph is given to show how the parameters affect the error. Finally, an experiment is designed and performed to verify the result. An application of the result in our neurosurgical robot system is given to show the effectiveness of the result.		Modelling a Micro Manipulation System with Flexure Hinge <i>Adha Imam Cahyadi, Yoshio Yamamoto</i> , Tokai University, JAPAN This paper deals with the study of micro manipulation system that is composed of piezoelectric actuator attached on flexure hinge mechanism. It has been the fact that hysteresis is inherent in any piezoelectric actuators, especially when using voltage steering which is in turn can degrade the performance of the system thus it should be treated carefully. In this work, a simple Dahl model is constructed to capture the hysteresis effect together with the mechanical model. For simplicity, the nature of the micro manipulator is assumed to be modelled as lumped parameters. Then a hysteresis observer is constructed based on this model for estimating the hysteresis effect. Finally, some simulations are performed. It is seen that the hysteresis could be well estimated.		A Heuristic Reinforcement Learning for Robot Approaching Object <i>Bin Wang, Jiawei Li, *Hong Liu</i> , Harbin Institute of Technology, CHINA, *German Aerospace Center, GERMANY Autonomous approaching objects for an arm-hand robot is a very difficult problem because the possible arm-hand configurations are numerous. In this paper, we propose a modified reinforcement learning algorithm for a multifingered hand approaching target objects. The proposed approach integrates the heuristic search information with the learning system, and solves the problem of how an arm-hand robot approaches objects before grasping. In addition, this method also overcomes the problem of time consuming of traditional reinforcement learning in the initial learning phase. The algorithm is applied to an arm-hand robot to approach objects before grasping, which can enable the robot to learn ap-approaching skill by trial-and-error and plan its path by itself. The experimental results demonstrate the ...	

Robotics, Automation & Mechatronics					Thu 8 June 16:00–18:00	
	T3D Chroen	Computer and Robot Vision Chair(s): Jui Jen Chou Atsuo Takanishi	T3E Charas I	Micro/Nano and Cellular Robots Chair(s): Hunmo Kim Danwei Wang	T3F Charas II	Intelligent Mobile Robots Chair(s): Chyi-Yeu Lin Janjai Bhuripanyo
17:00 – 17:20	Crop Identification for Automated Processing Systems with Wavelet Packet Analysis and Weighted Bayes Distance <i>Chun Ping Chen, *Jui Jen Chou</i> , InterVideo Digital Tech Inc., TAIWAN, *National Taiwan University, TAIWAN <p>This study proposes a novel approach for crop identification by using wavelet packet transform combined with weighted Bayes distance based on crop texture and leaf features. Automatic processing in agriculture requires accurate identification of crops to target plants for treatment according to their needs. Wavelet analysis, featuring spatial/frequency localization, data compression, denosing, data analysis/data mining, etc., is a good candidate for identifying crops. However, if the energy of wavelet packet coefficients is the sole identifying characteristic, results may vary significantly depending on different factors such as weather, plant density, growth stage, and sunlight, etc. To overcome these variations, the weighted Bayes distance is introduced for an identification criterion, also referred to as the decision distance, ...</p>		Micro-Manipulator Design based on Selectively Actuated Flexure Parallel Mechanisms <i>Huy-Hoang Pham, *I-Ming Chen</i> , Hochiminh City Univ. of Technology, VIETNAM, *Nanyang Technological Univ., SINGAPORE <p>The concept of Selective Actuation (SA) is introduced in Flexure parallel mechanism (FPM) design. A selectively actuation FPM has decoupled motion mechanical structure as well as a modularly mounted 1-DOF actuator for each motion axis of the FPM. The kinematic structure of SA-FPM is obtained based on the diagonal form of the manipulator Jacobian and screw-based synthesis approach. The flexure structure of SAFPM is designed based on the result of the synthesis process. The designs of a 3-DOF translational SA-FPM and a 6-DOF spatial SA-FPM are illustrated based on the proposed approach. Prototype of the 3-DOF SA-FPM is constructed. Experiment conducted on the prototype confirmed the motion requirement and performance set by the SA-FPM.</p>		A Force Field Method Based Multi-Robot Collaboration <i>Dikai Liu, Dalong Wang, Gamini Dissanayake</i> , University of Technology, Sydney, AUSTRALIA <p>A force field (F2) based multi-robot collaboration method is presented in this paper. In this method, a virtual force field is generated for every moving robot and continuously changing based on the robot status including its traveling speed, dimension, priority, location and environment, etc. The interactions among robots?force fields and obstacles provide a natural way for collision avoidance and collaboration while robots are on their way to goals. In this paper, the definition of reaction force direction is modified to reduce robot orientation oscillations which occur when a robot approaches obstacles or other robots. Then the influence of task priority on motion planning and the problem of deadlock in multi-robot cases are discussed. Simulations in a real indoor environment were carried out and demonstrated ...</p>	
17:20 – 17:40	Object Localization using Stereo Sensors for Adept SCARA Robot <i>C R Hema, M P Paulraj, R Nagarajan, Sazali Yaacob</i> , Northern Malaysia University, MALAYSIA <p>In this paper we present a stereo vision system for segmentation of partially occluded objects and computation of object grasping point in bin picking environments. The stereo vision system was interfaced with an Adept SCARA Robot to perform bin picking operations. Most researches on bin picking involve combination of vision and force sensors, however in this research an attempt is made to develop a bin picking system using only vision sensors for bin pick and place operation. An algorithm to segment partially occluded objects is proposed. The proposed stereo vision system was found to be effective for partially occluded objects and in the absence of albedo effects. The results are validated through real time bin picking experiments on the Adept Robot.</p>		Development of Precision Robot Manipulator using Flexure Hinge Mechanism <i>Gwang-Jo Chung, Kee-Bong Choi, Jin-Ho Kyung</i> , Korea Institute of Machinery and Materials, KOREA <p>This paper describes a tentative results obtained on the way of developing the nano order precision robot that works with the resolution of 10nm or less. For precision positioning of robot manipulator, we adopt the flexure hinge mechanism composed with notches and holes that allows high stiffness and easy applications to construct the parallel manipulator. As a hardware for in plane motion of manipulator with the workspace of 100umx100um, we suggests 2 kinds of planar parallel driving stage, one is developed using 3 PPR structure, composed with three axes of two prismatic joints and one rotational joint each, and the other is developed using 2 dimensional parallel linear spring mechanism that shows good positioning accuracy up to 3 nm. Next, we implement the 3 dimensional out-of-range motion mechanisms to ...</p>		A Novel Transformable Cobot <i>Chanpat Supaphon, Witaya Wannasuphopsrit</i> , Chulalongkorn University, THAILAND <p>Collaborative robot or Cobot, is a class of robotic devices designed to work directly with human operator within the same workspace. Cobots are inheritably passive and thus safe for direct physical interacting with human operators. Cobots use CVT (Continuously Variable Transmission) connecting between their joints to constraint direction of motion. Several cobots have been developed in recent years. All have fix configurations and some will be reviewed. In this paper, we propose a novel transformable Cobot, called T-Cobot which is able to expand or retract its configuration. Designs and construction of T-Cobot prototype is described. Then, kinematics is presented with computer simulation. In addition, experiment results in free and path mode are provided.</p>	
17:40 – 18:00	A Cylindrical Virtual Space Based Catadioptric Real-Time Panorama Imaging System <i>Wei Wang, *Zongsheng Cao</i> , National University of Defense Technology, CHINA, *Chinese Academy of Sciences, CHINA <p>Since it has small field of view and only records the light intension of scene, the regular optical imaging system is short of immersion and stereo vision. The needs for stereo apperception and recurrence of large field of view scene are emerging due to the development of robot navigation technology and virtual reality technology. Some panoramic stereo imaging technologies have been developed under the drive of optoelectronics and computer vision and graphics. In this paper, a new method to construct cylindrical image-based virtual space (IBVS) automatically with smooth quadric convex curved mirror catadioptric imaging is proposed, and the projection transformation with conic reflection surface and telecentric lens is described in detail. The method to transform pixel point at image plane taken by camera into...</p>		Desktop Micro Machining System by Multiple Micro Robots <i>H. Aoyama, O. Fuchiwaki, D Misaki, T. Usuda</i> , Univ. of Elect-Comm., Shizuoka Inst. of Sci.&Tech., Adv.Indus. Sci.&Tech., JAPAN <p>This paper describes the unique micro machining system performed by mutiple microrobots. These microrobots, which are composed of piezo elements and electromagnets, can move precisely with the manner of an inchworm on the steel plate. And these robots are equipped with the micro tools such micro drill and micro indenter to provide various micro works with much of flexible layout on the desktop. In this report, two typical applications are to be demonstrated. One of them is that two small robots can collaborate to make thin through-hole of 50 micron under the combination of global and local path control. Here the sample plate attached on the small robot can be positioned precisely to the other robot with micro drill tool, and the relative position between the sample and the tool can be controlled under the local ...</p>		Maggie: A Robotic Platform for Human-Robot Social Interaction <i>M Salichs, R Barber, A Khamis, M Malfaz, J F Gorostiza, R Pacheco, Rafael Rivas, *et Al</i> , Universidad Carlos III de Madrid, SPAIN. <p>Human-robot social interaction plays an important role in spreading the use of the robot in human daily life. Through effective social interaction, robots will be able to perform many tasks in the human society. These tasks may include, but not limited to, handling various house duties, providing medical care for elderly people, assisting people with motor or cognitive disabilities, educational entertainment (edutainment), personal assistance, giving directions at information points in public places, etc. These applications need to develop social robots that are able to behave with humans as partners if not peers. This paper presents Maggie, a robotic platform developed at UC3M RoboticsLab for research on human-robot social interaction. The different developed interaction modules are also described.</p>	

NOTES



TECHNICAL PROGRAM

Friday
8 June 2006

Session 1
10:00 – 12:00

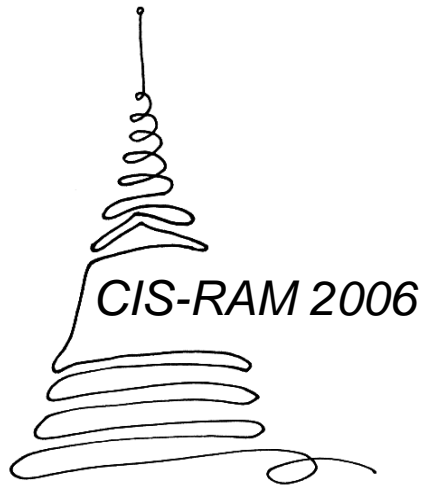
Cybernetics & Intelligent Systems					Fri 9 June 10:00–12:00	
	F1A Bumrang	Evolutionary Computation I Chair(s): Ponnambalam Sivalinga Govindarajan Prasong Praneetpolgrang	F1B Rong	Data Mining and Management Chair(s): Philippe Lenca Chandra Bala	F1C Charu	Neural Netwok II Chair(s): Paulo Gil Chun Che Fung
10:00 – 10:20	Multi-point Simulated Annealing with Adaptive Neighborhood <i>Keiko Ando, Mitsunori Miki, Tomoyuki Hiroyasu, Doshisha University JAPAN</i> <p>When Simulated Annealing (SA) is applied to continuous optimization problems, the design of the neighborhood used in SA becomes important. Many experiments are necessary to determine an appropriate neighborhood range in each problem, because the neighborhood range corresponds to distance in Euclidean space and is decided arbitrarily. We propose Multi-point Simulated Annealing with Adaptive Neighborhood (MSA/AN) for continuous optimization problems, which determines the appropriate neighborhood range automatically. The proposed method provides a neighborhood range from the distance and the design variables of two search points, and generates candidate solutions using a probability distribution based on this distance in the neighborhood, and selects the next solutions from them based on the ...</p>		On the Robustness of Association Rules <i>Philippe Lenca, *Benoit Vaillant, **Stephane Lallich, GET/ENST Bretagne,*Universite de Bretagne-Sud, **University Lyon 2, FRANCE</i> <p>Association rules discovery is one of the most important tasks in Knowledge Discovery in Data Bases. The rules produced with Apriori-like algorithms are then usually used for decision aiding in expert and knowledge based systems and/or by a human end user. Unfortunately such algorithms may produce huge amounts of rules and thus one of the most important steps in association rules discovery is nowadays the evaluation and the interpretation of their interestingness. Objective measures provide numerical information on the quality of a rule and a rule is said "of quality" if its evaluation by a measure is greater than a user defined threshold. In this paper we propose a new specificity of association rule objective interestingness measures: the threshold sensitivity. By dealing with this problem we intend to provide means of ...</p>		Hidden Unit Reduction of Artificial Neural Network on English Capital Letter Recognition <i>Kietikul Jearanaitanakij, Ouen Pinngern, King Mongkut's Institute of Technology, Ladkrabang, THAILAND</i> <p>We present an analysis on the minimum number of hidden units that is required to recognize English capital letters of the artificial neural network. The letter font that we use as a case study is the System font. In order to have the minimum number of hidden units, the number of input features has to be minimized. Firstly, we apply our heuristic for pruning unnecessary features from the data set. The small number of the remaining features leads the artificial neural network to have the small number of input units as well. The reason is a particular feature has a one-to-one mapping relationship onto the input unit. Next, the hidden units are pruned away from the network by using the hidden unit pruning heuristic. Both pruning heuristic is based on the notion of the information gain. They can efficiently prune away the</p>	
	Intelligent Exploration Method to Adapt Exploration Rate in XCS, based on Adaptive Fuzzy Genetic Algorithm <i>Ali Hamzeh, Adel Rahmani, Nahid Parsa, Iran University of Science and Technology, IRAN</i> <p>In this paper, we propose an extension to the Intelligent Exploration Method which is introduced in our previous work. IEM is an intelligent exploration method that is used to tune the exploration rate in XCS. In this paper we improve the IEM's performance using a learning fuzzy controller instead of the static one in IEM. The new system is called IEMII (IEM 2) and is compared with the IEM and the traditional XCS in some benchmark problems.</p>		An Obstacle Avoidance Strategy to Ant Colony Optimization Algorithm for Classification in Event Logs <i>Vivek Vijaykumar, Chandrasekar Ramachandran, Srinivasan Thanukrishnan, Sri Venkateswara College of Engineering, INDIA</i> <p>This paper presents a novel approach to the ant colony optimization algorithm by using an obstacle avoidance strategy for mining classification rules from event log file datasets. An obstacle is purported to be present on a path as a classification rule is incrementally discovered if the rule convergence time is high or the degree of change between successive modifications to the rule exceeds a certain threshold value. By assigning zones to complete paths in a region based on the associated average obstacle density and prioritizing them, classification rules are discovered in descending order of the priorities of zones to enable faster mining in more obstacle-free paths. Experimental results are shown describing a comparative study with the popular C5 algorithm for the event log file datasets</p>		Feature Extraction and Interval Filtering Technique for Time-series Forecasting using Neural Networks <i>Wiphada Wettayaprasit, Pornpimon Nanakorn, Prince of Songkla University, THAILAND</i> <p>This paper presents the algorithm for feature extraction and interval filtering technique for time-series forecasting using multilayer perceptron neural networks. The algorithm has four parts. The first part is data filtering and interval process. The second part is input feature extraction process from neural networks. The third part is time-series input variables forecasting process. The fourth part is time-series rainfall forecast process. The study uses weather data from the Meteorological Department of Thailand and the United States of America. The experimental results for rainfall forecast receive high accuracy comparing with other methods.</p>	
10:40 – 11:00	Particle Swarm Assisted Incremental Evolution Strategy for Function Optimization <i>Wenting Mo, Sheng Uei Guan, National University of Singapore, SINGAPORE</i> <p>This paper presents a new evolutionary approach for function optimization problems Particle Swarm Assisted Incremental Evolution Strategy (PIES). Two strategies are proposed. One is incremental optimization that the whole evolution consists of several phases and one more variable is focused in each phase. The number of phases is equal to the number of variables in maximum. Each phase is composed of two stages: in the single-variable evolution (SVE) stage, a population is evolved with respect to one independent variable in a series of cutting planes; in the multi-variable evolving (MVE) stage, the initial population is formed by integrating the population obtained by the SVE in current phase and by the MVE in the last phase. And then the MVE is taken on the incremented variable set ...</p>		A Robust Algorithm for Classification using Decision Trees <i>Chandra Bala, Pallath Paul Varghese, Indian Institute of Technology, Delhi, INDONESIA</i> <p>Decision trees algorithms have been suggested in the past for classification of numeric as well as categorical attributes. SLIQ algorithm was proposed (Mehta et al, 1996) as an improvement over ID3 and C4.5 algorithms (Quinlan, 1993). Elegant Decision Tree Algorithm was proposed (Chandra et al 2002) to improve the performance of SLIQ. In this paper a novel approach has been presented for the choice of split value of attributes. The issue of reducing the number of split points has been addressed. It has been shown on various datasets taken from UCI machine learning data repository that this approach gives better classification accuracy as compared to C4.5, SLIQ and Elegant Decision Tree Algorithm (EDTA) and at the same time the number of split points to be evaluated is much less compared to that of SLIQ and EDTA.</p>		Efficient Prediction of Foreign Exchange Rate using Nonlinear Single Layer Artificial Neural Model <i>R. Majhi, *G. Panda, **G. Sahoo, College of Eng., Bhubaneswar, *National Inst. of Tech, Jamshedpur, **Birla Inst. of Tech, Mesra, INDIA</i> <p>The presenting paper proposes an efficient adaptive forecasting model for one month ahead prediction of foreign exchange using single layer artificial neural network. Using real time series of rupees, pounds and yens the dollar exchange rate is predicted in each case. It is demonstrated that the proposed nonlinear model yields excellent prediction in each case.</p>	

Cybernetics & Intelligent Systems					Fri 9 June 10:00–12:00	
	F1A Bumrang	Evolutionary Computation I Chair(s): Ponnambalam Sivalinga Govindarajan Prasong Praneetpolgrang	F1B Rong	Data Mining and Management Chair(s): Philippe Lenca Chandra Bala	F1C Charu	Neural Network II Chair(s): Paulo Gil Chun Che Fung
11:00 – 11:20	Hybrid Ant Solony System for Solving Quadratic Assignment Formulation of Machine Layout Problems <i>Ramkumar A. S., *Ponnambalam Sivalinga Govindarajan, Amrita School of Engineering, INDIA. *Monash Univ. Malaysia, MALAYSIA</i> <p>The quadratic assignment problems (QAPs) are the problem of assigning 'n' facilities to 'n' locations so that the assignment cost is minimized, where the cost is defined by a quadratic function. In this paper we investigate and present the application of population based hybrid ant-colony system (PHAS) metaheuristic for solving machine (facility) layout problems formulated as quadratic assignment problem, a wellknown NP hard combinatorial optimization problem. Antcolony system is a model for designing metaheuristic algorithms for combinatorial optimization problems. The PHAS ant system algorithm incorporates population-based ants in its initial phase instead of small number of ants and probability based pheromone trail modification. We tested our algorithm on the benchmark instances</p>		Mining Positive and Negative Association Rules from Large Databases <i>Chris Cornelis, *Peng Yan, *Xing Zhang, *Guoqing Chen, Ghent University, BELGIUM, *Tsinghua University, CHINA</i> <p>This paper is concerned with discovering positive and negative association rules, a problem which has been addressed by various authors from different angles, but for which no fully satisfactory solution has yet been proposed. We catalogue and critically examine the existing definitions and approaches, and we present an Apriori-based algorithm that is able to find all valid positive and negative association rules in a support-confidence framework. Efficiency is guaranteed by exploiting an upward closure property that holds for the support of negative association rules under our definition of validity.</p>		Pattern Classification using Polynomial Neural Network <i>B. Misra, S. C. Satapathy, B. N. Biswal, P. K. Dash, *G. Panda, College of Eng., Bhubaneswar, *National Inst. of Tech., INDIA</i> <p>In this paper we present polynomial neural network (PNN) model using the Group Method of Data Handling to generate a nonlinear time series for classification of patterns. The proposed method considers nonlinear characteristics of the datasets and tries to evolve a polynomial using polynomial neural network that will approximate it to arbitrary token values representing the different classes in the dataset. The approach suggested finds the coefficients of PNN model by means of least square estimation technique. The PNN evolves its layers and number of neurons in each layer after evaluating the fitness function till it attains satisfactory result. Empirical result shows that PNN designed classifier performs better than many other classifier models on selected data sets using less number</p>	
11:20 – 11:40	Issues of Binary Representation in Evolutionary Algorithms <i>Swee Chiang Chiam, Chi Keong Goh, Kay Chen Tan, National University of Singapore, SINGAPORE</i> <p>Recent studies show that evolutionary algorithms are effective optimization tools for their success in solving realworld problem with complex and competing specifications. Although their performances are greatly influenced by the type of representation adopted, this choice often arises from intuition and guesswork due to the absence of proper guidelines and framework. This paper considers binary representation and presents a comprehensive study on its issues, identifying the key factors that affect its algorithmic performance. Furthermore, two metrics are proposed to generalize the concept of preservation which quantifies the similarities between the genotype and phenotype search space. The two classical translation codes i.e. binary and gray will be studied based on the identified factors and a preservation analysis revealed the differences between them.</p>		A Comparative Study for Outlier Detection Techniques in Data Mining <i>A. B. Zuriana, M. Rosmayati, A. Akbar, *M. D. Mustafa, Univ. College of Sci. & Tech, *College Univ. Tech. Tun Hussein Onn, MALAYSIA</i> <p>Existing studies in data mining mostly focus on finding patterns in large datasets and further using it for organizational decision making. However, finding such exceptions and outliers has not yet received as much attention in the data mining field as some other topics have, such as association rules, classification and clustering. Thus, this paper describes the performance of control chart, linear regression, and Manhattan distance techniques for outlier detection in data mining. Experimental studies show that outlier detection technique using control chart is better than the technique modeled from linear regression because the number of outlier data detected by control chart is smaller than linear regression. Further, experimental studies shows that Manhattan distance technique outperformed compared with the other techniques when the threshold values increased.</p>		Simulation and Experiment Study of Neural Network PID Controller in Central Air-conditioning System <i>Jiangjiang Wang, *Dawei An, North China Electric Power University, CHINA, *Tianjin University, CHINA</i> <p>This paper studied the application of neural network PID in the central air-conditioning system. From the control viewpoint, the central air-conditioning system has chrematistic as large inertia, delay and nonlinear and uncertain disturbance factor, for example the indoor and outdoor. In order to acquire better performance in the central air-conditioning system, the neural network PID control was studied through comparing the traditional PID control in simulation and experiments. The output of system was predicted through the algorithm of nonlinear, at last based on the mathematical model of air-conditioning space, the simulation and the experiment in a studio of TV station have found that neural network PID controller has the capability of self-studying and self-adapting and obtain faster response and better performance.</p>	
11:40 – 12:00	An Investigation on Noisy Environments in Evolutionary Multi-Objective Optimization <i>Chi Keong Goh, Swee Chiang Chiam, Kay Chen Tan, National University of Singapore, SINGAPORE</i> <p>In addition to the need of satisfying several competing objectives, many real-world applications are also characterized by a certain degree of noise, manifesting itself in the form of signal distortion or uncertain information. While studies have shown that many multi-objective evolutionary optimizers are capable of achieving optimization goals, their ability to deal with noise is rarely studied. In this paper, extensive studies are carried out to examine the impact of noisy environments in evolutionary multi-objective optimization based upon five benchmark problems characterized by different difficulties in local optimality, non-uniformity, discontinuity and non-convexity. Interestingly, the baseline algorithm employed tends to evolve better solution sets in the presence of low noise levels for some problems. Nevertheless,</p>		Medical Data Classification using Logical Similarity Based Measures <i>kalle Saastamoinen, Jaakko Ketola, Lappeenranta University of Technology, FINLAND</i> <p>In this article we study what kind of results can be established using logical similarity measures in classification of some well-known medical data. New approach for the detection of liver disorders, thyroid, diabetes and breast cancer. We compare our results to some known results and show that these logical comparison measures are able to give better results.</p>		On State-Space Neural Networks for Systems Identification: Stability and Complexity <i>Paulo Gil, Jorge Henriques, Antonio Dourado, *H. Duarte-Ramos, Universidade de Coimbra, *The New Univ. of Lisbon, PORTUGAL</i> <p>The problem of order estimation and global stability in affine three-layered state-space neural networks is here addressed. An upper bound for the number of neurons to be inserted in the hidden layer is computed using a subspace technique. Regarding the neural predictor's stability some sufficient conditions for the global asymptotic stability are presented using the Lyapunov stability theory and the contraction mapping theorem.</p>	

Robotics, Automation & Mechatronics					Fri 9 June 10:00–12:00	
	F1D Chroen	Electro-hydraulic System Control Chair(s): Tieshi Zhao Wei Tech Ang	F1E Charas I	Spherical Actuator and Manipulator Chair(s): Qiang Zhan Haibin Yuan	F1F Charas II	Dynamics and Control III Chair(s): Sylvain Miossec Thira Jearsiripongkul
10:00 – 10:20	Research on Modeling and Simulation of Aircraft Taxiing Rectification <i>Bo Li, Zongxia Jiao, Shaoping Wang</i> , Beijing University of Aeronautics and Astronautics, CHINA For ideal condition, applied the same brake instruction signals to the aircraft right and left brake devices, the main wheels brake synchronously, and the aircraft doesn't yaw. Whereas considering the side wind, the asymmetry of brake devices and the differences between tire and course coefficients, the aircraft may yaw. By analyzing the causations of aircraft deviation from the course during taxiing, the aircraft dynamic model with side wind is built, and a kind of differential braking control law based on slip ratio is proposed. Simulation results show that, by introducing this law the difference of brake tire velocities is eliminated, thereby aircraft can run along the correct course.		Fuzzy Decision Support System for Electric Utilities Fault Comprehensive Evaluation in Electric Control System <i>Haiwen Yuan, Haibin Yuan, Xingshan Li</i> , Beihang University, CHINA Aim at existing fault evaluation practice for electric utilities diagnosis and maintenance prediction, a novel fuzzy decision support system (FDSS) architecture based on simulation platform is presented. The specialty is that the information of all the fault factors that influence component failure are simulated through the platform according to specific requirement. FDSS architecture and theoretical analysis model using fuzzy decision engine method is presented, all factors used for decision making are taken into consideration and determined by the severity of failure through corresponding consequence analysis using fuzzy algorithm. A simplified application evaluation process is introduced to show the feasibility and potential benefits. The proposed FDSS can deal with test or field evaluation process ...		Design of Thrusters Configuration and Thrust Allocation Control for a Remotely Operated Vehicle <i>Cheng Siong Chin, Micheal Wai Shing Lau, Eicher Low, Gerald Gim Lee Seet</i> , Nanyang Technological University, SINGAPORE The paper addresses method of thruster configuration and thrust allocation control for an underactuated remotely operated underwater vehicle (ROV). With the opposing axial velocity generated by the propeller and the thruster-to-ROV surface interaction, good thruster configuration on the ROV platform is required. The paper concentrates on finding a thruster configuration on the ROV using one-norm algorithm and comparing it with modified singular values method. The thrust allocation control that determine the voltage input to each thruster has shown to achieve a lower voltage input to thrusters and better thrusters' utilization as compared to the one without the thrust allocation. Illustrative simulations are provided to demonstrate the effectiveness and correctness of the proposed methods on the ROV.	
10:20 – 10:40	Active Control on Fluid Borne Pulsation using Piezoelectric Valve as Absorber <i>Pingchao Ouyang, Zongxia Jiao, Hongmei Liu, Shuli Li, Yunhua Li</i> Beijing University of Aeronautics and Astronautics, CHINA With the development of the aircraft hydraulic power supply system towards high pressure and large load, the fluid borne pulsation has become increasingly a vital problem demanding an urgent solution. Passive pulsation dampers have been used traditionally to reduce the fluid borne pressure pulsations of high frequencies, but the application of such passive devices are limited in low frequency conditions because of their bulk volumes and poor performances. This paper presented a vibration active control method using piezoelectric direct drive servovalve to reduce the vibration of fluid power supply and pipeline systems. The theory of vibration active control based on the piezoelectric direct drive servo was illustrated in detail. Models of the piezoelectric direct drive servovalve, aero-pump and ...		Dynamic Trajectory Planning of a Spherical Mobile Robot <i>Qiang Zhan, Tingzhi Zhou, Ming Chen, Sanlong Cai</i> , Beijing University of Aeronautics and Astronautics, CHINA A spherical mobile robot, BHQ-1, designed for environment exploration, was briefly introduced. The dynamic model of BHQ-1 was established with a simplified Boltzmann-Hamel equation. From the dynamic model the expressions of the input moments of two motors to drive the robot are deduced when the robot moves along straight trajectory and circular trajectory separately. Simulation result of the robot to track a complex trajectory and experiments of the robot to avoid an obstacle show the trajectory planning method is effective.		A Collision Detection Algorithm using Particle Sensor <i>Nida Saenghaengtham, Pizzanu Kanongchaiyos</i> , Chulalongkorn University, THAILAND Most collision detection techniques based on hierarchical bounding representation usually cannot handle deformable objects efficiently because their bounding representations have to be updated when surface deformation occurs. Therefore, this research presents an alternative algorithm for collision detection among non-rigid deformable polygonal models using particle sensor. LBG quantization is firstly applied for partitioning objects' surface into k areas, which k corresponds to the approximated number of objects that can touch the surface. Each area is then assigned with a particle moving inside by the attractive forces between the particle and other particles on neighboring objects. Collision between objects is detected when the distance between a pair of corresponding particles becomes very small. ...	
10:40 – 11:00	Research on Automatic Drive Technology of High-speed Railway Rail-laying Vehicles <i>Yulong Zhao, *Yunhua Li, *Limn Yang</i> , Beihang University, CHINA *Beijing University of Aeronautics and Astronautics, CHINA The high-speed railway rail-laying vehicles is large-scale special vehicles, its automatic drive can improve precision and efficiency for laying rail. This paper presents rail-laying vehicle framework and automatic driving function, designs automatic drive control system based on CAN-bus. Especially, hydraulic steer model is set up by analyzing the steer system of rail-laying vehicles, resolves the bottleneck problem of automatic steering during vehicles automatic drive by studying rail-laying vehicles' guiding method and fuzzy adapting PID control strategy of automatic steering. Simulation experiment proves this method is effective.		Numerical Orientation Workspace Analysis with Different Parameterization Methods <i>G Yang, W Lin, *S K Mustafa, *I-Ming Chen, *Song Huat Yeo</i> , Singapore Inst. of Manufact. Tech., *Nanyang Tech. U., SINGAPORE For numerical orientation workspace analysis, a finite partition of the orientation workspace in its parametric domain is necessary. Among various parameterization methods for rigid-body rotations, it has been realized that the Euler angles, the Tilting-and-Torsion (T&T) angles, and the exponential coordinates are appropriate for finite partition. With these three parameterization methods, the rigid body rotation group, i.e., the Special Orthogonal Group (SO(3)), can be mapped to a rectangular parallel-piped (for Euler angles), a solid cylinder (for T&T angles), and a solid sphere (for exponential coordinates). To simplify the computation, isotropic/equi-volumetric partition schemes are proposed for the three geometric entities so that each of them can be geometrically divided into finite elements with equal volumes. ...		A Method for Trajectory Optimization of Robots having Contacts or Motion Constraints <i>Sylvain Miossec, Kazuhito Yokoi, Abderrahmane Kheddar</i> , Advanced Industrial Science and Technology, JAPAN The problem of motion trajectory optimization with constraints is considered for robotic system with actuated joints. Constraints concern contacts and path-following in the Cartesian space. These constraints arise in walking patterns. In this study we are dealing with cases where the same constraints hold during a given motion. The trajectory optimization is performed by defining some state variables as polynomials, and the best parameters of the polynomial functions are obtained from suitable optimization programs. By taking into account motion constraints, it appears that the number of the problem's optimization parameters can be reduced. Subsequently, the structure of the optimization problem is different. A procedure to solve this optimization problem is proposed. ...	

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11:00 – 11:20	Study of Motion Synchronization for Dual-path Electro-hydraulic Control Systems based on Computer Visual Feedback <i>Chao Li, *Yunhua Li, Liman Yang</i> , Beihang University, CHINA, *Beijing University of Aeronautics and Astronautics, CHINA The paper develops a new measurement system based on computer visual feedback and adopts the nonlinear control method for measuring and controlling the synchronization error of dual-cylinder-group electro-hydraulic system in the pushing railway bridge machinery. According to theory of computer visual feedback, a new kind of model of measurement system and the algorithm of transformation of coordinates is proposed to detect the bridge's position and attitude with the adoption of CCD sensors and image-processing on real-time. A kind of dual-loop controller is designed by modifying conventional PID controller. The simulation results verify the effectiveness of the conclusions.		Design & Prototyping of a Novel Omni-Directional Wheel using Porgressive Wave Method <i>C K Lim, I-Ming Chen, L Yan, *G Yang, *W Lin</i> , Nanyang Techl Univ., S'PORE, *S'pore Institute of Manufacturing Technology, SINGAPORE A new actuation approach coined as the "Progressive Wave Method" (PWM) was proposed recently. The novelty lies in recognizing propagating electromagnetic wave generated from energized electromagnets in free space and visualizing them as "virtual gears", which is analogous to mechanical gears employed in conventional gearing system. The heart of motion generation rest in the contactless meshing of the "virtual gears" created from electromagnets and permanent magnets. This technique offers a simpler alternative in the directional and velocity control aspect. This paper details the design of a novel omni-directional wheel. The primary objective was to implement this innovative wheel in replacement of traditional robotic platform using differential steering system with omni-directional wheels. ...		Disk Brake Squeal: Modeling and Active Control <i>Thira Jearsiripongkul, *Daniel Hochlenert</i> , Thammasat University, THAILAND, *Darmstadt University of Technology, GERMANY Considerable effort is spent in the design and testing of disk brakes of modern passenger cars. This effort can be reduced if refined mathematical-mechanical models are used for studying the dynamics of these brakes before prototypes are available. The present paper is devoted to the modeling of a floating caliper disk brake, special regard being given to the suppression of squeal. A simplified model for the dynamics of a floating caliper disk brake is presented. The model includes the brake disk, modeled as a flexible rotating plate, caliper and brake pads. In the model all the prominent features of squeal are reproduced, such as e.g. independence of the frequency on the speed, etc. For a moderately wide frequency range (1-5 kHz) the transverse vibration of the disk plays a significant role in squeal. ...	
11:20 – 11:40	FPGA Implementation of Closed-loop Control System for Small-sized RoboCup <i>Chirot Charitkhuan, Janjai Bhuripanyo, Rerngwut Choomuang</i> Sripatum University, THAILAND In the small version of the RoboCup competition, some hardware designers utilize off-the-shelf controller such as: LM629 etc. to setup a PID control loop for each individual motor on the wheel. The drawback of such approach is the unbalanced synchronization of the controllers because the programmer has to send a series of command bytes to each controller individually one by one. This creates a time lag of at approximately 12+ μ S for each controller setup. The time lag for such controllers varies depending on the number of controllers involved with the move. For a typical 4 wheel robot, such the time lag can vary up to 3 setup times lag (36+ μ S) between the setup of the 1st to the setup of the 4th motor. The purpose of this paper is to use the proposed field programmable gate array (FPGA) implementation ...		Development of a Bio-Inspired Wrist Prosthesis <i>S K Mustafa, *G Yang, S H Yeo, *W Lin, C B Pham</i> , Nanyang Technological U., *S'pore Inst. of Manufact. Technology, SINGAPORE This paper presents a novel mechanical design of a 3-DOF wrist prosthesis. Mimicking biological solutions from the human arm anatomy, the wrist prosthesis is designed to have a parallel structure and is cable-driven. This results in a much lighter prosthesis, with higher loading capacity as compared to a rigid-linked, serial structured design. Based on the wrist joint capabilities, this paper focuses on the cable tension, stiffness and workspace analyses. This is to develop a comprehensive framework to optimize the wrist prosthesis design. Finally, a prototype is fabricated based on the optimization results.		Multiple Impedance Control of Redundant Manipulators <i>S Ali A Moosavian, Majid Mostafavi</i> , K. N. Toosi University of Technology, IRAN The Multiple Impedance control (MIC) enforces a designated impedance on all cooperating manipulators, and the manipulated object itself. A redundant manipulator exploits more degrees of freedom than those required to achieve the desired position and orientation of the end-effector. In this paper, the MIC law is extended to control cooperative redundant manipulators in the presence of impacts due to contact with the environment. Due to redundancy, the jacobian velocity matrix is non-squared. However, in the proposed method the adjustment of robot behavior is done without calculation of inverse of this jacobian matrix. The extended formulation of the MIC algorithm is presented, and a system of two cooperating redundant planar manipulators carrying a common object is studied.	
11:40 – 12:00					Computing 4-Fingered Force-Closure Grasps from Surface Points using Genetic Algorithm <i>Chalermsub Sangkhavijit, Nattee Niparnan, Prabhas Chongstitvattana</i> , Chulalongkorn University, THAILAND This work proposes an evolutionary computation method to compute force-closure grasps from surface points. The object is presented as set of points. The proposed method searches for grasping configurations without prior knowledge of object's geometry. The experiment is carried out to validate the proposed method. The result when compared with a random search method shows that the proposed method finds more and better grasping configurations.	

NOTES



TECHNICAL PROGRAM

Friday
9 June 2006

Session 2
13:30 – 15:30

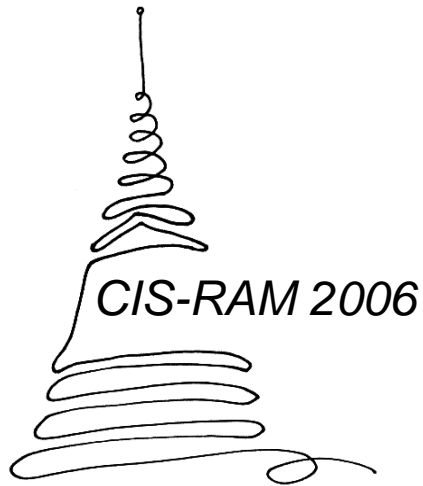
Cybernetics & Intelligent Systems					Fri 9 June 13:30–15:30	
	F2A Bumrang	Evolutionary Computation II Chair(s): Chidchanok Lursinsap Prasong Praneetpolgrang	F2B Rong	Pattern Recognition Chair(s): Shih-Chieh Lin Kay Chen Tan	F2C Charu	Soft Computing I Chair(s): Sutthiphong Srigrarom Danwei Wang
13:30 – 13:50	Genetic Algorithm with Species and Sexual Selection <i>Mukesh M Raghuwanshi, *O G Kakde</i> , RCERT, Chandrapur, INDIA <i>*Nagpur University, INDIA</i> <p>In this paper we have proposed new real coded genetic algorithm with species and sexual selection (GAS3). GAS3 is a distributed quasi steady-state real-coded genetic algorithm. GAS3 uses sex determination method (SDM) to determine the sex (male or female) of members in population. Each female member is considered as a niche in population and the species formation take place around these niches. Sexual selection strategy selects female and required number of male members from species to perform the recombination operation. The parent-centric recombination operators are used to generate offspring. If species is not performing well, then the merging of species to the nearby species takes place. Performance of GAS3 is tested on unimodal and multi-modal test functions. It got success in solving wide ...</p>		A Visual Inspection System for Surface Mounted Devices on Printed Circuit Board <i>Shih-Chieh Lin, Cha-Hsin Su</i> , National Tsing Hua University, TAIWAN <p>The object of this study is to develop a more reliable and faster visual inspection system for printed circuit board inspection. In order to reach this goal, the inspection process was divided into two stages, namely, screening stage and classification stage. In the first stage, only one image feature is abstracted from the examined image and is used as a screening index to quickly screen out most normal components fast. In the second stage, neural networks are used to integrate all image feature information available to more precisely inspect those left after the screening test. Since there are numerous image features available, the way to select proper image features also worth of discussion. In this study, parting coefficient is used as an index for selecting proper image features. The proposed system is trained by a set of revised ...</p>		A Fuzzy Multiple Criteria Decision Making Method <i>Chien-Chang Chou</i> , National Taiwan Ocean University, TAIWAN <p>The aim of this paper is to propose a fast and easy ranking method for solving the fuzzy multiple criteria decision-making (MCDM) problems. The representation of multiplication operation on fuzzy numbers is useful for decision makers who are in the fuzzy multiple criteria decision-making environment to rank all candidate alternatives and choose the best one. In this paper, we first propose the representation of multiplication operation on triangular fuzzy numbers and then this representation of multiplication operation on triangular fuzzy numbers is applied to solving a numerical example of location selection.</p>	
13:50 – 14:10	An Empirical Comparison of Non-adaptive, Adaptive and Self-Adaptive Co-evolution for Evolving A.N.N. Game Players <i>Yi Jack Yau, Jason Teo</i> , University Malaysia Sabah, MALAYSIA <p>This paper compares the implementation of the non-adaptive, adaptive, and self-adaptive co-evolution for evolving artificial neural networks (ANNs) that act as game players for the game of Tic-Tac-Toe (TTT). The objective of this study is to investigate and empirically compare these three different approaches for tuning strategy parameters' in coevolutionary algorithms in evolving the ANN game-playing agents. The results indicate that the non-adaptive and adaptive co-evolution systems performed better than the self-adaptive coevolution system when suitable strategy parameters were utilized. The adaptive co-evolution system was also found to possess higher evolutionary stability compared to the other systems and was also successful in synthesizing ANNs with high TTT playing strength both as the first as ...</p>		Gait Recognition Considering Directions of Walking <i>Xu Han, Jiwei Liu, Lei Li, Zhiliang Wan</i> , University of Science and Technology, Beijing, CHINA <p>Studies on Gait Recognition are mostly based on the assumption that walking direction is parallel to the camera, and the person's side view is extracted. Recently, walking direction has becoming one of the gait recognition challenge problems. In this work we explore gait recognition considering any directions of walking which is not definitely parallel to the camera. We propose a novel approach to computing the walking direction and extracting features by employing a human model. Furthermore, a Support Vector Machine (SVM) is performed allowing us to investigate and evaluate the recognition power of any walking directions. We applied our method to the real human walking video data, and achieved high recognition rate. Our approach finds out how changes in walking direction affect gait parameters in terms of recognition performance. As it is entirely based on human gait, our approach is robust to different type of clothes and different walking directions.</p>		Affine TS-Model-Based Optimal Fuzzy Regulating Control <i>Shing-Jen Wu, Cheng-Tao Wu</i> , Da-Yeh University, TAIWAN <p>Affine T-S fuzzy system is much preferred than linear type in providing one more adjustable parameter for computation-intelligent (neural-fuzzy-evolution) modeling of mode-free physical system or highly nonlinear and complex model-based system. However, few researches are devoted in intrinsic analysis of affine-type fuzzy system and in developing controllers to regulate affine TS-based nonlinear systems. In this paper, the affine-type global optimal fuzzy control design scheme is theoretically derived. The generated closed-loop fuzzy systems are demonstrated to be stable. The performance of the proposed fuzzy controller is demonstrated via two nonlinear systems. Simulation results show the proposed controller can stabilize the affine fuzzy system in very short time.</p>	
14:10 – 14:30	Toward a Practical Framework for Quantum Evolutionary Computation <i>Donald A Sofge</i> , Naval Research Laboratory, UNITED STATES <p>Biological evolution provides an immensely powerful toolset for problem solving, while evolutionary computation attempts to harness the power of biological evolution for solving problems using classical computing paradigms. Quantum computing offers many apparent advantages over classical computing for certain types of problems, such as searching or optimizing over large solution sets. Once practical quantum computers are available, we would like to take advantage of their highly parallel computing capabilities for use in evolutionary computation. In this work we explore the nexus between quantum and evolutionary computation, and propose an approach toward a practical framework for performing evolutionary computation on quantum computers.</p>		Structural Approach on Writer Independent Nepalese Natural Handwriting Recognition <i>Santosh K. C., Cholwich Nattee</i> , Thammasat University, THAILAND <p>The writing units vary in writer independent unconstrained handwriting (for example, number of strokes, shape, size, order, and speed etc.). Many algorithms were developed to improve the accuracy of the handwriting recognition system in both statistical and structural approaches on real-time databases, from which researchers still are not satisfied. We propose to use structural properties of the feature vector sequences of strokes of variable writing units by using Dynamic Programming (DP). This paper focuses on Dynamic Time Warping (DTW) as a global distance calculation along with the use of local distance metric between two real-time feature vector sequences of strokes and is followed by robust agglomerative hierarchical clustering to produce sensible clusters, which have intrinsic characteristics. We utilize...</p>		Feasibility Study of a Force Feedback Controlled Robotic System for Bone Milling <i>Beng Kwang Lee, *Soo Jay, Louis Phee</i> , Nanyang Polytechnic, SINGAPORE, *Nanyang Technological University, SINGAPORE <p>The paper is written mainly based on developing a robust and reliable robotic arm and to develop a program to help the robot to improve system performance where a high degree of environment uncertainty exists such as avoiding obstacles along its moving path during milling of bone. An intelligent logic iteration model (Fuzzy logic) is deployed onto a standard industrial robot with six-degree-of-freedom serial kinematics for milling of the bone in orthopaedic surgery. The objective is to enhance the surgeon's precision movements and dexterity. The system was tested in a series of experiments that measured its ability to track the desired path on an in vitro setup. The reliability and robustness of the method were also evidently shown from the experimental results. This development of this milling ...</p>	

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14:30 – 14:50	Solving Constrained Optimization Problems by Epsilon Constrained Particle Swarm Optimizer with Adaptive Velocity Limit Control <i>Tetsuyuki Takahama, *Setsuko Sakai</i> , Hiroshima City University, JAPAN, *Hiroshima Shudo University, JAPAN		Feature Extraction from 2D Gesture Trajectory in Dynamic Hand Gesture Recognition <i>Manas Kamal Bhuyan, Debashis Ghosh, Prabin Kumar Bora</i> , Indian Institute of Technology, Guwahati, INDIA		Thermal Error Modeling of a Machining Center using Grey Sys. Theory & Adaptive Network-Based Fuzzy Inference Sys. <i>Kun-Chieh Wang</i> , Ling Tung University, TAIWAN	
	<p>The epsilon constrained method is an algorithm transformation method, which can convert algorithms for unconstrained problems to algorithms for constrained problems using the epsilon level comparison that compares the search points based on the constraint violation of them. We proposed the epsilon constrained particle swarm optimizer ePSO, which is the combination of the epsilon constrained method and particle swarm optimization. In the ePSO, the agents who satisfy the constraints move to optimize the objective function and the agents who don't satisfy the constraints move to satisfy the constraints. But sometimes the velocity of agents becomes too big and they fly away from feasible region. In this study, to solve this problem, we divide agents into some groups and control the maximum velocity of agents ...</p>		<p>Vision-based hand gesture recognition is a popular research topic for human-machine interaction (HMI). We have earlier developed a model-based method for tracking hand motion in complex scene by using Hausdorff tracker. In this paper, we now propose to extract certain features from the gesture trajectory so as to identify the form of the trajectory. Thus, these features can be efficiently used for trajectory guided recognition/classification of hand gestures. Our experimental results show 95% of accuracy in identifying the forms of the gesture trajectories. This indicates that the trajectory features proposed in this paper are appropriate for defining a particular gesture trajectory.</p>		<p>The thermal effect on machine tools has become a well-recognized problem in response to the increasing requirement of product quality. The performance of a thermal error compensation system basically depends on the accuracy and robustness of the thermal error model. This paper presents a thermal error model using two mathematic schemes: GM(1,N) model of the grey system theory and the adaptive network-based fuzzy inference system (ANFIS). First, the measured temperature and deformation results were analyzed via the GM(1,N) model to obtain the influence ranking of temperature ascent on thermal drift of spindle. Then, using the high-ranking temperature ascents as the input of ANFIS and training these data by hybrid learning rule, the thermal compensation model can be quickly built. ...</p>	
	Updating Strategy in Compact Genetic Algorithm using Moving Average Approach <i>Sunisa Rimcharoen, Daricha Sutivong, Prabhas Chongstitvatana</i> Chulalongkorn University, THAILAND				Research of Fuzzy Control System of Supported Rotor System in a New Type Gyro <i>Gannan Yuan, Jianfeng Liu, Lihua Wang</i> , Harbin Engineering University, CHINA	
14:50 – 15:10	<p>The Compact Genetic Algorithm (cGA) has a distinct characteristic that it requires almost minimal memory to store candidate solutions. It represents a population structure as a probability distribution over the set of solutions. Although cGA offers many advantages, it has a limitation that hinges on an assumption of the independency between each individual bit. For example, cGA fails to solve a deceptive function or the so called trap function, which is a standard difficult test problem for genetic algorithm. This paper proposes applying a moving average technique to update a probability vector in the compact genetic algorithm. This method requires fewer evaluations and achieves a higher solution quality. The results are compared with the original cGA, sGA, persistent elitist cGA (pe-cGA) and nonpersistent elitist cGA ...</p>				<p>The magnetic system in the new type of Gyro is designed according to the characters of magnetic supported system. A method using additional compensating coil is proposed. It is proved that the rotor suspended in the system is stably suspended. The control mathematic model for Gyro's rotor supported system is founded. The system is characterized by its instability and nonlinearity. In this paper a fuzzy controller is designed. On the basis of common fuzzy control theories, a fuzzy controller is designed. The simulation results show that our controller is characterized by fast dynamic responding, strong robustness. The results show that the controller can keep every state parameter in the rotor magnetic supported system to trend towards its designed value</p>	
15:10 – 15:30	Using an Evolutionary Algorithm for the Tuning of a Chess Evaluation Function based on a Dynamic Boundary Strategy <i>H. Nasreddine, H. S. Poh, *G. Kendall</i> , Univ. of Nottingham, Malaysia Campus, MALAYSIA, *Univ. of Nottingham, Jubilee Campus, UK				Product Design based on Clustering Analyzing and Fuzzy Recognition <i>Lingling Li, Quanming Zhao, Zhigang Li, Huijuan Zhang</i> , Hebei University of Technology, CHINA	
	<p>One of the effective ways of optimising the evaluation function of a chess game is by tuning each of its parameters. Recently, evolutionary algorithms have become an appropriate choice as optimisers. In the past works related to this domain, the values of the parameters are within a fixed boundary which means that no matter how the recombination and mutation operators are applied, the value of a given parameter cannot go beyond its corresponding interval. In this paper, we propose a new strategy called "dynamic boundary strategy" where the boundaries of the interval of each parameter are dynamic. A real-coded evolutionary algorithm that incorporates this strategy and uses the polynomial mutation as its main exploitative tool is implemented. The effectiveness of the proposed strategy is tested by competing our</p>				<p>Based on clustering analyzing, a structure selecting method was proposed for design-oriented expert system during product conceptual design. The clustering analyzing method was introduced to find out the attribute sets in different levels matched with structure tree so as to set up a product characteristic space. In this space, each sub-space is matched with a type of product structure. Similarly, the standard model of product can be set up according to the clustering result and all the models are formed as standard structure tree. Then, the fuzzy recognition method is adopted to determine the type of product structure by mapping one certain node of the tree with the design requests. The method can be wide used in applications of mechanical design.</p>	

Robotics, Automation & Mechatronics					Fri 9 June 13:30–15:30	
	F2D Chroen	Rob. & Auto. in Unstructured Environment II Chair(s): Simon X. Yang Liyong Su	F2E Charas I	Medical Robots and Systems Chair(s): Guilin Yang Janjai Bhuripanyo	F2F Charas II	Modeling, Planning and Control III Chair(s): Oliver Sawodny Taming Shih
13:30 – 13:50	Extraction of Topological Map based on the Characteristic Corners from Grid Environment Exploration <i>L Su, Y Yu, W Chen, *Z Cao, *M Tan</i> , Beijing University of Technology, CHINA, *Chinese Academy of Sciences, CHINA More and more robot tasks extend to unknown environments. Extraction of the topological map from the robot exploration results of an unknown environment is of great importance for the completion of robot path-planning tasks. In this research, a robot explores the environment and builds a grid map in the simulation experiments; the building of topological map based on the features of the grid map is studied. A new method is proposed that the grid environment be classified to 8 basic types of concave and protruding corners and the 8 basic types be defined by mathematical equations. According to the definition a strategy is designed to divide the grid map into a and a topological map of the environment is built.		A Dynamic Performance Evaluation of Flexible Manipulator with Active Proportional Damping and Estimation Algorithm <i>Dibakar Bandopadhyaya, Bishakh Bhattacharya</i> , Indian Institute of Technology, Kanpur, INDIA In this paper an effort has been made to actively attenuate the vibration of a single link planar flexible manipulator with rotary joints using a combination of Ferro-magnetic alloys/ Polyethylene-Polyethylene Glycol and Terfenol-D as Smart Nano-Composite. Such materials can be used as intelligent distributed layers over the link to introduce distributed control of vibration. The method utilizes the property that under a control voltage/magnetic flux, the smart materials bonded to the flexible structure deforms and generates a bending strain through end moments that opposes the structural deformation. Proportional damping scheme is used to model the damping of passive layers. Together with the active material this arrangement has shown high efficiency to reduce the vibration. However, to identify ...		Analysis of Nonlinear Normal Modes by Extended Normal Form Method <i>T Shih, *T-L Teng, **C-Y Hsu</i> , Chung Cheng Inst of Tech, TAIWAN, *Da-Yeh Univ., TAIWAN, **Chinese Naval Academy, TAIWAN An extended normal form method is developed here to study the nonlinear normal mode. The method is based on the traditional normal form method in nonlinear dynamics analysis. It will be shown that the concept of linear modal space can be extended to nonlinear modal space and the linear modal space is tangent to the nonlinear modal space. Therefore, the purpose of this paper is to provide a framework of nonlinear coordinate transformation that can transform a nonlinear system into nonlinear modal coordinate. By using the modal invariance property, we will form a set of homological equations; and the coordinate transformation process is converted to a coefficients-to-be-determined problem. Compared with the traditional normal form method, the extended normal form method bares the merits of intuitive, ease of use ...	
13:50 – 14:10	A Knowledge Based GA for Path Planning of Multiple Mobile Robots in Dynamic Environments <i>SXYang, *YHu, **MQ-HMeng</i> , Chongqing U. of Posts and Telecom, CHINA, *U. of Guelph, CANADA, **Chinese U. of H.K, H.K S.A.R. In this paper, a knowledge based genetic algorithm (GA) for on-line path planning of multiple mobile robots in dynamic environments is proposed. The proposed GA uses a unique problem representation method to represent 2-D robot environments with complex obstacle layouts and obstacles are allowed to be of arbitrary shapes. Correspondingly, an effective evaluation method is developed specially for the proposed GA. The proposed evaluation method is capable of accurately detecting collisions among robot paths and arbitrarily shaped obstacles, and assigns costs that are effective for the proposed GA. Problem-specific GA instead of the standard GAs are used for robot path planning. The proposed knowledge based GA incorporates the domain knowledge into its specialized operators, some of which also combine ...		i-Merc: A Mobile Robot to Deliver Meals inside Health Services <i>F Carreira, *T Canas, *ASilva, *C Cardeira</i> , Polytechnic Inst. of Lisbon, PORTUGAL, *Technical University of Lisbon, PORTUGAL With the aim of increasing the quality of the meals transportation service inside hospitals and health care centers (HHC), we are developing a dedicated mobile robot to perform this service, the i- MERC. This robot is equipped with a heating system in the meals compartment which guarantees the meals temperature and prevents bacteriologic proliferation. The i-MERC also integrates a personalized diets information system where information about patients' diets can be introduced and accessed by the service personnel. This project has been developed within the compass of the Master in Engineering Design, at the Technical University of Lisbon. The product development of the robot addressed many knowledge areas, some of which are presented in this paper. We finished the first stage of the project with ...		Controller Design based on Computed Feedback Linearization <i>Ratchatin Chanchaoen, Nattapong Pongsin, Piyapong Reesewat, Supawat Jiamluksanapaisal</i> , Chulalongkorn University, THAILAND The computed feedback linearization is proposed to control a nonlinear mechanical system. This technique numerically determines the feedback signal, as a function of state, such that the resulting feedback system is linear and stable. The aim is to design a universal controller for nonlinear system based on feedback linearization. Once the feedback system is linear, the superposition holds, and thus the additional control effort can be superimposed to control the trajectory. In this way, stabilization and trajectory controller are seamlessly integrated. In addition, the proposed technique can be used in conjunction with the LQ technique to determine the near optimum gains. Both simulation and experiment based on water tank system and disk plant are used to demonstrate the technique.	
14:10 – 14:30	Active Perception Strategy for Vehicle Localisation and Guidance <i>Cedric Tessier, Christophe Debain, *Roland Chapuis, *Frederic Chausse</i> , Cemagref, FRANCE, *LASMEA, FRANCE Vehicle localisation in outdoor environment is an important issue. When this localisation system has to provide an accurate and reliable position for an automatic guidance system, this is a challenge. In this paper, we propose a supervised active localisation system to satisfy this need. When localisation system mustn't meet vehicle control process requirements: accurate position and high confidence level, the supervisor requests the active detection of a particular landmark. It must be seen as a first step towards the development of a multi-sensor localisation system. The main contributions of this paper are: 1) The introduction of the notion of the "perceptive triplet" within a general framework that associates landmarks, sensors and detectors to supervise the detections. 2) This is the supervisor that determines each time ...		Decomposing and Reconstructing Required Functions to Construct the Remote Ultrasound Diagnostic System <i>N Koizumi, S Warisawa, M Mitsuishi, *Hiroyuki, Hashizume</i> , The University of Tokyo, JAPAN, *Kasaoka Daiichi Hospital, JAPAN Remote diagnosis can be realized utilizing the communication network. A master-slave type remote medical system has been developed for the diagnosis of the shoulder disease such as dialysis related amyloid arthropathy (DRAA) by ultrasonographic images. In this paper, we propose a method of decomposing and reconstructing required functions in the ultrasound diagnosis to construct the remote ultrasound diagnostic system. Proper position, orientation, and contact force between the ultrasound probe and the affected part of the patient are required to acquire proper diagnostic images in this diagnosis. Safety and manipulability are also required to construct the remote medical system.		Trajectory Tracking Control for a New Generation of Fire Rescue Turntable Ladders <i>Steven Lambeck, *Oliver Sawodny, *Eckhard Arnold</i> , Technische Universitaet Ilmenau, GERMANY, *University of Stuttgart, GERMANY A trajectory tracking control was developed for a new generation of fire turntable ladders with an additional joint in the upper ladder part in order to reduce swaying of the moving cage because of the limited stiffness of the ladder set. Therefore, the arm elasticity, which is characterized by significant flexion and torsion, plays an important role in the design process, especially in the case of large ladder lengths. A decentralized control strategy based on a dynamic model of the ladder has been developed. The implementation of this control strategy leads to an active oscillation damping for all ladder movements and therefore allows higher velocities for the rescue operations.	

Robotics, Automation & Mechatronics					Fri 9 June 13:30–15:30	
	F2D Chroen	Rob. & Auto. in Unstructured Environment II Chair(s): Simon X. Yang Liyang Su	F2E Charas I	Medical Robots and Systems Chair(s): Guilin Yang Janjai Bhuripanyo	F2F Charas II	Modeling, Planning and Control III Chair(s): Oliver Sawodny Taming Shih
14:30 – 14:50	Three-dimensional Machine Vision using Gated Imaging System: A numerical Analysis <i>C S Tan, *G G L Seet, *A Sluzek, A Shacklock, S'pore Inst.of Manu. Technology, SINGAPORE, *Nanyang Tech. Univ., SINGAPORE</i> Various researchers have suggested techniques in gated imaging and "smart" pixels technologies that achieve simultaneous depth mapping and optical imaging with enhanced depth detection accuracy and resolutions range from a few cm to less than 1 mm. In this paper, we demonstrate how depth accuracy and resolution can be studied more systematically (and depending on the range detection technique). We propose that the depth detection and resolution study should be treated as two separate configurations. In particular, we recommend statistical approach for camera gating shorter than (or equal to) target irradiance and quantitative approach for gating time longer than target irradiance. A very accurate method by J. Busck is analyzed as an example of the statistical approach. ...		Intramedullary Nail Distal Hole Axis Estimation using Blob Analysis and Hough Transform <i>Chatchai Neatpisarnvanit, Jackrit Suthakorn, Mahidol University, THAILAND</i> In a closed intramedullary nailing of femoral surgery, one of the most difficult task for surgeons is to identify the position and orientation of the screwing holes at both ends of the intramedullary nail (IMN) after being inserted into a patient's femoral canal. The distal hole location may be shifted by external forces and torques applied to the IMN during the insertion procedure resulting in the IMN to deform. To recover the position and orientation (or "pose") of the screwing holes in the conventional operation, surgeons require high degree of experience, and a number of trial-and-error adjustments to correct the path for inserting the screws. Both surgeon and patient are also continuously exposed to a great amount of X-ray exposure from the fluoroscopic imaging system. This paper discusses a necessary part of a surgical navigation research...		Iterative Learning Variable Structure Controller on Linear Motors for Point-To-Point Motion <i>Jianhua Wu, Han Ding, Shanghai Jiaotong University, CHINA</i> In this paper an iterative learning variable structure controller is presented for the point-to-point motion and implemented on an X-Y positioning table driven by linear motors. The methods consist of an iterative learning controller for the high-speed motion and a sliding controller for the high-accuracy positioning. It contributes to making good use of the actuators to reduce the settling time in point-to-point motion. The comparison of experiments results between the proposed controller and the PD plus saturation controller shows the performance can be improved greatly.	
14:50 – 15:10			Developing a Hybrid Cartesian Parallel Manipulator for Knee Surgery <i>Ping-Lang Yen, Chi-Chung Lai, National Taipei University of Technology, TAIWAN</i> In this paper, we use Cartesian parallel mechanism (CPM) as the key module of the constructed knee surgical robot. In the constructed robot, the limited workspace and high rigidity of Cartesian parallel manipulator provide the surgical robot with enhanced safety and high cutting accuracy. The complex kinematics of parallel manipulators is also avoided because of the decoupled feature of the CPM. The dynamics of the CPM is derived by using Langrange-D'Alembert principle. Using the dynamic model, the position control law is derived based on the computed torque method in order to compensate in the feedforward loop the coupled forces from other limbs of the CPM. The simulated and experimental results both showed that high positioning accuracy and desired position profile can be achieved by the proposed controller. ...		Planning Optimal Force-Closure Grasps for Curved Objects by Genetic Algorithm <i>Thanathorn Phoka, Nattee Nipaman, Attawith Sudsang, Chulalongkorn University, THAILAND</i> This paper describes the use of Genetic Algorithm to solve the problem of planning optimal force-closure grasps on 2D and 3D objects. The proposed approach searches for optimal grasps from parametric curves of a 2D object or parametric surfaces of a 3D object. The search method is based on the concept of Q distance which can guide the search direction to better solutions. On this metric, Genetic Algorithm can exploit the characteristic of Q distance to find optimal grasps by directly using the computation of Q distance as the fitness function. This approach is applied to plan optimal force-closure grasps on 2D and 3D curved objects with three and four contact points respectively. Preliminary results are also presented.	
15:10 – 15:30			Design Requirements and User Interfacing for a Rehabilitation Robot for the Lower Limbs <i>CA-Marquez, DBradley, *MHawley, *SBrownell, **PEnderby, **HBuri, ***S Mawson, **E Scott, U. Abertay Dundee, *Barnsley District Gen. Hospital, **U. Sheffield Comm. Sci. Cen., ***Sheffield Hallam U., U.K</i> The development of automated and robotic systems to support the rehabilitation of the lower limbs presents a number of challenges to the systems designers, including those of working with and interpreting the requirements of individuals with different backgrounds. The paper discusses the design of one such system and considers how it has evolved to meet a range of requirements as well as how decisions made, influenced the developed prototype system.		An Inventory Control System for Remanufacture with Disposal <i>Huiqing Ouyang, Xiangyang Zhu, Shanghai Jiaotong University, CHINA</i> In recent decades, for the pressure of the environmental legislations, the economical interesting and the conscious of environment, many producers have to take their products back after used. The product tackbar (PTB) program would bring economic burden to the producers, while many of the returned products have economic value and could be remanufactured to satisfy the market demand. Inventory management is an essential area in the remanufacturing process. In this paper, we extend the traditional (s,Q) inventory strategy to an (Sp,Q,Sd) inventory control model for product remanufacture with disposal. We assume that the return and demand are independent Poisson process, and derive the exact expression of expected average total cost under this strategy. By means of numeral simulation ...	

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TECHNICAL PROGRAM

Friday
9 June 2006

Session 3
16:00 – 17:00

Cybernetics & Intelligent Systems					Fri 9 June 16:00–17:00	
	F3A Bumrang	Adaptive Computing Systems Chair(s): Mohammad A Tinati	F3B Rong	Soft Computing II Chair(s): Ching Seong Tan	F3C Charu	Image Processing II Chair(s): Andries P Engelbrecht
16:00 – 16:20	Towards a Learning Automata Solution to the Multi-Constraint Partitioning Problem <i>Geir Horn, *B John Oommen</i> , SIMULA Research Laboratory, NORWAY, *Carleton University, CANADA We consider the problem of partitioning a set of elements (or objects) into mutually exclusive classes (or groups), where elements which are "similar" to each other are, hopefully, located in the same class. This problem has been shown to be NP-Hard, and the literature reports solutions in which the similarity constraint consists of a single index. For example, typical "similarity" conditions that have been used in the literature include those in which "similar" objects are accessed together, or when they communicate (as processes do) with each other. In this paper, we present the first reported solution to the case when the objects could be linked together in a multi-constraint manner, and indeed, visit the scenario when the constraints could, themselves, be contradictory. The solution we propose is based on theory...		The Properties of the Zadeh Extension of Real-valued Exponential Function <i>Guixiang Wang, *Youming Li</i> , Hangzhou Dianzi University, CHINA, *Agricultural University of Hebei, CHINA In this paper, we discuss the properties of the fuzzy number function which is the Zadeh extension of usual real-valued exponential function on fuzzy number space. The continuity, monotonicity, convexity (or concavity), G-differentiability and the integral over directed line segment of the fuzzy number function are characterized with the corresponding analytical properties of the usual real-valued exponential function.		Discussions of Sketch-based Transparent Model Reconstruction <i>Y. Sun, Y. T. Lee, *J. Sun, **J. Liu</i> , Nanyang Tech. Univ, SINGAPORE, *National Univ. of SINGAPORE, , **Chinese Univ. of HONG KONG The framework of three dimensional (3d) reconstruction of opaque model is discussed. The issues in regularity extraction and application in the reconstruction are analyzed to reveal the problems existing in the current reconstruction process. A 3d reconstruction system needs to handle both useful information and noises. To obtain an efficient and effective reconstruction, a model based reconstruction strategy is proposed to seek for a suitable reconstruction system. Support vector machine (SVM) based methods are suggested for further investigation.	
	16:20 – 16:40	Designing of an Adaptive Adcock Array and Reducing the Effects of other Transmitters, Unwanted Reflections and Noise <i>Mohammad A. Tinati, Sadjad Bayati</i> , University of Tabriz, IRAN In the design of modern high frequency radio direction finder (DF), multi elements DF antennas are used. The advantage of DF to the conventional types is in utilizing four elements. Error of arriving wave angle and calculated angle depends on few factors, such as array dimensions, number of elements, and location of main transmitter. Recently research works have been reported on reducing error between arriving wave angle and calculated angle but in practical case, other transmitters, unwanted reflection and the noise could increase the error. In this paper, we investigate effect of above parameters on the error then by using adaptive blind algorithm, these effects are reduced and SINR in output is increased.		A New Limit Equation Based Stability Analysis of Linguistic Fuzzy Control System <i>Chengjia Li, Peng Zhao</i> , Hangzhou Dianzi University, CHINA Fuzzy control has always been an active discipline in fuzzy set theories and in fuzzy control the stability analysis is one of the most important issues and is also of great interest to scholars in this area. Many important results have been obtained in Tanaka-Sugeno fuzzy control system based on Lyapunov stability theory in the past ten years. Stability analysis in Mamdani fuzzy control system is still quite limited, though it is the first fuzzy controller of their kinds in literature. In this paper, stability analysis of Mamdani type fuzzy controller is studied based on a limit relation equation deduced from the generalized fuzzy control system. The structure and the solutions of the limit equation are closely related with the stability of the fuzzy system. The minimal solutions of the limit equation produce elementary stable matrix forms, which are useful to analyze the stability of closed loop fuzzy systems. An example from the level control of water tank illustrates the.		Self-Adaptive Differential Evolution Methods for Unsupervised Image Classification <i>Mahamed G H Omran, *Andries P Engelbrecht</i> , Arab Open University, KUWAIT, *University of Pretoria, SOUTH AFRICA A clustering method that is based on Self-Adaptive Differential Evolution (SDE) is developed in this paper. SDE is a self-adaptive version of DE where parameter tuning is not required. The proposed algorithm finds the centroids of a user specified number of clusters, where each cluster groups together similar patterns. The application of the proposed clustering algorithm to the problem of unsupervised classification and segmentation of images is investigated. To illustrate its wide applicability, the proposed algorithm is then applied to synthetic, MRI and satellite images. Experimental results show that the SDE clustering algorithm performs very well compared to other state-of-the-art clustering algorithms in all measured criteria.
16:40 – 17:00		Laplacian Mixture Modeling for Overcomplete Mixture Matrix Estimation in Wavelet Packet Domain by Adaptive EM-type ... <i>Mohammad A. Tinati, B. Mozaffary</i> , University of Tabriz, IRAN Speech process has benefited a great deal from the wavelet transforms. Wavelet packets decompose signals in to broader components using linear spectral bisecting. In this paper, mixtures of speech signals are decomposed using wavelet packets, the phase difference between the two mixtures are investigated in wavelet domain. In our method Laplacian Mixture Model (LMM) is defined. An Expectation Maximization (EM) algorithm is used for training of the model and calculation of model parameters which is the mixture matrix. Therefore individual speech components of speech mixtures are separated.		Mean Values of Fuzzy Numbers and the Measurement of Fuzziness by Evaluation Measures <i>Yuji Yoshida</i> , University of Kitakyushu, JAPAN In this paper, we discuss an evaluation method of fuzzy numbers as mean values and measurement of fuzziness defined by fuzzy measures, and the presented method is applicable to fuzzy numbers and fuzzy stochastic process defined by fuzzy numbers/fuzzy random variables in decision making. We compare the measurement of fuzziness and the variance as a factor to measure uncertainty. Formulae are also given to apply the results to triangle-type fuzzy numbers and trapezoidal-type fuzzy numbers.		Fuzzy Similarity Measures for Colour Images <i>Dietrich Van Der Weken, Valerie De Witte, Mike Nachtegaal, Stefan Schulte, Etienne Kerre</i> , Ghent University, BELGIUM In this paper we will give an overview of the possible application of fuzzy similarity measures to colour images. First of all, we review the component-based approach for the extension of similarity measures for greyscale image to colour images. And secondly, we discuss a vector-based approach using vector morphological operators. Both approaches are compared using several experiments.

Robotics, Automation & Mechatronics

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	F3D Chair(s): Ekachai Leelarasamee Chroen	F3E Chair(s): Peraphon Sophatsathit Charas I	F3F Chair(s): Li Li Charas II
16:00 – 16:20	<p>Transition of Mixed, Virtual, and Augmented Reality in Smart Production Environments - An Interdisciplinary View <i>Mike Eissele, Oliver Siemoneit, Thomas Ertl, University of Stuttgart, GERMANY</i></p> <p>The advancing desire of companies to provide their customers highly individualized products so as to gain sustainable advantages over their competitors has unavoidably deep effects on the production process. Although augmented and virtual reality is a quite common topic of research, in order to meet these demands, the analysis of the seamless transition of different reality-states like real reality, augmented reality, augmented virtuality, and virtual reality within one and the same production task is a often neglected subject. In a broad and interdisciplinary approach we want to draw the attention of the research community on this, set the scene and explore the potential benefits and problems. Technical, epistemological, and philosophical as well as economic aspects are discussed. A prototype is presented ...</p>	<p>Scatter Bitmap: Space-Time Efficient Bitmap Indexing for Equality and Membership Queries <i>Sirirut Vanichayobon, Jarin Manfuekphan, *Le Gruenwald, Prince of Songkla University, THAILAND, *Univ. of Oklahoma, U.S</i></p> <p>In a data warehouse environment, indexing techniques based on bitmap representations are useful for answering complex and ad hoc queries efficiently without adding additional hardware. They significantly improve query processing time by utilizing low-cost Boolean operations and multiple indices scans, executing queries by performing simple predicate conditions on the index level before going to the primary data source. In this paper, we propose a new bitmap called Scatter Bitmap Index that uses less space than existing bitmap indices while maintaining query processing time. Our Scatter Bitmap Index achieves this by representing each attribute value using only two bitmap vectors, but each bitmap vector represents many attribute values. Our experimental results confirm that the performance ...</p>	<p>Effects of System Delay in Passivity-based Haptic System <i>Thavida Maneewarn, Phanaprai Tothawornyuenyong, King Mongkut's University of Technology, Thonburi, THAILAND</i></p> <p>In this paper, we study the effect of unobserved energy in the haptic system due to different types of system delay and the observed pair of power variables. When the previously proposed Passivity Observer (PO) can not observe the energy produced by some types of system delay, the Passivity Controller (PC) may not be able to stabilize the system. We propose a fuzzy controller which is designed based on passivity that can improve system performance during virtual wall contact even when the Passivity Observer can not detect the energy generated in the system due to delays.</p>
16:20 – 16:40	<p>A Heuristic Method for a Flexible Flow Line with Unrelated Parallel Machines Problem <i>Chun-Lung Chen, Chuen-Lung Chen, National Chengchi University, TAIWAN</i></p> <p>The problem considered in this paper is a flexible flow line with multiple serial stages, where there are one or more unrelated parallel machines at each stage and there exists a bottleneck stage in the system. The objective of the scheduling problem is to minimize the total flow time of jobs. A heuristic method is proposed to solve the scheduling problem. It focuses on the bottleneck stage and a heuristic procedure is developed as part of the method to construct the schedule for the bottleneck stage. This is because the bottleneck stage may not be the first: the arrival time of jobs at the bottleneck stage may not be zero. A trial simulation is adopted to schedule the jobs at the stages ahead of the bottleneck stage so as to obtain the arrival time of jobs at the bottleneck stage. To evaluate the performance ...</p>	<p>Driving Electric Car by using EMG Interface <i>Shinichi Aso, Akinori Sasaki, Hiroshi Hashimoto, *Chiharu Ishii, Tokyo University of Technology, JAPAN, *Kogakuin University, JAPAN</i></p> <p>This paper proposes a useful method driving the electric car by using EMG interface, which is used as living body interface. The EMG signal can be measured from all the people easily, even physically handicapped people, elderly and so on. The EMG signals are measured from both hand palms and neck using a simple electrode. In our interface, the effective frequency band of EMG signal is extracted to drive the electric car effectively. The extracted signal is converted to binary signal which drives differential motor. In the experiments that driving the electric car by using the proposed EMG interface, we used the SD method to evaluate of operation feeling and riding comfort. As a result, it is shown that the effective frequency band gives an influence on operating feeling and riding comfort.</p>	<p>Robust Haptic Telemanipulation Control Systems <i>Li Li, *Kash Khorasani, Wuhan Institute of Technology, CHINA, *Concordia University, Montreal, CANADA</i></p> <p>This paper discusses how linear fractional transformation (LFT) technique and μ-analysis and synthesis theory can be applied into the design of robust haptic telemanipulation systems with multiple uncertain sources including communication time delay, and presents a framework of controller design for such a system under the assumption that all components in the system possess uncertainty.</p>
16:40 – 17:00	<p>Development of Positioning Jig for Glass Capillary Bending Mechanism <i>Wei Xia, Hung-Yao Hsu, Lingxue Kong, University of South Australia, AUSTRALIA</i></p> <p>In a bending mechanism for glass capillary, the positioning jig to hold the capillary in place is one of the most important components to ensure the bending quality. The tapered shoulder of the capillary is used as the positioning reference. Since the dimension of the shoulder of individual capillaries varies slightly, the geometry of the capillaries is studied to identify the desired positioning spot on the shoulder. Upon determination of the positioning spot, a positioning jig is designed, which is composed of positioning, holding, and clamping units. A prototype is made and assembled onto the bending mechanism for testing. The testing results show that the mechanism is able to achieve the desired functionalities demanded by the delicate bending process.</p>	<p>Ant Colony Optimization based Simultaneous Task Allocation and Path Planning of Autonomous Vehicles <i>A. K Kulatunga, D. Liu, G Dissanayake, *S. B, Siyambalapitiya, Univ. of Technology, Sydney, AUSTRALIA, *Univ. of Peradeniya, SRI LANKA</i></p> <p>This paper applies a meta-heuristic based Ant Colony Optimization (ACO) technique for simultaneous task allocation and path planning of Automated Guided Vehicles (AGV) in material handling. ACO algorithm allocates tasks to AGVs based on collision free path obtained by a proposed path and motion planning algorithm. The validity of this approach is investigated by applying it to different task and AGV combinations which have different initial settings. For small combinations, i.e. small number of tasks and vehicles, the quality of the ACO solution is compared against the optimal results obtained from exhaustive search mechanism. This approach has shown near optimal results. For larger combinations, ACO solutions are compared with Simulated Annealing algorithm which is another commonly used meta-heuristic approach. The results show that ACO solutions have slightly better performance than that of Simulated Annealing algorithm.</p>	<p>Haptic Surfaces through Mechatronic Design <i>Wayne Book, Haihong Zhu, Georgia Institute of Technology, UNITED STATES</i></p> <p>The requirements and challenges of a haptic surface display are discussed and solutions are proposed and implemented. A prototype array of actuated pins provides resolution of 5mm, travel of 45 mm, with force and position sensing on each cell. The design is extendible to much larger arrays without further technological improvements and is currently interfaced to other displays over the internet. Specifically discussed is the strategies and details leading to the breakthrough design, including fluid actuation with integrated position sensing and alternatives to position sensing, signal conditioning and data collection for the sensors, interpretation of force and motion cues for editing the surface. The advances in mechatronics are presented through a discussion of five prototypes culminating in the current design for which performance data is provided. ...</p>

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