2009 IEEE International Conference on Automation and Logistics

August 5 – 7, 2009
Northeastern University, Shenyang, China

Conference Program Digest

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Welcome

It is our great pleasure to welcome you to the 2009 IEEE International Conference on Automation and Logistics (IEEE ICAL 2009), which takes place from August 5 to 7, 2009 at the Hanqing Conference Hall of Northeastern University in Shenyang, China.

IEEE ICAL 2009 marks the third event of the IEEE ICAL annual conference series. We have received 903 paper submissions from 20 countries and regions. After a rigorous full-paper peer-review process, 409 papers were accepted for oral or poster presentation at the conference in 28 technical sessions, resulting in an acceptance rate of 45%. These papers reflect the dynamism of the research and development activities in automation and logistics, as well as the emergence of new research and development topics in addressing the ever increasing challenges from the related industrial and societal needs.

The conference program is highlighted by six invited plenary speeches to be delivered by Prof. David D. Yao of Columbia University, USA, Prof. Kazuhiro Kosuge of Tohoku University, Japan, Prof. Zhongtuo Wang of Dalian University of Technology, China, Prof. Warren B. Powell of Princeton University, USA, Prof. Yoshimi Takeuchi of Osaka University, Japan, and Prof. Mengchu Zhou of New Jersey Institute of Technology, USA. The main objective of the IEEE ICAL conference series is to provide a forum for researchers, educators, engineers, and government officials involved in Automation and Logistics to disseminate their latest research results and exchange views on the future research directions of the related fields. IEEE ICAL 2009, hosted in the famous historical city of Shenyang, China, promises to be a great event for participants from all over the world, with an excellent technical program as well as social activities.

We wish to express our gratitude to all of our sponsoring societies and organizations and to all the individuals who have contributed to the organization of this conference. Special thanks are extended to our colleagues in the Program Committee for their thorough review of all the submitted papers, which is vital to the success of this conference. We must also extend our thanks to our Organizing Committee and our volunteers who have dedicated their time toward ensuring the success of this conference. Last but not least, we thank all the contributors from 20 countries and regions for their support and participation in making this conference a great success. Finally, if your travel plans permit, we encourage you stay beyond your meeting to enjoy visiting Shenyang and China. We wish you a great conference experience and enjoyable stay in Shenyang, China.

Tianyou Chai  Tzyh-Jong Tarn  Toshio Fukuda  Huaguang Zhang
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Xinzhi Zheng
Huiyu Zhou
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Qun Zong
General Information

Conference Venue

Han-Qing Conference Hall
Northeastern University
Shenyang
China

Language

The conference and all its activities will be conducted in English.

Conference Secretariat

IEEE ICAL 2009, c/o Ms. Zhuo Liu
Northeastern University, China
E-mail: liuzhuo@ise.neu.edu.cn; telephone: +86 (24) 2390-9157

Dietary Needs

Conference delegate or partner with special dietary needs etc. is invited to indicate his/her special dietary needs to the organizing committee at the Registration Desk.

Welcome Reception

This welcome dinner on Wednesday night features famous Liao Cuisine of Shenyang region at the favoured New Hong’s Restaurant for all registered ICAL 2009 participants. Don’t miss this opportunity to enjoy local cuisine and to meet friends and colleagues.

Date: August 5th, 2009
Time: 18:00 - 20:30
Venue: New Hong’s (新洪记) Restaurant

Conference Registration

Tuesday, August 4th, 2009: 14:00 - 20:00
Venue: Registration desk on the second floor of Sheraton Hotel Shenyang

Wednesday August 5th, 2009 08:00-17:00
Thursday August 6th, 2009 08:00-17:00
Friday August 7th, 2009 08:00-12:00
Venue: Han-Qing Conference Hall Lobby, Level 1, Northeastern University
Conference Banquet

Date: Thursday, August 6\textsuperscript{th}, 2009  
Time: 18:00 - 21:00 (Please gather at the lobby of Han-Qing Hall to take bus at 18:00)  
Venue: Banquet Hall of Liaoning Tower

Additional Equipment

Please note that each session room will be equipped with a LCD projector, screen, laser pointer, and microphone. Laptop and/or desktop computers will be provided. General software presentation package are preinstalled, such as Microsoft PowerPoint, Adobe Acrobat reader. If you plan to use specific software presentation packages other than stated above, you are required to bring your own computer and install them before your presentation. Please include your paper number in all correspondence. Each presentation is allocated 20 minutes including question and answer period.

Conference Proceedings

Conference registration fee includes a copy of the Conference Proceedings on USB Key. Additional copies are available at a cost of US$50.00 (RMB350) each. Please enquire at the Registration Desk.

Internet Access

Free wireless access will be provided for all delegates at the conference venue: Han-Qing Conference Hall and in all presentation rooms on Wednesday, Thursday and Friday.
Transportation Information

The main airport in Shenyang is the Shenyang Airport (SHE) is the largest airport of northeast China offering direct flights to cities around China including countries such as Japan, Russia, and Korea

Here are some of airlines out of Shenyang:

**ANA:** +1 800 235 9262; http://www.fly-ana.com

**Asiana Airlines:** +1 888 437 7718; http://www.flyasiana.com

**China Northern Airlines:** +86 23 197 188; http://www.cna.com.cn/Eng/index-en.html

**China Southern Airlines:** +86 20 950 333; http://www.cs-air.com/en/index.asp

By plane

The city is served by the Shenyang Taoxian International Airport (沈阳桃仙国际机场, airport code SHE), as well as by several smaller, regional airports. Direct flights from Shenyang go to Beijing, Changsha, Chaoyang, Chengdu, Chongqing, Dalian, Fuzhou, Guangzhou, Haikou, Hangzhou, Harbin, Hefei, Hong Kong, Jinan, Kunming, Lanzhou, Nanjing, Ningbo, Qingdao, Qiqihar, Sanya, Shanghai, Shantou, Shenzhen, Shijiazhuang, Taiyuan, Tianjin, wuromqi, Wenzhou, Wuhan, Xiamen, Xian, Xuzhou, Yanji, Yantai, Zahuang, Zhengzhou, and Zhuhai.

**Direct international flights** go to Seoul and Cheongju, South Korea; Pyongyang, North Korea; Irkutsk and Khabarovsk, Russia; Osaka and Tokyo, Japan with connections to Frankfurt, Germany, Sydney, Australia, Los Angeles, USA and other cities. The airport is located 30 km south of the city. An airport shuttle runs from the airport to the main China Northern Airlines ticket office (Zhonghua Lu 117) and back frequently.

By car

Shenyang is connected by a major expressway, the Jing-shen 6-lane Expressway, to the city of Beijing, some 658 kilometers away. Expressways also link Shenyang with Jilin and Heilongjiang provinces. The Shen-Da Expressway connecting Shenyang and Dalian was the first expressway ever built in China. It is the fastest highway (8-lane) linking one of the largest port cities to Shenyang.
By train

Train service is provided through two train stations, the north train station and the south train station. The north train station handles the majority of the long-distance trains while the south train station handles most of the Dongbei (northeast) trains and does local service around the province. Some trains travel to both stations so be aware of which station you need to board your train.

North Train Station (Shenyang Bei Zhan) at Beizhan Lu

- **Beijing** - takes about 8 hours (or if you are lucky to get a ticket for the new fast train 'D Train', about 4 hours)
- **Dalian** - takes about 6 hours (express trains take 3 - 4 hours)
- **Dandong** - takes about 5 hours
- **Guangzhou** - takes about 30-48 hours
- **Harbin** - takes about 7 hours
- **Jilin** - takes about 6-9 hours
- **Shanghai** - takes about 27-34 hours
- **Tianjin** - takes about 10-14 hours
- **Qinhuangdao** - takes about 5-6 hours

South Train Station (Shenyang Huoche Zhan) at Shengli Beijie

- **Baihe via Songjianghe** - takes about 9 hours
- **Beijing** - takes about 8-10 hours
- **Changchun** - takes about 4 hours - 2 hours for express trains
- **Dalian** - takes about 5 hours
- **Dandong** - takes about 4 hours
- **Harbin** - takes about 7 hours
- **Jilin** - takes about 7 hours
- **Tianjin** - takes about 9 hours
- **Tonghua** - takes about 7 hours
- **Tumen** - takes about 16 hours
By bus

Long distance bus service is handled by the following two bus stations:

**Main Long-Distance Bus Station** (Shenyang Qiche Kuaisu Keyun Zhan): Located on Huigong Jie, this station serves routes to and from major cities. You can also find night buses to Beijing being hawked outside the north train station.

- **Beijing** - takes about 8 hours
- **Changchun** - takes about 4 hours
- **Dandong** - takes about 3 hours
- **Dalian** - takes about 6 hours
- **Harbin** - takes about 7 hours
- **Jilin** - takes about 5 hours
- **Jinzhou** - takes about 3 hours

**South Bus Station**: Buses queue along Minzhu Lu (opposite the south train station), around Minzhu Square and some nearby streets. On most buses you pay the conductor on the bus but for Anshan and Liaoyang you must purchase tickets at the office on the east side of Minzhu Square. These buses run medium distance routes to neighbouring cities within Liaoning. Buses stop departing this bus stations around 6pm. Passengers arriving to this station may be offloaded from the bus on a nearby street or some distance away at a yard used for storing coaches, sited behind the post office on Zhongshan Jie.

- **Anshan** - takes about 1 hour 40 minutes
- **Benxi** - takes about 1 hour
- **Liaoyang** - takes 1 hour
- **Fushun** - takes 1 hour
Program Schedule

Tuesday, August 4th 2009
14:00-20:00 Registration on second floor of Sheraton Hotel Shenyang

Wednesday, August 5th 2009
08:30-18:00 Registration at Zhang Xue-Liang Conference Hall Lobby
08:30-09:00 Opening Ceremony at HQHT Auditorium
09:00-10:00 Plenary Talk #1 by Professor David D. Yao
10:00-10:20 Morning Break with tea and coffee
10:20-12:00 Technical Sessions WM
12:00-14:00 Lunch Break (University Town Restaurant buffet lunch)
14:00-15:40 Technical Sessions WP
15:40-16:00 Afternoon Break with tea and coffee
15:40-16:40 Poster Sessions WPP
16:40-17:40 Plenary Talk #2 by Professor Kazuhiro Kosuge
18:00-20:30 Welcome Dinner at New Hong’s (Xin Hong Ji) Restaurant

Thursday, August 6th 2009
08:30-18:00 Registration at Zhang Xue-Liang Conference Hall Lobby
09:00-10:00 Plenary Talk #3 by Professor Zhongtuo Wang
10:00-10:20 Morning Break with tea and coffee
10:20-12:00 Technical Sessions TM
12:00-14:00 Lunch Break (University Town Restaurant buffet lunch)
14:00-15:00 Plenary Talk #4 by Professor Warren B. Powell
15:00-16:00 Poster Sessions TPP
15:40-16:00 Afternoon Break with tea and coffee
16:00-17:00 NEU 111 Project Panel Automation & Logistics Forum
17:00-18:00 Plenary Talk #5 by Professor Yoshimi Takeuchi
18:00-21:00 Award Banquet with performance (Banquet Hall of Liaoning Tower)

Friday, August 7th 2009
08:30-12:00 Registration at Zhang Xue-Liang Conference Hall Lobby
09:00-10:00 Plenary Talk #6 by Professor Mengchu Zhou
10:00-10:20 Morning Break with tea and coffee
10:20-12:00 Technical Sessions FM
12:00-14:00 Lunch Break (University Town Restaurant buffet lunch)
14:00-15:20 Technical Sessions FP
15:20-15:40 Afternoon Break with tea and coffee
15:40-16:40 Poster Sessions FPP
16:40-17:40 Poster Sessions FEP
18:00-20:30 Farewell Party at Sheraton Hotel Shenyang
Floor Plan of Zhang Xue-Liang Conference Hall

Plenary talks and parallel technical sessions will be held at Zhang Xue-Liang Conference Hall on two different floors: ground floor (Level 1) and third floor (Level 3).

For ground floor (Level 1), will be used for Plenary talks, poster sessions on Wednesday Thursday and Friday.
For third floor, function room HQHT 304, 308, 312, 313 and 314 will be used for all oral sessions on Wednesday, Thursday and Friday.

Third Floor (Level 3)
New models of stochastic networks in supply chain and logistics management often involve features that are beyond the capabilities of classical tools in control theory and operations research. These include, for example, simultaneous resource occupancy, sharing of service capacities, and the real-time resource allocation among different job classes. These features are widely present in applications ranging from internet and web servers to assemble-to-order and revenue management systems. We overview some of the recently developed methodologies and applications in this area, focusing on performance analysis, limiting regimes and asymptotic optimality.
Biography

David Yao has been on the faculty of Columbia University since his PhD in 1983, where he rose to full professorship in 1988 and was appointed to the Edison Chair in 1992. He has also held academic and professional appointments at Harvard, Yale, Tsinghua, Chinese University of Hong Kong, and IBM T.J. Watson Research Center.

He is an IEEE Fellow, an INFORMS Fellow, and a recipient of honors and awards including the Guggenheim Fellowship; the Presidential Young Investigator Award from the U.S. National Science Foundation; the Franz Edelman Award from the Institute for Operations Research and Management Sciences; the SIAM Outstanding Paper Prize from the Society for Industrial and Applied Mathematics; and from IBM, the Outstanding Technical Achievement Award, Research Division Award, Invention Achievement Award, and the IBM Faculty Award. Author/co-author of over 180 refereed publications, three books and five edited volumes, he has been a principal investigator of over thirty research grants and contracts from government and industrial sources. He is also a holder of six U.S. patents in manufacturing operations and supply-chain logistics.
iCART: Intelligent Cooperative Autonomous Robot Transporters

Professor Kazuhiro Kosuge
Department of Bioengineering and Robotics
Tohoku University, Japan

Abstract

Mechanical parking systems, such as elevator/tower parking systems, convey parking systems, shuttle parking systems, etc., are very popular in Japan especially inside of a crowded city. These systems are used to park automobiles efficiently in narrow space available for parking in department stores, hotels, etc., although users are required to maneuver their cars skillfully and guide their cars into a specified narrow place. iCART (Intelligent Cooperative Autonomous Robot Transporters) is a robot system which assists the users to maneuver their cars in a narrow space.

The current robot system consists of two mobile robots and each robot consists of three parts; a mobile base module, which is nonholonomic but having omni-directional mobility, a lifter module, which lifts up automobile without touching its body, and a
connecting module, which connects the mobile base module and the lifter module and plays both roles of a suspension for the system and a three degrees of freedom force/torque sensor. The use of two mobile robots enables the robot system to handle a variety of cars having different dimensions.

Coordination of multiple mobile robots handling an automobile together is challenging. The slippage between the mobile base and the ground is unavoidable and odometry could not be used for the coordination of multiple robots having physical interaction. The estimation error of robot pose caused by the slippage could damage the automobile. A new coordinated motion control scheme has been designed inspired by a caster mechanism and implemented in the robots to overcome the problem. Several laser range finder systems have been also installed for localization of robots and the automobile and for robot motion planning. Through the development of iCART, we will discuss issues relating to robotics as systems integration.

Biography

Kazuhiro Kosuge is a Professor in the Department of Bioengineering and Robotics at Tohoku University, Japan. He received the B.S., M.S., and Ph.D. in control engineering from the Tokyo Institute of Technology, in 1978, 1980, and 1988 respectively. From 1980 through 1982, he was a Research Staff in the Production Engineering Department, Nippon Denso Co., Ltd. (DENSO Co., Ltd. at present). From 1982 through 1990, he was a Research Associate in the Department of Control Engineering at Tokyo Institute of Technology. From 1990 to 1995, he was an Associate Professor at Nagoya University. From 1995, he has been at Tohoku University. He received the JSME Awards for the best papers from the Japan Society of Mechanical Engineers in 2002 and 2005, the RSJ Award for the best papers from the Robotics Society of Japan in 2005. He is an IEEE Fellow, a JSME Fellow, a SICE Fellow and RSJ Fellow. He is IEEE RAS President Elect for 2008-2009.
Abstract

In this presentation a new concept Supernetwork and its applications are introduced. Supernetwork can be referred as Network of networks and has the following features:
- Multi-tiered;
- Multi-level;
- Multi-mode network flows;
- Congestion;
- Alternative behavior of users of the network;
- Multi-criteria;
and
- Conflict between user’s optimization and system optimization.

Concept of supernetwork has a wide range of applications and only a small part of those applications has been explored thus far. Some specific applications of supernetworks are: supernetworks consisting of social networks interacting with supply chain networks, supernetworks consisting of social networks interacting with financial networks, and knowledge supernetworks. This framework captures the different interacting networks in one model. It allows one to compute optimal solutions under different scenarios and to test how the equilibrium will change.
when certain cost and benefit functions are changed. Application areas of supernetwork models:

- Telecommuting/Commuting Decision-Making
- Teleshopping/Shopping Decision-Making
- Supply Chain Networks with Electronic Commerce
- Financial Networks with Electronic Transactions
- Reverse Supply Chains with E-Cycling
- Energy Networks/Power Grids
- Knowledge Networks

**Biography**

**Zhongtuo Wang** is the professor of School of Management, Dalian University of Technology (DUT), head of the PhD Program of Systems Engineering, director of Research Center of Knowledge Science and Technology, DUT. He is the member of Chinese Academy of Engineering. He was the vice-president of Systems Engineering Society of China. In fifties of last century, he joined the department of Electrical Engineering, Dalian University of Technology. As the founder of Department of Control Engineering of DUT, he made a lot of contributions to the teaching and research works in the field of Optimizing control and Computer applications. In the year of 1977, he moved to the area of Systems Engineering. As one of the originators of PhD Program and research works of Systems Engineering in China and founder of Institute of Systems Engineering DUT, he devoted himself to the task of theoretical research in decision analysis, complex adaptive system and network optimization. As a leader he has organized a lot of projects of applying methodology and techniques of Systems Engineering to the Chinese economic and engineering endeavors, including the strategic analysis of regional economic development, production planning of the petroleum refinery, planning and scheduling of the construction projects, and impact of information technology to the management transformation. At the same time, he organized the education task of MS and PhD program of Systems Engineering and Management Science in DUT. In the years 1986-1988, He worked in International Institute for Applied Systems Analysis (IIASA) in Vienna, Anstria as research scholar and head of international collaborative project and known internationally for his contribution. He has published 10 books and 9 translations and more than 170 papers and reports. He received 2 national awards, 9 awards from ministries of Chinese government. He is now working in Knowledge Management and Technological Innovation.
Abstract

Managing fleets of trucks, locomotives, business jets, vaccines, medical resources and energy all share something in common: they are all high-dimensional stochastic resource allocation problems. They can be formulated as dynamic programs with state, information and action variables with thousands or even millions of dimensions, a characteristic we refer to as the "three curses of dimensionality." Classical techniques in approximate dynamic programming solve only part of the problem. We show how the use of the post-decision state variable allows us to break a problem into three distinct components: simulation, deterministic optimization and statistical learning. This strategy decomposes problems over time, allowing us to use commercial optimization packages to
solve the problem at each point in time using value function approximations to produce good solutions over time. The challenge is designing and estimating value function approximations. I will describe a simple method that works well for a wide range of problems, and discuss some of the algorithmic challenges that we are still facing. I will describe several applications of ADP in transportation and energy policy modeling.

Biography

Warren B. Powell has been a faculty member at Princeton University since 1981, with specialization in stochastic optimization problems arising in a variety of resource allocation problems, with applications encompassing freight transportation, military operations, energy resource management, health and finance. He founded and currently heads CASTLE Laboratory within the Department of Operations Research and Financial Engineering at Princeton where he has developed advanced optimization models and algorithms for some of the largest freight transportation companies in the country.

His research achievement includes fundamental contributions to stochastic optimization, computational advances in the solution of large-scale stochastic optimization problems, and the formulation and solution of complex resource allocation problems arising in transportation. He has also recently begun a new line of research in optimal learning that addresses the challenges of collecting information in an efficient way. These problems arise in drug discovery and medical testing, business, R&D portfolio optimization, engineering design, optimization of expensive simulations, and biosurveillance, to name a few.

He has authored or coauthored over 140 refereed publications, and he is the author of Approximate Dynamic Programming: Solving the curses of dimensionality, published by John Wiley and Sons. This research has led to the first stochastic, multiscale model for energy policy analysis, and his techniques have been used in applications in finance and health. His work in freight transportation has spawned two consulting firms, and he was twice a finalist in the Edelman competition. A recipient of the Informs Fellows Award, Professor Powell has served in a variety of editorial and administrative positions for Informs, including Informs Board of Directors, Area Editor for Operations Research, President of the Transportation Science Section, and numerous prize and administrative committees.
Automatic Fabrication of Ultraprecision Microparts with Complicated Shape

Professor Yoshimi Takeuchi
Department of Mechanical Engineering
Osaka University, Japan

Abstract

Ultraprecision micromachining is a key technology to realize the fabrication of microparts, microrobots, etc. Until now, etching and lithography based technologies are well known in the microfabrication fields, where such a material as silicon oxide is generally utilized. A large problem of these technologies is the difficulty of producing 3-dimensional shapes with inclined and sculptured surfaces. Ultraprecision mechanical micromachining technology is utilized to meet the requirement, using a diamond cutting tool and an ultraprecision machine tool such as a turning lathe or a milling machine, especially with the multi-axis control machining function. Multi-axis control machine tools are one solution for improving productivity and accuracy, however, it is difficult to actually implement due to the interference between a cutting tool and a workpiece. Thus, the
speech presents the current state of multi-axis control ultraprecision machine tools in Japan and a machined example of small workpieces with a complicated shape by making use of multi-axis control machining function. In order to set a cutting tool at an arbitrary position with an arbitrary attitude, 6 degrees of freedom are required, that is, 3 translational positioning mechanisms, X, Y, and Z, and 3 rotational positioning mechanisms, A, B, and C around each corresponding translational axis. Usually, conventional machine tools consist of 3 translational axes. On the contrary, multi-axis control machine tools stand for machine tools having more than 3 control axes. 5-axis control machine tools, the representative of multi-axis control ones, are usually equipped with 3 translational axes and 2 rotational axes, for example, X, Y, Z, A, and B. The axis C is used as the main spindle to rotate a diamond cutting tool or a workpiece so that high cutting speed can be realized. In case of 6-axis control machining, non-rotational diamond cutting tools are used, which enable the characteristic machining in spite of extremely low cutting speed. In general, ultraprecision machine tools have the translational positioning accuracy of 1 nm and the rotational one of 0.00001 degree. In Japan, there are currently more than 5 ultraprecision machine tool builders. Ultraprecision machine tools can be classified into several types in terms of driving mechanism of movement axes such as ball-screw, pneumatic/hydrostatic screw or linear drive, and supporting mechanism/bearing such as ball/roller bearing or pneumatic/hydrostatic bearing. In order to fabricate microparts with complicated shape, advanced CAM systems are essential. Such a CAM system can generate NC data for ultraprecision machine tools, based on 3-D CAD systems. In other words, it is impossible to create microparts with complicated shape without advanced CAM systems. As a representative of complicated micromachines, there is a micropump useful for water-cooling of heat generation from CPU, fuel-supplying to fuel cells, blood circulation and so on. Let us introduce the machining of an inducer of axial flow type micropump for blood circulation. Then, several machined results by means of our own multi-axis control CAM system for ultraprecision milling are presented.

Biography

Yoshimi Takeuchi is a professor of the Department of Mechanical Engineering, Graduate School of Engineering at Osaka University. He graduated from the University of Tokyo in 1971, and received Master Degree in 1973 and Doctor Degree in 1976 respectively. He was a visiting researcher of Machine Tool Laboratory at Technical University of Aachen, Germany during 1978.4 to 1979.3 under the support of Alexander von Humboldt foundation. He is a fellow of CIRP, editor-in-chief of International Journal of Automation Technology and International Journal of Precision Engineering. He received Paper Awards from JSPE at 1997, 2000 and 2008, and from JSME at 1998 and 2004, respectively. He is now a vice-president of JSPE. His research interests are the development of ultraprecision micromilling technology to make small size and complicated shape parts, and the application of 3D-CAD/CAM to multi-axis control machining.
Abstract

Cluster tools provide a flexible, reconfigurable, and efficient environment for semiconductor manufacturing. They become difficult to operate because of residency time constraints and process time variation. This talk addresses their modeling, scheduling and control issues. A generic Petri net model is developed to model them. It describes the robot activity sequence with robot waits included. Hence, to operate a cluster tool is to determine robot wait times. A two-level operational architecture is proposed and discussed. It includes an off-line optimal periodic scheduler and real-time controller. This proposed approach allows a cluster tool to adapt to activity time variation while operate at its highest throughput at the steady-state. The presented Petri net
models play a critical role in ensuring proper transient processes and optimal steady-state operations of cluster tools. The advantages of the propose methodology over the existing Petri net methods and mathematical programming approaches are discussed.

Biography

MengChu Zhou is a Professor of Electrical and Computer Engineering and the Director of Discrete-Event Systems Laboratory at New Jersey Institute of Technology. His research interests are in Petri nets, semiconductor manufacturing, sensor networks, system security, and life-cycle engineering product design. He has over 300 publications including 9 books, 130+ journal papers, and 17 book-chapters. Based on the data analysis from Scopus database (the world’s most extensive database covering science and engineering papers), in the area of Petri nets, Dr. Zhou ranks the top one in terms of the number of publications; and top two in terms of the number of citations. He ranks the top one in the area of automated manufacturing systems in both indices. He is Editor of IEEE Transactions on Automation Science and Engineering, Associate Editor of IEEE Transactions on Systems, Man and Cybernetics: Part A and IEEE Transactions on Industrial Informatics. He was General Co-Chair of 2003 IEEE International Conference on System, Man and Cybernetics, Washington DC, October 5-8, 2003, Founding General Co-Chair of 2004 IEEE Int. Conf. on Networking, Sensing and Control, Taipei, March 21-23, 2004, and General Chair of 2006 IEEE Int. Conf. on Networking, Sensing and Control, Ft. Lauderdale, Florida, U.S.A. April 23-25, 2006 and IEEE Conf. on Automation Science and Engineering, Washington D.C., August 23-26, 2008. He was Program Chair of 1998 and 2001 IEEE International Conference on System, Man and Cybernetics (SMC) and 1997 IEEE International Conference on Emerging Technologies and Factory Automation. Dr. Zhou was the recipient of NSF’s Research Initiation Award, CIM University-LEAD Award by Society of Manufacturing Engineers, Perlis Research Award by NJIT, Humboldt Research Award for US Senior Scientists, Leadership Award and Academic Achievement Award by Chinese Association for Science and Technology-USA, Distinguished Lecturer of IEEE SMC Society, and Chang Jiang Scholars Program Award from PRC Ministry of Education. He was the founding chair of Discrete Event Systems Technical Committee of IEEE SMC Society, and founding chair of Semiconductor Manufacturing Automation Technical Committee of IEEE Robotics and Automation Society. He is a Fellow of IEEE.
NEU 111 Project Panel
Automation & Logistics Forum

16:00 - 17:00, August 6th, 2009
Han-Qing Conference Hall Auditorium

Chairs: Tianyou Chai and Tzyh-Jong Tarn

Panelists

Tianyou Chai, Northeastern University, China
Tongwen Chen, University of Alberta, Canada
Toshio Fukuda, Nagoya University, Japan
Sam Shuzhi Ge, National University of Singapore, Singapore
Kazuhiro Kosuge, Tohoku University, Japan
Wei Lin, Case Western Reserve University, USA
Derong Liu, Unversiity of Illinois at Chicago, USA
Max Q.-H. Meng, The Chinese University of HongKong, China
Warren B. Powell, Princeton University, USA
Sizhao Qin, University of Southern California, USA
Chunyi Su, Concordia University, Canada
Tzyh-Jong Tarn, Washongton University, USA
Yoshimi Takeuchi, Osaka University, Japan
Hong Wang, University of Manchester, UK
Zhongtuo Wang, Dalian University of Technology, China
David D. Yao, Columbia University, USA
Hong Zhang, University of Alberta, Canada
Mengchu Zhou, New Jersey Institute of Technology, USA

The Northeastern University 111 project participants and the plenary speakers of IEEE ICAL 2009 conference, with research interests in the areas of automation and logistics, will form the panel of this forum to share and discuss their perspectives, experience, and advice on conducting high-impact engineering research in the general research areas of automation and logistics. Important issues common to various engineering disciplines and specific issues in automation and logistics will be discussed. This forum is open to all participants of the conference. It will be particularly useful for graduate students as well as and researchers and professors in the early stages of their career development. The panel will entertain questions from the audience during the forum.
Symbols for Technical Sessions

Symbols for Days of a Week

W = Wednesday
T = Thursday
F = Friday

Symbols for Session Time Slots

Session XM = 10:20 - 12:00
Session XP = 14:00 - 15:40
Session XPP = 15:40 - 16:40
Session XEP = 16:40 - 17:40

Symbols for Room Assignments

HQHT = Han-Qing Conference Hall

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# Session IDs, Session Titles & Session Chairs

## Wednesday August 5th, 2009

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### Afternoon

| WP-1    | Robotics II                          | Lingfei Wu, Yangmin Li    |
| WP-2    | Modeling II                          | Mingzhu Zhang, Dayou Li   |
| WP-3    | Automatic control II                 | Donglian Qi, Shi Jin       |
| WP-4    | Intelligent control and automation II| Yuqing Chen, Fujun He     |
| WP-5    | Logistics planning                   | Na Xu, Chao Hu            |

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<td>Chao Hu, Hong Wang</td>
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<td>Ming Zhong, Xiaohua Yu</td>
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### Afternoon

| TPP     | System modeling                      | Guohui Tian, Xianming Li  |

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<td>Yingzi Wei, Ze Tao</td>
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### Afternoon

| FP-1    | Optimization II                     | Jing Bai, Shuli Sun       |
| FP-2    | Simulation II                       | Yunong Zhang, Yanjun Shen |
| FP-3    | Intelligent transportation system    | Chenjin Zhang, Hong Zhang|
| FP-4    | Network-based systems II            | Aiguo Ming, Yingwei Zhang|
| FP-5    | Transportation systems              | Jason Gu, Simon Yang      |

### Evening

| FEP     | Modeling and simulation             | Yibin Li, Chengjin Zhang  |
Oral Session

Han-Qing Conference Hall - Level 3
(东北大学汉卿会堂)
Wednesday August 5, 2009

WM-1  Robotics I
WM-2  Modeling I
WM-3  Automatic control I
WM-4  Intelligent control and automation I
WM-5  Supply chain management
WP-1  Robotics II
WP-2  Modeling II
WP-3  Automatic control II
WP-4  Intelligent control and automation II
WP-5  Logistics planning
Robotic Gripper Based on Advanced System Set-up and Fuzzy Control Algorithm

*A. M. Soliman, *A. M. Zaki, **A mourning. El-Shafei, and **O. A. Mahgoub
*Electronics Research Institute, Egypt **Faculty of Engineering, Cairo University, Egypt

- Gripper importance appears in hazardous and routine work.
- Applying the minimum force to grasp and handle unknown object without dropping it or smashing it is the main purpose of this research.
- New grasping scenario using fuzzy logic controllers is developed and presented.
- Economical system configuration is presented and good system performance was obtained through experimental results.

Continuous Steps toward Humanoid Push Recovery

Wentao Mao, Jeong-Jung Kim and Ju-Jang Lee
KAIST, Korea

- Continuous Steps Method proposes a method which employs continuous steps reaction to recover humanoid from a big push.
- Continuous Steps Method has more stable and soft responses compared to the previous methods.
- Mathematical Dynamic modeling of steps proposes a reasonable, strong and reliable reference to humanoid push recovery.

Predictive Function Cascade Control Scheme and its Application to Hydraulic Robot Systems

Zhihuan Zhang
Ningbo Institute of Technology, Zhejiang University
Ningbo, China

- Predictive Function Cascade Control Scheme.
- PFC-P controller for hydraulic robot.

Object-Centric Programming

Andreas Angerer, Alain Hoffmann, Frans Ortmeier, Michael Vistein and Wolfgang Reif
Institute for Software and Systems Engineering, University of Augsburg
Augsburg, Germany

- Manipulator-level programming is often inflexible and non-intuitive
- Goal: Focus on the task that shall be accomplished and objects in this task
- Goal can be accomplished by a proper object-oriented robotic architecture → "Object-Centric Programming"
- Example: Palletizing

The Model-Based Iterative Learning Control for Industrial Robot Manipulators

Je Sung Yeon, Jong Hyeon Park, Seung-Woo Son, and Sang-Hun Lee
School of Mechanical Engineering, Hanyang University, Korea

- This paper proposes a model-based iterative learning control (MB-ILC) for industrial robot.
- The proposed MB-ILC modifies the desired trajectory but not the control input signals.
- To achieve stability of the MB-ILC algorithm in the iteration domain, two filters are used.
WM-2: Modeling I
Session Chair: Jason Gu and Na Xu
HQHT-308  10:20-12:00 Wednesday, August 5th

HQHT-308(1)  10:20-10:40
Modeling and Simulation of Yard Trailer Dispatching at Container Terminals
Bin Li, Wen-feng Li, Yu Zhang, Yan-hong Ge, Huan Chen and Xiao-ke Liang
School of Logistics Engineering, Wuhan University of Technology
Wuhan, China
- Whether yard trailer dispatching at container terminals is sound or not possesses of important significance to improve on the operational efficiency.
- This paper utilizes hybrid flow shop with blocking based on attributes to build the mathematical model of yard trailer dynamic dispatching and presents the corresponding formalization model based on Harvard architecture and multi-agent.
- The following simulations validate the feasibility and creditability of the above modeling methodology.

HQHT-308(2)  10:40-11:00
Kinematics Modeling and Simulation for an Amphibious Robot: Design and Implementation
Rui Ding, Junzhi Yu, Qinghai Yang, and Min Tan
Key Laboratory of Complex Systems and Intelligence Science
Institute of Automation, Chinese Academy of Sciences, Beijing, China
- Wheel-driving mechanism
- Kinematics analysis on land
- Kinematics model established by Solidworks and ADAMS
- Simulation of straight-going, turning, and slope climbing

HQHT-308(3)  11:00-11:20
The Finite Element Model of Transient Temperature Field of Airplane Brake Disks with Rough Surface Profile
Xue Jing, Li Yuren, Liu Weiguo, Tian Guanglai and Wei Hanbing
College of Automation, Northwestern Polytechnical University
Xi'an, China
- Contact model of surface roughness
- Finite element model of temperature field of brake disks.
- Performance simulations in ANSYS

HQHT-308(4)  11:20-11:40
PSO Algorithm for a Single Machine Scheduling Problem with Batching in Chemical Industries
Ping Yan, and Lixin Tang
Liaoning Key Laboratory of Manufacturing System and Logistics, The Logistics Institute, Northeastern University
Shenyang, China
- A single machine batch processing scheduling problem (SBPSP) integrating batching decision is investigated. The integration problem of batching and scheduling is to allocate the demands from different customer orders to sets of batches and schedule these batches such that the total weighted tardiness costs and the total set-up costs are minimized.
- A PSO algorithm incorporated AIA mechanism is proposed to solve this problem effectively.

HQHT-308(5)  11:40-12:00
Assigning Skus to Multiple Automated-Picking Areas over Multiple Periods
Peng Liu, Yachua Wu, Na Xu
School of Control Science and Engineering, Shandong University
Jinan, China
- Based on fluid model, the optimal allocation of storage resources to each sku for the automated picking system is presented to minimize the total restocking cost.
- For a given period, greedy heuristic algorithm is developed to assign skus to automated-picking areas.
- Sequence viscosity is formulated to evaluate skus over multi-period by minimizing the total cost of picking, restocking, and reslotting.
- Efficient heuristic algorithms are adopted to assign skus to automated-picking areas over multiple periods.
Neural Network Control of Scanning Probe Microscope Precision Stage
Qiang Wei, Chengzhong Hu, Dong Zhang, and Xianming Li
Department of Physics and Electronic Science, Taishan University, Taian, China
School of Control Science and Engineering, Shandong University, Jinan, China

• Precision stage is actuated by the piezoelectric ceramics, and a dynamics model based on Neural Network is given.
• The traditional PID controller is replaced by a neural network PID controller. Weights in the network and parameters in the PID controller are adjusted.
• Experimental verification and validation of the proposed method using a nano-positioning stage is designed.
• The response time is reduced from 0.38s to 0.18s, and the steady-state error is shortened from 4.2% to 1.9% under a displacement of 10μm.

Design of Plant-Friendly PID Controllers Based on Constrained Optimization
Dawei Shi, Junzheng Wang, Linlin Ma, and Jueguo Zhao
School of Automation, Beijing Institute of Technology, Beijing, China

• Plant-friendliness is evaluated based on the total variations of the control variable.
• The controller is designed by optimizing plant-friendliness while considering transient response and robustness.
• The trade-off between the transient performance and plant-friendliness is analyzed.
• Applications to typical process models illustrate the effectiveness of the proposed method.

Concise Nonlinear Adaptive Robust Control of ship Steering Systems
Guan Wei, Zhang Xian-ku and Wang Xin-ping
Laboratory of Marine Simulation and Control, Dalian Maritime University, China

• For ship steering systems, a CNARC derived from Backstepping design method based on CGSA.
• The CNARC adaptive nonlinear compensator overcomes the high conservative of the pure nonlinear robust.
• The CNARC design procedure is simple and direct, easy to reach information symmetric.
• Through the simulations, we can see that the CNARC has a superior performance.
WM-4: Intelligent control and automation I

Session Chair: Sam Ge and Simon Yang

HQHT-313 10:20-12:00 Wednesday, August 5th

**HQHT-313(1) 10:20-10:40**

**Neural Network Tracking Control of Ocean Surface Vessels with Input Saturation**
Mou Chen, Shuzhi Sam Ge and Yoo Sang Choo
Department of Electrical and Computer Engineering, National University of Singapore, Singapore

- Design of an approximation based control in combination with back-stepping control.
- Account for control input saturation explicitly in the control design stage for both full state feedback control and output feedback control.
- Rigorous stability analysis via Lyapunov analysis which shows that the semiglobal uniform boundedness of the closed-loop signals are guaranteed.

**Simulation Results**

**The Tracking error**

**Identification and Control Scheme**

**HQHT-313(2) 10:40-11:00**

**Decentralized Cooperative Control for Swarm Agents with High-Order Dynamics**
B. Ren, S. S. Ge and T. H. Lee
NUS, Singapore

H. L. Pei and Z. D. Sun
SCUT, Guangzhou, China

- Objective: To drive a swarm of multi-agent systems with high-order nonlinear dynamics into a moving target region while avoiding collisions among themselves.
- Control design is based on a fusion of two kinds of new potential functions, backstepping technique and Lyapunov synthesis.
- Flexibility and scalability are improved.

**Simulation Results**

**HQHT-313(3) 11:00-11:20**

**Nonlinear Systems Identification and Control using Dynamic Multi-Time Scales Neural Networks**
Xuan Han and Wen-Fang Xie, Member, IEEE
Department of Mechanical & Industrial Engineering, Concordia University, Montreal, Canada

- On-line identification algorithm via dynamic neural networks with different time-scales
- Adaptive control method for Dynamic systems with nonlinearity and uncertainty
- Lyapunov function analysis, singularly perturbed technique and sliding mode methodology
- Guarantee trajectory tracking and stability

**Identification and Control Scheme**

**HQHT-313(4) 11:20-11:40**

**Inverse Rate-Dependent Prandtl-Ishlinskii Model for Hysteresis Nonlinearities Compensation**
M. A. Jaradat, S. Rakheja, C.-Y. Su
Department of Mechanical and Industrial engineering, Concordia University,

- Inverse of the rate-dependent Prandtl-Ishlinskii model is proposed to compensate rate-dependent hysteresis effects in smart actuators.
- The rate-dependent hysteresis properties were characterized using the rate-dependent play operators.
- The inverse model is subsequently obtained analytically from the rate-dependent play operators.

**Hysteresis**

**HQHT-313(5) 11:40-12:00**

**Fuzzy Based Control of Dissolved Oxygen Concentration in a Bioreactor for Wastewater Applications**
Jesse Rocca and Simon X. Yang
Advanced Robotics and Intelligent Systems Laboratory, University of Guelph, Guelph, Ontario, Canada

- A new fuzzy controller for robust control of the dissolved oxygen concentration in a wastewater bioreactor is presented
- The fuzzy controller is developed and tested using first order plus dead time models obtained from a real bioreactor
- The fuzzy controller performance is benchmarked against a similarly tuned PID controller and shows several enhancements

**Identification and Control Scheme**

**Simulation Results**

Han-Qing Conference Hall – Level 3 (东北大学汉卿会堂)
Studies on Fashionable Products’ Demand Forecast and Stock Control

The study of inter-organizational collaboration by cluster supply chain
Xiao Xue, Biqing Huang and Tianyuan Xiao
National CIMS Engineering Research Center, Tsinghua University
Beijing, China

Cluster supply chain is a set of networks comprised of horizontal ties between firms within a particular industrial cluster, which are sequentially arranged based on vertical less between firms in different layers.

Cluster supply chain analysis integrates supply chain and network perspectives on inter-organizational collaboration with particular emphasis on the value creating and coordination mechanism.

We posit that sources of value and coordination mechanisms correspond to distinct types of collaborations: vertical, pooled horizontal and reciprocal horizontal.

Research on Collaborative Quality Management System into Supply Chain
Xingyu Jiang
School of Mechanical Engineering, Shenyang University of Technology
Shenyang, China

To cope with the challenges of traditional quality management system applied in supply chain, which consists of internal practices that are contained within a firm, external practices that cross organizational boundaries integrating a firm with its customers and suppliers, a collaborative quality management system model into supply chain, integrated several enabling technologies such as collaborative-supported-computer-work), Statistical Process Control and comprehensive evaluation. Furthermore, some of key enabling technologies were studied in detail, including collaborative quality design based on CSCW, dynamic process quality control, quality management based on supply chain, etc.

A Joint Decision Model of Inventory Control and Promotion Optimization based on Demand Forecasting
Gao Jun-jian, Kang Ting
Sydney Institute of Language and Commerce, Shanghai University
Shanghai, China

We study the problems of jointly determining the promotion, pricing and inventory control of multiple beer product variants in a Chinese retail supermarket based on demand forecasting.

We examine the joint effect of two modes of promotional policies: price discount and inventory stimulation.

A numerical solving algorithm is proposed and an experimental example is given.

Our experimental analysis reveals that the two-stage joint optimization model has good flexibility and robustness and appropriate inventory control strategies and promotional methods would achieve higher profit.

Response to the Supply Chain Disruptions with Multiple Sourcing
ZHOU Xiaozhang and FANG Huijiang
Jiangxi University of Finance and Economics
Nanchang, Jiangxi Province, China

In a two-echelon supply chain consisted of one purchaser and two homogeneous suppliers, the purchaser could synchronously order from two suppliers, but the suppliers maybe don’t fulfill the orders because of emergencies.

If choosing the multiple sourcing strategy, the purchaser orders equal-quantity materials from two suppliers.

The total order quantity of multiple sourcing is greater than single sourcing. Multiple sourcing can provide backup inventory to the purchaser.
Bio-inspired Design and Realization of a Novel Multimode Amphibious Robot
Weibing Wang1, Junzhi Yu2, Rui Ding2, and Min Tan2
1Shihezi University, Xinjiang Uygur Autonomous Region 832003, China
2Institute of Automation, Chinese Academy of Sciences, Beijing 100190, China

- Related work of amphibious robot
- Biological inspiration and updated schemes
- Improved buoyancy design and wheel-propeller-fin mechanism
- Mechanical implementation and testing results

Accurate Localization in Combination with Wireless Sensor Networks and Laser Localization
Lingfei Wu, Max Q.-H. Meng, Huawei Liang, Wen Gao
Center for Biomimetic Sensing and Control Research, IIM, Hefei, China

- An Accurate Localization in Combination with Wireless Sensor Networks and Laser localization scheme for Lunar Rover is proposed.
- The lunar rover position system consisted of the Lander, the lunar rover and a wireless sensor network is introduced.
- In the proposed scheme, the wireless sensor networks firstly localize themselves, and then help lunar rover to get position in the special conditions.
- In initial experiment, we validate the proposed method using the test platform designed by us.

Minimum Fuel Guidance Law for the Powered Descending Phase of a Lunar Module
Feng Zhang, Guangren Duan, and Yangzheng Shan
Centre for Control Theory and Guidance Technology, Harbin Institute of Technology, Harbin, China

- Based on 3-dimensional kinetic model, the fuel optimal problem is considered.
- With a time scaling transform and constraint transform, the problem is translated into a standard constrained optimal control problem.
- An open-loop parametric optimal guidance law is derived.
- With the parametric eigenstructure assignment method, a state feedback control law is obtained.

Parameter Design and Optimization for Mobile Mechanism of a Transformable Wheel-Track Robot
Zhiqing Li, Shugen Ma, Bin Li, Minghu Wang, Yuechao Wang
State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, China

- Propose a TWTR robot to adapt autonomously to the irregular environment.
- Each wheel-track unit, equipped with one actuator, has the following features:
  - transforming the track configuration
  - changing the locomotion mode between track mode and wheel mode.
- Design and optimize the parameters for the TWTR mechanism based on genetic algorithm.
- The validity of the parameters is demonstrated by simulation on transforming the track configuration and changing the locomotion mode.

Comparative Analysis for the Inverse Kinematics of Redundant Manipulators based on Repetitive Tracking Tasks
Jingguo Wang and Yangmin Li
Department of Electromechanical Engineering, University of Macau, Macao, China

- The closed-loop inverse kinematics algorithm via pseudo-inverse method is used to solve the joint trajectories.
- The repetitive trajectories are tracked in the simulations made on the 3-DoF planar and 4-DoF spatial manipulators respectively.
- Two optimization methods with joint limits avoidance are considered.
- The simulation results provide detailed comparative analysis among different methods and cases.
WP-2: Modeling II

Session Chair: Mingzhu Zhang and Dayou Li
HQHT-308  14:00-15:40 Wednesday, August 5th

HQHT-308(1)  14:00-14:20

Efficiency Analysis of an Innovative Multi-range Hydro-mechanical Continuously Variable Transmission
Zhang Mingzhu, Zhou Zhi, Xu Liyou
Henan University of Science and Technology, Luoyang, China

- Study the calculating method of the total efficiency of the innovative multi-range hydro-mechanical continuously variable transmission (HMCVT).
- Factors such as the power cycle and the variation of the efficiency of hydraulic units with their input power are considered.
- Give an efficiency algorithm of the closed pump-motor system.
- Describe a reasonable efficiency calculating procedure and calculate the efficiency of the multi-range HMCVT.

HQHT-308(2)  14:20-14:40

The Analysis of the Energy Efficiency of Refrigeration Stations in HVAC
Xiaotong Du, Xiaomei Qi, Maolang Ai
School of Control Science and Engineering, Shandong University Jinan, China

- In buildings refrigeration stations account for the most of energy consumption.
- Bring forward the concept of energy efficiency of refrigeration stations, define the expression of energy efficiency and energy consumption of refrigeration stations.
- Give out relation between energy efficiency in different cooling water temperature and variation of load.

HQHT-308(3)  14:40-15:00

Design and Dynamic Simulation of Permanent Magnet Motor Actuator on High Voltage Circuit Breaker
Lin Xin, Li Yong-xiang, Yang Chuan, Xu Jian-yuan, Liu Ai-min
College of Electrical Engineering, Shenyang University of Technology, Shenyang, China

- The motor drive actuator which used in high voltage circuit breaker is showed in this paper.
- The characteristics requirement of VCB is analyzed and calculated.
- The limited angle permanent magnet DC motor is designed.
- The transient finite element method is employed in the permanent magnet DC motor actuator.

HQHT-308(4)  15:00-15:20

Multi-dimensional Fuzzy Interpolation Neural Network
Dayou Li1, Hua Qi2, Yong Yue1, Casten Maple1, Vitaly Schetinin1
1Department of Computer Science and Technology, University of Bedfordshire, UK
2Department of Mechanical Engineering, Kyushu Sangyo University, Japan

- Fuzzy interpolation is the piecewise linearisation of a given function using a collection of fuzzy sets.
- K-dimensional fuzzy interpolation approximates an MISO function with a collection of small hyper-surfaces.
- An accurate approximation depends on how fuzzy sets are defined.
- Fuzzy interpolation neural network allows the fuzzy set optimally defined.

HQHT-308(5)  15:20-15:40

Human-Adaptive Step Estimation Method for Dance Partner Robot
Daishi Nakayama, Kazuhiro Kosuge, and Yasuhisa Hirata
Department of Bioengineering and Robotics in Tohoku University, Japan

- A dance partner robot has been proposed as a platform for human-robot coordination.
- Human-adaptive step estimation method for dance partner robot is proposed.
- Experimental results will show the effectiveness of the proposed method.

Partner Ballroom Dance Robot
WP-3: Automatic control II

Session Chair: Donglian Qi and Shi Jin
HQHT-312  14:00-15:40 Wednesday, August 5th

HQHT-312(1)  14:00-14:20
Same Cycle Servo Control System Based on Built-in NC
Shuanghui Hao, Jiahu Liu, Weifeng Zheng, Minghui Hao and Ruizheng Lang
School of Mechanical Engineering, Harbin Institute of Technology, Harbin, China

• The electrocircuit and control software of AC servo system are designed in this paper.
• Combined with the arithmetic of vector control, the NC instruction is embedded in the control model.
• The NC instruction, machine loop and current loop are successfully achieved in the same control circle, and the time of control circle is determined in the 60us.
• The response frequency and the performance of motion control are improved greatly.

HQHT-312(2)  14:20-14:40
Motion Control System Simulation of Cylindrical Linear Induction Motor Used in Circuit Breaker Operating Mechanism
Lin Ai-min, Li Jia-jue, Li Yong-xiang, Lin Xin
School of Electrical Engineering, Shenyang University of Technology, China

• Introduction of C-LIM.
• Building the system load model.
• Planning the model of curve based on motor movement.
• The modeling and simulation for vector control.
• Conclusion.

HQHT-312(3)  14:40-15:00
Simulation and Design of Control System on High Voltage Circuit Breaker Permanent Magnet Linear Motor Drive
Wang Xiaoyu, Lin Xin, Xu Janyuan, Li Yongxiang
School of Electrical Engineering, Shenyang University of Technology, Shenyang, China

• Design of Linear Servo Motor Drive of HVCB
• The Hardware system of servo motor actuator
• Control strategy of servo system
• Simulation of the control system
• Discussion

HQHT-312(4)  15:00-15:20
$H_{\infty}$ Robust Control for VSCF Brushless Doubly-Fed Wind Power Generator System
Shi Jin, Fengge Zhang and Yongsin Li
College of Electrical Engineering, Shenyang University of Technology, Shenyang, China

• The operation characteristics of wind turbine is analyzed.
• A $H_{\infty}$ speed controller without orthogonality assumptions is designed for variable speed constant frequency brushless doubly-fed wind power generation system.
• The proposed controller enhances system robustness to the parameters uncertainties and rapid tracking performance to the input signal to implement the maximum wind energy tracking.

HQHT-312(5)  15:20-15:40
The Title of My Paper on Aibo Behavior
Jie Yang, Donglian Qi, Guangzhou Zhao
College of Electrical Engineering, Zhejiang University, Hangzhou, China

• A synchronization control approach for unified chaotic system with uncertainties and time delay is presented using passive control theory.
• Because the chaotic trajectory is limited and the nonlinear function of the system satisfies Lipschitz condition, the error system transformed by synchronization error system can be globally asymptotically stabilized by state feedback, therefore it implements the synchronization control of unified chaotic system with uncertainties and time delay.
• Simulation results show that the adaptive passive synchronization scheme is efficient.
WP-4: Intelligent control and automation II

Session Chair: Yuqing Chen and Fujun He

HQHT-313  14:00-15:40 Wednesday, August 5th

HQHT-313(1)  14:00-14:20

**Key Technologies of 3D Surface Inspection for Complex Workpiece Using OMP60 probe**

Yuqing Chen, Zi Ma and Huipu Xu
Automation Research Center, Dalian Maritime University
Dalian, China

- Probe sphere radius compensation algorithm
- Hand-Eye calibration process is presented based on armed robot inspection system
- Point-sets registration
- Point distribution and path planning are developed and tested on realistic scenarios

![Armed robot inspection system](image)

HQHT-313(2)  14:20-14:40

**Study of PID Neural Network for Hydraulic System**

Beitao Guo, Hongyi Liu, Zhong Luo and Fei Wang
School of Mechanical Engineering and Automation, Northeastern University
Shenyang, Liaoning Province, China

- System model PID Controller Based On BP Network.
- PID Control and simulation.
- Adaptive PID Controller Based on BP Neural Network.
- Simulation Research and analysis

![The Hydraulic system](image)

HQHT-313(3)  14:40-15:00

**A New Fiber Winding Precision Tension Control System**

Ren Sheng-le, Lai Yinan, Wang Yong-zhang, and Lu Hua
School of Mechanical & Power Engineering, Harbin University of Science and Technology
Harbin, China

- Introduction
- Set-up of the system scheme
- Mathematical model of the system
- Software development of control system
- Results and analysis of the experiments

![The Fiber Tension Control Equipment](image)

HQHT-313(4)  15:00-15:20

**Humanoid Detection of Indoor Dangerous Gas Source by Mobile Robot**

Fujun He, Zhijiang Du, Yingfei Sun, and Xiaolei Liu
State Key Laboratory of Robotics and System, Harbin Institute of Technology
Harbin, China

- The robot can detect the indoor dangerous gas and give alarm.
- Two kinds of searching strategy is presented.
- The responding and recover delay features of gas sensors is analyzed and indoor searching features is discussed.
- The strategy imitates person’s searching process, which can evaluates risk with a fuzzy inferring system.

![The detecting robot](image)

HQHT-313(5)  15:20-15:40

**Automatic Performance Degradation Prediction by Use of Field Data with Noise**

Tao Zhang, Jian Wang and Peng Guo
Department of Automation, Tsinghua University, Beijing 100084, China

- Proposes an automatic performance degradation prediction approach for equipment by use of field data with noise.
- Auto-regression model is employed for making performance degradation prediction by means of field data.
- Improved least square method is adopted for parameter identification of auto-regression model.
- Field data of the temperature of gas engine are adopted to analyze the performance degradation of gas engine.

![Raw Data of Gas Engine](image)
WP-5: Logistics planning

Session Chair: Na Xu and Chao Hu

HQHT-314 14:00-15:40 Wednesday, August 5th

HQHT-314(1) 14:00-14:20

SOA - BPM Based Information System For Promoting Agility Of Third Party Logistics
Wen Zhen-Hua, Huang You-Sen, Deng Zhi-Yun and Zhang Wei
Hunan Technology College of Modern Logistics, Changsha, China

- SOA-BPM based IT infrastructure was suggested for promoting agility of 3PL information system
- Tuscany and Osworkflow were used for implementation of a prototype system
- Further research will carry out for improvement and application of the prototype system.

HQHT-314(2) 14:20-14:40

Design on Highway Accelerated Loading Testing Facility
Zhiguan Guan1,2, Mingxing Lin1, Xuguang Wang1, Jiwei Zhang2
1. School of Mechanical Engineering, Key Laboratory of High Efficiency and Clean Mechanical Manufacture, Ministry of Education, Shandong University, Jinan, China
2. Shandong Jiaotong University, Jinan, China

- The facility is 26.24 meters long, 7.92m high and 3.48m wide.
- Simulating vehicle’s real running conditions.
- Test wheel: 4, driver wheel: 2, driven wheel: 2.
- Effect test length: 6m.
- Maximum load on the test wheel: 150kN.

HQHT-314(3) 14:40-15:00

Profit Allocation in Collaborative Less-Than-Truckload Carrier Alliance
Na Xu, Chengxin Yu, Lei Zhang and Peng Liu
Business School, Shandong Jianzhu University, Jinan, China

- The international Financial Crisis has made the Less-than-truckload industry face with severe challenges of survival and development.
- Based on the cooperative game theory, formulate the LTL collaboration game and discuss the well-known profit allocations including proportional allocation, Shapley value and Nucleolus.
- Propose a new allocation method Weighted Relative Savings Model (WRSM) which is in the core and minimizes the maximum difference between the contribution ratio weighted relative savings among the participants.

HQHT-314(4) 15:00-15:20

Cyclic Transfer Algorithm for Single Batching Machine with Total Weighted Completion Time
Daguang Feng, Lixin Tang
Liaoning Key Laboratory of Manufacturing System and Logistics, The Logistics Institute, Northeastern University, Shenyang, China

- Introduction.
- Dijkstra algorithm for partitioning batches.
- Cyclic transfer algorithm for the partitioned batch
- Empirical results.

HQHT-314(5) 15:20-15:40

A particle swarm optimization for the quay crane scheduling problem with non-interference constraints
Jiao Zhao, Lixin Tang
Liaoning Key Laboratory of Manufacturing System and Logistics, The Logistics Institute, Northeastern University, Shenyang, China

- The quay crane scheduling problem discussed in this paper is to schedule a fixed number of cranes in order to load and unload containers into and from a vessel considering interference between cranes.
- A particle swarm optimization (PSO) algorithm to obtain solutions.
Thursday August 6, 2009

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<td>TM-5</td>
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An Optimal Energy Control for a Flexible Robot Arm

Xuezhang Hou, Zuoquan Wang

1 Mathematics Department, Towson University, Baltimore, Maryland 21252-0001, USA
2 School of Science, Changchun University of Science and Technology, Changchun, China

In this paper, we are concerned with a flexible robot arm formulated by partial differential equations with the initial and boundary conditions. An optimal energy control of the robot system is investigated after the system has been transformed to an abstract evolution system in an appropriate Hilbert space. The existence and uniqueness of the optimal energy control are proposed, discussed and proved, and an approximation result is obtained in terms of semi-group methods of linear operators.

Counterweight-Navigation of a Mobile Inspection Robot Working on the Ground Wires

Jan Jin, Huajin Zhu, Guoxian Zhang

Department of Mechanical Automation, Shanghai University, Shanghai, China

- An inspection robot for power transmission lines.
- Working on the ground wires.
- Performing the obstacle navigation automatically.
- Governing the centroid balance by a simple method.

Trajectory Planning for a Redundant Mobile Manipulator using Avoidance Manipulability

Ze Cui, Peng Li, Yanming Shao, Donghai Qian, Xiangcan Wang

Department of Precision Mechanical Engineering, School of Mechatronics Engineering and Automation, Shanghai University, Yanchang Road, Shanghai, China, 200072

cuize0421@tom.com

A trajectory planning method for a mobile manipulator is proposed in this paper. The mobile manipulator studied here consists of a mobile platform and a redundant manipulator. Since the system has the redundant degree of freedom to perform some tasks, it will have infinite configurations to make the end-effector reach the desired points. To optimize the avoidance ability of the redundant manipulator, we extend the AMSI and AMSIP which were used to optimize the avoidance ability of redundant manipulator to carry out the trajectory planning in this paper. We firstly predefine the trajectory of the mobile platform and stop it at a certain position defined by AMSI where allows the manipulator to reach all the desired points on the trajectory, then optimize the configuration of the manipulator according to AMSI and AMSIP to realize the whole trajectory planning task. The experiments are performed by the mobile manipulator in real environment.

Service Robots for Hospitals: A Case Study of Transportation Tasks in a Hospital

Ali Gürcan Özkil, Zhun Fan, Steen Dawids, Henrik Klaesstrup Kristensen, Kim Harland Christiansen

In this paper, the need for automated transportation systems for hospitals is investigated. Among other alternatives, mobile robots stand out as the most prominent means of automation of transportation tasks in hospitals. Existing transportation routines of a hospital are analyzed in order to verify the need for automation and identify possible areas of improvement. The analysis shows that most of the existing transportation is carried out manually, and hospitals can greatly benefit from automated transportation. Based on the results of the analysis, three alternatives are derived for implementing mobile service robots for transportation tasks in hospitals.

Home Service by a Mobile Manipulator System -Mobile Manipulation of Chairs-

Manabu Yamashiro, Zhaoxian Xie, Hisashi Yamaguchi, Aiguo Ming and Makoto Shimojo

The University of Electro-Communications, Tokyo, JAPAN

- As a practical and versatile platform for home service, a mobile manipulator system has been developed.
- A RFID-based sensor fusion system is constructed to realize efficient and detailed recognition.
- Mobile manipulations of various chairs based on the detailed information by the sensor fusion system have been performed successfully.
TM-2: Modeling III
Session Chair: Sam Ge and Simon Yang
HQHT-308 10:20-12:00 Thursday, August 6th

HQHT-308(1) 10:20-10:40
Dynamic Analysis and Safety Monitoring of Tank Truck
Zhao Jianwen, Bo Huang, Zhu Feibai, Lu Shizhou
Robotics Institute, Harbin Institute of Technology at Weihai
Weihai, China

- Tank trucks transporting dangerous gas often have serious traffic accidents
- build full-vehicle model and found the relationship between tank truck dynamic parameters and its working state
- simulations validate model’s handling directional stability.
- road test validate the tank truck model
- Simulations under different conditions in order to study the performance of dynamic parameters.

HQHT-308(2) 10:40-11:00
An Improved Semantic Entropy Maximum Model and Its Applications
Munan Li
School of Business Administration, South China University of Technology
Guangzhou, China

- Brings forward a novel semantic discovery approach based on the SEM (Semantic Entropy Maximum).
- This approach applies the entropy maximum algorithm to the matching and the recognizing of the semantic service, and meanwhile, it compares this algorithm with other related algorithms.
- The results of those experiments show that the SEM (semantic entropy maximum) model has some preferable performances.
- In a practical enterprise application of Chinese semantic recognition, the SEM model is proved to be useful and valuable in semantic recognition of Chinese.

HQHT-308(3) 11:00-11:20
Applying Multifractal Spectrum Combined with Fractal Discrete Brownian Motion Model to Wood Defects Recognition for Sawing
Lei Yu and Dawei Qi
Northeast Forestry University

- the principles of operation, configurations, and features are discussed.
- Both the equivalent magnetic circuit method and Finite Element Analysis are adopted to analyse the electromagnetic coupling of the machine.
- Design methodology is given.
- the combination of field with circuit should be done to design the machine.

HQHT-308(4) 11:20-11:40
Design and Finite Element Analysis on a Novel PMSM with Anti-rotation Dual Rotor
Jinhua Chen, Fengge Zhang, Guangpei Liu and Zhaohe Meng
College of Electrical Engineering, Shenyang University of Technology
Shenyang, China

- Storage locations pre-plan for outbound containers is important and complex.
- Practical rules for storage planning for outbound containers are collected from the actual container terminals
- Rules are treated and described in the three levels mathematic model with rolling-horizon planning idea.
- Simulation scenarios are designed for validating the rules and principles described in mathematic models.
Determination of Effective Energy in Buildings
Xiaotong Du Xiaomei Qi Cundong Wang
School of Control Science and Engineering, Shandong University, Jinan, China

- The phenomenon of low efficiency and waste is prevalent in public buildings.
- This paper presents a concept of energy efficiency. One part is effective energy, the other one is ineffective energy.
- The ratio of both times can represent energy validity indirectly.
- It would be a quantitative indicator to obtain reasonable energy consumption of building.

Wavefront Array Based Distributed Collaborative Measurement Pattern
Zhang Dengpan, Cui Shuxin, and He Lingsong
School of Mechanical and Power Engineering, Henan Polytechnic University, Jiaozuo, Henan Province, China

- The Architecture of Wavefront Array Based Measurement.
- The Virtual Bus of the Wavefront Array Pattern.
- The wavefront array model of the data exchange way.
- The collaborative measurement pattern for the distributed environment.

A Hybrid Algorithm of Tabu Search and Benders Decomposition for Multi-product Production Distribution Network Design
Wei Jiang, Lixin Tang and Shixu Xue
Liaoning Key Laboratory of Manufacturing System and Logistics, The Logistics Institute, Northeastern University, Shenyang, China

- The paper presents a hybrid algorithm of Tabu search and Benders decomposition to solve a multi-product two-stage production distribution network design problem.
- The computational experiments show the hybrid algorithm saves tremendous time compared with conventional benders decomposition.

Design of Three-dimensional Guidance Law Based on Extended State Observer for Hit-to-Kill Interceptors
Yuan Tian, Jian Chen and Zhang Ren
School of Automation Science and Electrical Engineering, Beihang University, Beijing, China

- 3D high-speed engagement.
- Approximate miss distance formula.
- Extended State Observer.
- Feedback linearization.
- Decoupling 3D nonlinear kinematics into two one-order subsystems.
- Simulation and results.
A Method to Coordination for Decentralized Multi- MPC Controllers in Integrated Plant

Aimin An 1, Xiaohong Hao1, Hongye Su2, Guangtao Yang3, Yongwei Ma1
1Lanzhou University of Technology, Lanzhou, China
2Zhejiang University, Hangzhou, China
3Lanzhou Petroleum Chemical Engineering Company, Lanzhou, China

- A method to coordinate multi-decentralized model predictive controllers (DM MPC) is proposed.
- It is a strategy to control the integrated plant through decomposing the total system model into different functional sub-models.
- The main aim is to relieve the expensive computation load and for improving the flexibility and reliability for operation.
- A stochastic probability density functions(PDFs) coordination rule is applied to coordinate optimizer with decentralized MPC controllers in the hierarchical control structure.

A Pragmatic Approach for Selecting Weight Matrix Coefficients in Model Predictive Control Algorithm and Its Application

Aimin An1, Xiaohong Hao1, Chao Zhao2 and Hongye Su2
1Institute of Electrical and Information Engineering, Lanzhou University of Technology, Lanzhou, China
2Institute of Cyber-Systems and Control, Zhejiang University

- To select appropriate coefficients often requires large expensive computation duty in MPC.
- The controllability and the observability Gramians of a stable controlled system are needed to calculate.
- The controllability and observability Gramians singular value matrices are calculated.
- Gramians singular values of the system are used as a benchmark to select the weight coefficients corresponding to different variable in the objective function of MPC.

A FCM-Weighted Markov Model for Remaining Life Prediction

Jihong Yan and Chaozhong Guo
Department of Industrial Engineering, Harbin Institute of Technology, Harbin, China

- Basic Markov model
- Weighted Markov model
- Fuzzy C-Means (FCM)-weighted Markov model for remaining life prediction
- Application of FCM-weighted Markov model for rotor life prediction to a Bently RK4 unbalance test-bed

Probabilistic Quality Control in non-Gaussian Process Control Applications

Puya Afshar*, Amin Nobakhti, Hong Wang*
Control Systems Centre, The University of Manchester, Manchester, UK

- A multi-objective process/quality control method for non-Gaussian stochastic batch processes (CSTR) is proposed
- Process tracking error and tracking error entropy as well as dwelling time error and its entropy are minimised
- In stage1, Evolutionary Algorithms are used to find the best batch parameters
- In Stage2, PI control input is calculated and applied to plant
- In Stage3, product is accepted/rejected based on quality monitoring results

Application of Robust Right Coprime Factorization Approach to a Distributed Process Control System

Shengjun. Wen, Mingcong. Deng, Akira. Inoue
Graduate School of Natural Science and Technology, Okayama University, Okayama, Japan

- A distributed process experimental system model is shown which includes a water level process model and a water flow process model.
- Robust right coprime factorization based nonlinear control scheme of the distributed process is proposed.
- From the industrial application viewpoint, implementation issues of designed controllers are investigated.
- Experimental results show the effectiveness of the proposed approach.
TM-5: Modeling and application  
Session Chair: Ming Zhong and Xiaohua Yu  
HQHT-314  10:20-12:00 Thursday, August 6th

HQHT-314(1)  10:20-10:40  
A Dynamic Vessel Fleet Planning Model in Uncertain Circumstances  
Zhong Ming and Min De quan, Liu Jian qiu  
Transportation Management College, Dalian Maritime University  
Liaoning, China  
- This paper aims to establish a dynamic vessel fleet planning model in uncertain circumstance, which offers the shipping companies the appropriate development strategy.  
- We establish a forecast model to predict the future shipping demand by virtue of Grey—Markov chain.  
- We bring the shipping demand as an uncertainty into the fleet planning, further, a dynamic fleet planning model in uncertain circumstances is established from the view of minimizing the total operating costs.  
- Finally, we use an example to verify the model and the algorithm presented.

HQHT-314(2)  10:40-11:00  
Ship Oscillation Simulation System Based on Direction Spectrum  
Bo Huang, Jianwen Zhao, Yanyu Su, Shizhou Lu  
Ship Engineering College, Harbin Institute of Technology  
Weihai, China  
- Oscillating motion of ship makes a great impact on the safety of ocean shipping of LNG tank  
- construct several groups of simulation environment and an algorithm based on direction spectrum to describe ocean wave spectrum according to Seakeeping theory  
- ship oscillation simulation system is built by VC++ and DirectX.  
- the simulation results are close to the ship’s experimental data.

HQHT-314(3)  11:00-11:20  
Application of Model-following Adaptive Neural Network Control Theory in Gust Load Alleviation  
Rui Nie, Weiguo Zhang, Guangwen Li, Xiaoxiong Liu  
College of Automation Northwestern Polytechnical University  
Xi’an, China  
- Based on the model-following adaptive neural network control theory, a gust load alleviation controller for civil airplanes by direct force control is proposed  
- Simulation results show that the GLA control can obtain good robust stability and the capability of restraining gust turbulence and measurement noises can be obtained by using the method in this paper.

HQHT-314(4)  11:20-11:40  
Electrocardiogram (ECG) Signal Modeling and Noise Reduction Using Wavelet Neural Network  
Suranai Poungponsri, Xiao-Hua Yu  
Department of Electrical Engineering  
California Polytechnic State University  
San Luis Obispo, CA 93407, USA  
- Electrocardiogram (ECG) signal has been widely used in cardiac pathology to detect heart disease  
- Wavelet neural networks (WNN) combine the multi-resolution nature of wavelets and the adaptive learning ability of artificial neural networks  
- In this paper, WNN is studied for ECG signal modeling and noise reduction. The WNN is trained by Adaptive Diversity Learning Particle Swarm Optimization (ADLPSO) and the gradient decent algorithm. Satisfactory Computer simulation results are obtained.

HQHT-314(5)  11:40-12:00  
Toward Bacteria Swarm for Environmental Monitoring  
John O Oyekan and Huosheng Hu  
University of Essex, United Kingdom  
- For optimal coverage of an environmental variable for pollution monitoring.  
- Control of real and simulated agents using a combination of bacteria controller and flocking controller.  
- Architecture and system design for the System.
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FM-1: Optimization I
Session Chair: Xiaohua Yu and Dayou Li
HQHT-304 10:20-12:00 Friday, August 7th

HQHT-304(1) 10:20-10:40
F-separation law inference and law mining
Huang Shunliang, Gao Houli
School of Management, Shandong University of Technology
Zibo, China
• Present concepts of f-separation law, F-separation law, f-separation law dependence and F-separation law dependence.
• Propose some theorems of f-separation law, F-separation law.
• Propose criteria of law dependence-discovery.
• Give an example of law mining.

HQHT-304(2) 10:40-11:00
Design and Realization of the Economical Operation Monitoring System for Traction Transformers
Huige Lai1, Xuejun Zhu1, and Jinshou Yu2
1School of Mechanical Engineering, Ningxia University; Yinchuan, China
2Research Institute of Automation, East China University of Science and Technology; Shanghai, China
• Security and economical operation of TT is a significant guarantee for electric railway with growing pace.
• TT economical load factor must be judged by the critical load factor; The critical load synthesis losses are key index; The power economized TT is selected optimally on the new or upgrade electric railway.
• TT monitoring system can be embedded in a digital protection system of power substation.

HQHT-304(3) 11:00-11:20
Vehicle Scheduling Problem of Hazardous Materials Based on Risk
Jianghua Zhang1, Qiang Han 2, Jin Li 3, and Daoli Zhu4
School of Management, Shandong University
Jinan, China
• This paper studies the vehicle scheduling problem of Hazardous materials based on risks which vary with time, taking into account the cost constraints and allowing for waiting at the nodes of the network.
• A mixed integer programming model is proposed, a novel heuristic algorithm is designed. The computational complexity of the algorithm is also analyzed. a numerical example is presented to show its validity and feasibility of this algorithm.

Running Window of Monitoring System

HQHT-304(4) 11:20-11:40
Application of Reinforcement Learning in Dynamic Pricing Algorithms
Wang Jintian, Zhou Lei
Department of Computer Science and Technology, Hefei University of Technology; Hefei, China
• dynamic pricing problems of a duopoly case in electronic retail markets
• simulated annealing Q-learning (SA-Q) and win-or-learn-fast policy hill climbing algorithm (WoLF-PHC)

Two sellers monopolizing electronic retail markets model

HQHT-304(5) 11:40-12:00
Genetic and Simulated Annealing Algorithm based on Chaos Variables
Jing Jiang, Boxue Tan and Lidong Meng
School of Electrical and Electronic Engineering, Shandong University of Technology
Zibo, China
• Procedures of genetic algorithm
• Combination of genetic algorithm with simulated annealing
• Using chaos vaviables to search neighborhood

Han-Qing Conference Hall - Level 3 (东北大学汉卿会堂)
FM-2:Simulation I
Session Chair: Ming Zhong and Zaiwen Liu
HQHT-308 10:20-12:00 Friday, August 7th

HQHT-308(1) 10:20-10:40
A Model of Fleet Planning for Land-Island Transport
Zhong Ming, Shen Jiang, Li Li
Transportation Management College, Dalian Maritime University
Liaoning, China
- The paper’s purpose is to establish a model of fleet planning of land-island transport.
- By using the linear programming method, the model’s object function is to minimize the annual operating cost of the fleet and the constraints are defined on the basis of the characteristics of land-island transport.
- Take the land-island routes between Pikou port and the islands of Changhais in Dalian PRC as an example to test the model and obtain the result of the following five years.
- The model is fit for solving the problem of the fleet planning of land-island transport.

HQHT-308(2) 10:40-11:00
CODP Position of leagile supply chain based on polychromatic sets theory
Dongmei Liu, Wen Wang, and Weiping Fu
School of Mechanical and Precision Instrument Engineering
Xi’an University of Technology, Xi’an, 710048, P. R. China
- According to the resource capacity of supply chain members, a kind of decision-making model represented by CODP is established.
- Using the polychromatic sets to the positions of element order decoupling point on leagile supply chain.
- a case studies including two manufacturers enterprise on supply chain network is used to illustrate the proposed model and approach.
- Though information of different levels in the model corresponding with the uniform color and the individual color in the polychromatic sets, the reasoning relational matrix of the influencing factors about members and separation point positioning indicators in the supply chains. Then the reasoning on the positions of decoupling points has been achieved.

HQHT-308(3) 11:00-11:20
Prediction Technique for Water-Bloom in Lakes Based on Elman Network
Zaiwen Liu, Xiaoyi Wang, Jiping Xu, Lifeng Cui, Xiaofeng Lian
College of Computer and Information Engineering, Beijing Technology and Business University, China
- Structure and feature of Elman network.
- Main factor analysis and modeling method for occurrence of water-bloom in rivers and lakes
- Test of water-bloom short-term prediction model
- Conclusion.

HQHT-308(4) 11:20-11:40
Research of Virtual Flight Testing System
Li Liu, Jinglei Li and Rongzhen Ja
School of Automation Science and Electrical Engineering, Beihang University
Beijing, China
- VFT can replace part of the flight test to validate the real aircraft flying qualities and performance.
- The VFT system includes flight management & control console, data acquisition, processing and evaluation console, digital aircraft, database.
- The VFT system is based on aircraft virtual prototyping or flight simulators.
- By testing on takeoff performance, research indicates that VFT is an efficient method of flight testing.

HQHT-308(5) 11:40-12:00
Numerical Simulation of Induction Heating of Steel Bar with Nonlinear Material Properties
Sun Yafei1, Sun Jing2 and Niu Dongjie3
1 Guangdong Institute of Science and Technology, Zhuhai, Guangdong, China
2 Northeastern University, Shenyang, Liaoning, China
3 Tongji University, Shanghai, China
- The simulation of PC steel bar heating process with different carbon content is presented.
- The surface temperature of PC steel bar in heating below Curie temperature is depended on the carbon content.
- The tempering temperature of the PC steel bar in quenched-and-tempered process should be adjusted according to the carbon content.
FM-3: Image Processing

Session Chair: Yangmin Li and Fei Lu

HQHT-312  10:20-12:00 Friday, August 7th

A Multi-stage Fingerprints Matching Algorithm
Honglei Wei, Danni Liu
School of Mechanical Engineering, Dalian Fisheries University
Dalian, China

This paper divides fingerprint matching process into three stages:
- Local orientation structures matching.
- Local minutia structure matching.
- Global minutia structure matching.

The final similarity was gotten according to the matching scores calculated from above three stages.

An Emotion based 3D Spatial Design Considering Effective Factors and Evaluation
Yong-Tae Won, Nam-Yee Kim and Hoon-Sung Kwak
Research Laboratory for Image Processing, National University of Chungbuk
Jeonju-City, Korea

• Emotional spatial design
  - Coloration modeling
  - Lighting
  - Illumination
  - 3D Real-time rendering dictionary visualization
  - Evaluation through database server build-up
• Emotional spatial design coloration
• Evaluation of emotion

A multi-camera system for precise pose estimation in industrial applications
Fangwu Shu, Jianwei Zhang, Youfu Li
Department of Informatics, University of Hamburg, Germany

• A multi-camera system is used to determine the poses of the large work objects.
• A practical approach to camera calibration is proposed for robot vision applications.
• Pattern compensation, pattern weight, zero measurement and camera pose recalibration are introduced to solve the practical issues.
• The proposed approaches have been proved to be able to improve the performances of a multi-camera system in practice.

Particle Swarm Mixel Decomposition for Remote Sensing Images
Dong Wang1,2+, Xiangbin Wu2, Dongmei Lin3
1Department of Computer Science and Technology, Foshan University, China
2College of Geosciences and Environmental Engineering, Central South University, China
3Center of Information and Education Technology, Foshan University, China

• Directly utilizing intelligence particle without pre-selecting training samples.
• Needn't know or assume the distribution of samples.
• Utilizing adequately neighboring information of mixels in image.
• Robustness to operating environments.

Eyes localization in an infrared image
Tang Jin, Chen Shouming and Xie Xiuzhen, Jason Gu
School of Information science and Engineering, Central South University
Changsha, China

The result of Eye localization
FM-4: Network-based systems I

Session Chair: Yingwei Zhang and Chunyi Su

HQHT-313 10:20-12:00 Friday, August 7th

Approximate Dynamic Programming of Continuous Annealing process

Yingwei Zhang, Chao Guo and Xue Chen Yongdong Teng
Key Laboratory of Integrated Automation of Process Industry, Ministry of Education, Northeastern University, Shenyang, China

- The production line of Continuous Annealing.
- Approximate Dynamic Programming.
- Design and Implementation of Controller Based on ADHDP.

Component-Based ECU Design Method of Passenger Car Information Integrated Control System

Jian HU, Gangyan Li and Jun Xu
School of Mechanical & Electronic Engineering, Wuhan University of Technology, Wuhan, Hubei, China

- ECU Function Analysis and Classification of Passenger Car Information Integrated Control System.
- Component-Based ECU Design Method of Passenger Car Information Integrated Control System.
- Component-Based ECU Implementation Technology of Passenger Car Information Integrated Control System.
- Component-Based ECU Design of WG6100ENH Model Natural Gas City Bus Information Integrated Control System.

UAVs Task Allocation Using Multiple Colonies of Ants

Wang Zhenhua, Zhang Weiguo, Li Guangwen
College of Automation, Northwestern Polytechnical University, Xi’an, China

- PRMs is used to construct routes for UAVs, and a new sampling method for PRMs is introduced.
- A new method using Multiple colonies of ants is introduced to allocate the targets to the UAVs.
- Compared with Genetic algorithm, our method shows better performance.

A Design of a WSN System for Pollution Monitoring and Positioning Based on GAF Routing Algorithms

LI Xiao-fang, XIA Wei, MAO Ying-chi, YU Xian
Research College of Computer and Information Engineering, Hohai University, Nanjing, China

- Proposed an architecture of a hydrologic telemetry and pollution tracking and positioning system based on the public mobile communications network.
- Designed a network protocols based on the GAF routing algorithm.
- Emphasizes the network’s lifecycle, pollution source positioning, limited node energy, network quality and etc. when the GAF algorithm is used in practical application of the system.
FM-5: Planning and scheduling  
Session Chair: Yingzi Wei and Ze Tao
HQHT-314  10:20-12:00 Friday, August 7th

HQHT-314(1)  10:20-10:40
A Backward Algorithm for Multi-Processor Scheduling Problem with Unequal Release Dates
Kai Li and Shu-Chu Zhang  
School of Management, HeFei University of Technology, HeFei, China
- The multi-processor scheduling problem with unequal release dates to minimize total completion times is considered.
- This problem is NP-hard in the strong sense.
- The localization and blindness of the traditional forward heuristics are analyzed.
- A backward algorithm BA is proposed.

HQHT-314(2)  10:40-11:00
Pattern Driven Dynamic Scheduling Learning Approach using Reinforcement Learning
WEI Yingzi, JIANG Xinli, HAO Pingbo, GU Kanfeng  
Shenyang Ligong University, Shenyang, China
- The paper presents an adaptive iterative scheduling algorithm that operates dynamically to schedule the job in the dynamic job-shop.
- The reinforcement learning system is done with the phased Q-learning by defining the intermediate state pattern.
- We use five heuristic rules, CNP-CR, CNP-FCFS, CNP-EFT, CNP-EDD and CNP-SPT, as actions and the scheduling objective: minimization of maximum completion time.

HQHT-314(3)  11:00-11:20
Ant Colony Optimization Based Scheduling for a Semiconductor Wafer Fabrication Facility with Bottleneck Stations
Li Li, Fei Qiao, Xiaoyu Tian and Qidi Wu  
School of Electronics and Information Engineering, Tongji University, Shanghai, China
- Our Results/Contribution
  - Create a production environment applicable ACO based scheduling method for a wafer fab with bottleneck stations.
  - The proposed method is superior to the common rule (FIFO, EDD, CR,SRPT) with better performance on the movements of the jobs and the machine utilities.
- Summary
  - More higher workload of a wafer fab is, the improvements of the proposed method are better.

HQHT-314(4)  11:20-11:40
A Stable Scheduling for Single Machine under Uncertainty
Qiaoyun Li and Bing Wang  
School of Mechanical & Electrical Engineering, Shandong University at Weihai, Weihai, China
- Introduction.
- The classification of uncertainties and its modelling approaches.
- Problem formulation.
- Modified Optimized Surrogate Measure Heuristic (MOSMH).
- Computational results and its analysis.
- Conclusion.

HQHT-314(5)  11:40-12:00
Dynamic Classified JSP Scheduling Based on Petri Net and GASAN
Ze Tao, Changzhong Hao  
Department of Mechanical Engineering, University of Shenyang Ligong, Shenyang, China
- Controller design when all transitions are controllable, and Petri net model with uncontrollable transitions.
- Flexible scheduling algorithm.
- Dynamic classified scheduling based on machine repairing time, and worker leaving time, and task of order cancelling.
- Simulation based on some job shop scheduling problems.
Application of Neighbourhood Topology Particle Swarm Optimization to Cylinder Linear Induction Motor Design

Liu Ai-min, Zhang Xiao-ling, Lin Xin, and Li Yong-xiang
School of Electrical Engineering, Shenyang University of Technology, Shenyang, China

- This paper introduces the PSO and improved PSO algorithms.
- Neighborhood Topology Particle Swarm Optimization (NTPSO) is introduced.
- Based on NTPSO, optimization design of C-LIM is executed.
- The optimization results analyze.

A New Start Method for Rolling Piston Compressor Based on DSP to Improve the Load Performance

Jilong Qi, Yantao Tian, Yimin Gong, Cheng Zhu, and Xueping Zhao
School of Communication Engineering, College of Physics, Jilin University, Changchun, China

- PMSM traditional starting schemes are introduced.
- The new starting method is proposed.
- Hardware and startup process of compressor are described.
- Simulation experiments and hardware experiments results are provided.

Global Convergence of Variable Step Size LMS Adaptive Filtering Algorithm Based on Variable Region

Bai Jing, Yin Yi-xin, Hao Zhi-hong, and Xue Jian
1) Information Engineering School, UST Beijing, China, 100083; 2) Information Engineering School, Beihua University, China, 132021.

- A new variable step size LMS adaptive filtering algorithm is proposed based on variable region.
- The step size $\mu(k)$ in the algorithm varies with variation of the deviation $e(k)$ to ensure the optimization of the three performance objectives, which are initial convergent speed, tracking ability of the time-varying system and stable state convergence precision.
- The convergence of the algorithm is respectively proved by Lyapunov function and ODE with random noise and non-random noise.

Optimal and Suboptimal Prior Filters with Bounded Multiple Packet Dropouts

Shuli Sun, Lihua Xie, and Wendong Xiao
Department of Automation, Heilongjiang University, Harbin, China, sunsl@hlju.edu.cn
School of EEE, Nanyang Technological University, Singapore, elhxie@ntu.edu.sg
Media Processing Department, Institute for Infocomm Research, Singapore, wxiao@i2r.a-star.edu.sg

- Discrete-time stochastic linear system with bounded multiple packet dropouts is considered.
- An optimal prior filter is developed in linear unbiased minimum variance sense.
- The optimal solution depends on the recursion of a Riccati equation and a Lyapunov equation.
- To reduce the computational cost, a suboptimal prior filter is presented.
Further Studies on Zhang Neural-Dynamics and Gradient Dynamics for Online Nonlinear Equations Solving

Yunong Zhang1, Peng Xu2 and Ning Tao2
1 School of Information Science and Technology, 2 School of Software, Sun Yat-Sen University, Guangzhou, China

- Zhang neural dynamics (ZD) is generalized for solution of nonlinear equation $f(x) = 0$.
- ZD is different from conventional gradient-based dynamics (GD).
- Further analyze, investigate and compare the characteristics of such two dynamics ZD and GD.
- Three illustrative examples show us some interesting implications and the efficacy of ZD.

Cyclostationarity Analysis and Diagnosis Method of Bearing Faults

Wu Bin, Wang Minjie, Luo Yuegang, Feng Changjian
Dalian Nationality University, Dalian, China

- Demodulation Feature Analysis of Cyclic Autocorrelation Function (CAF).
- Extraction method of Bearing Fault Characteristic Defect Frequency by CAF.
- Construction Method of Fault Characteristic Vector Based on HMM Model.
- Model Training, Fault Diagnosis Experiment and Conclusion.
FP-3: Intelligent transportation system
Session Chair: Chengjin Zhang and Hong Zhang
HQHT-312 14:00-15:20 Friday, August 7th

**HQHT-312(1) 14:00-14:20**

The Design and Implement of the Decision Support Systems of Logistics Distributing Center Based on XML
Tao Wang
College of Information Technology, Zhejiang University of Finance & Economics, Hangzhou, Zhejiang Province, China
tomtaowang@sina.com

Abstract - According to the research of the theories, concepts and methodology of Web and DSS, this paper presents a new design method of DSS based on XML technology. The paper describes the developing process of the DSS of logistics distributing center based on XML. The problems have been solved that how data is transferred and exchanged between the DSS of logistics distributing center, logistics ERP and users and how the decision support models of logistics distributing center are constructed. The analysis and design method generated from the process of the system realization offers a new method for developing different kinds of the DSS based on Web.

**HQHT-312(2) 14:20-14:40**

Synergetic Method of Traffic State Recognition Based on Manifold Learning
Weizhi Wang, Lei Pang and Binghan Liu
College of Civil Engineering, Fuzhou University, Fuzhou, China

- To solve the problem on large storage of images in the synergetic recognition, an improved synergetic recognition method based on manifold learning has been proposed in this paper, in which advantage and feasibility of combining the two methods has been discussed.
- The geometrical structure in high dimensions can be well maintained by using manifold learning to reduce dimensions while it is somehow innovative to combine synergetic recognition method and the manifold learning method.
- The traffic state recognition has been realized by adopting Isomap algorithm in this paper, and the results proves that the method has better recognition effects.

**HQHT-312(3) 14:40-15:00**

Study on a new safety control method for a vehicle
Shirong Yan[1,2] and Zhiwei Lin[1]
1 School of Mechanical Engineering, Fuzhou University, Fujian, China
2 Department of Automotive, Minjiang University, Fujian 350108, China

- A 14-DOF dynamic model is dopted for a car.
- A new chassis control scheme is studied, which combines ABS, AFS with DYC.
- Some simulation work is done to test the control method.
- The control method developed here can make the vehicle having a good braking stability and better trace in the braking process.

**HQHT-312(4) 15:00-15:20**

AUTONOMOUS VEHICLE OVERTAKING - AN ONLINE SOLUTION
Ghumman Usman, and Faraz Kunwar
Department of Mechatronics Engineering National University of Science and Technology, College of Electrical and Mechanical Engineering campus, Peshawar Road Rawalpindi, Pakistan

- A novel guidance-based on-line trajectory-planning algorithm, capable of handling emergency situations is presented
- The focus has been on three primary aspects:
  - Time-optimal overtaking
  - Safety
  - Passenger comfort.
Optimal Control of Continuous Annealing Process Using PSO

Chao Guo, Yingwei Zhang, Xianqiang You, Xue Chen and Yang Zhang
Key Laboratory of Integrated Automation of Process Industry, Ministry of Education, Northeastern University, Shenyang, China

- The Continuous Annealing Process.
- Particle Swarm Optimization (PSO).
- Simulation of Temperature and Energy.

The flowchart of the particle swarm optimization algorithm

Grid-based Load Balancing Mechanism for RFID Middleware Applications
Jiann-Liang Chen, Nong-Kun Chen, Yi-Wei Ma, Han-Chieh Chao and Cheng-Yen Wu
Department of Electrical Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan

- Buffer Management.
- Load Balancing Management.
- Priority Agent and Job Relocator.
- Monitor.
- Load Balancing Trigger.

A Communication Quality Improved Routing Protocol for Wireless Sensor Network
Fei Chen, Chengdong Wu, Peng J. and Yunzhou Zhang
Information Science and Technology college, Northeastern University, Shenyang, China

- An energy effective routing protocol based on Low-Energy Adaptive Clustering Hierarchy Protocol, which is called CQIR, is proposed to meet the QoS requirement and minimize the energy consumption.
- The CQIR routing protocol optimizes the clustering structure by improving clustering heads selection mechanism.
Poster Session

Han-Qing Conference Hall - Level 1
(东北大学汉卿会堂)
Wednesday August 5, 2009

WPP Automation I
WPP Automation II
WPP Automation III
WPP Automation IV
WPP Automation V
WPP Computer vision I
WPP Computer vision II
WPP Computer vision III
WPP Evaluation and optimization I
WPP Instrumentation I
WPP Intelligent control I
WPP Transportation system I
Design and Application of Auto-constant Water Supply System
LI Suling and LIU Junying
School of Electrical Engineering, Shandong University of Technology
Zibo, Shandong Province, China

1. An automatic constant pressure closed-loop water supply and monitor system of a little type secondary pressure waterworks, which composed of Siemens S7-300 PLC, WinCC and ABB frequency converter, is presented.
2. The principle and construction as well as characteristics of the system are introduced. That has improved the function, stability and reliability of the water supply system.
3. The super-harmonic oscillation of waterworks pipe network is reduced. The purpose of saving energy and reducing consumption has been realized.
4. The necessary support conditions have been provided for the entire production management information system of waterworks.

Supported by scientific fund of Shandong university of technology (No:2005KJM09)

A Novel Adaptive Control for Elevator System with Observer and Parameter Identification
Haiyan Yu, Xin Zhang, Xiaohui Dong
School of Information and Science Engineering, Shenyang University of Technology
Shenyang, China

• An adaptive controller is presented.
• A servo error observer and a disturbance rejection control is designed.
• The parameters of system are identified, thus allowing the observer coefficients and the gain values to be adapted.
• Simulation results have shown that the resulting controller achieves good performance with robustness.

Synchronous Motion Control of Biaxial Driving System with Linear Servo Motors
Dongmei Yu, Qing Hu and Fei Zhao
School of Electrical Engineering, Shenyang University of Technology, Shenyang, China

• High synchronization positioning accuracy for gantry moving type milling machining centre.
• Use dual linear servomotors to drive gantry.
• The same position feedback controller is used to position servo axis independently.
• The acceleration feedforward control and electrical cross-coupled control algorithms based on fuzzy logic are applied to dual linear motor position servo axes.

Control Synthesis for Polynomial Nonlinear Systems
Chang-Fei Tong, Feng Wang
Institute of Operational Research and Cybernetics, Wenzhou University
Wenzhou, China

• Global controller was designed by density function.
• Local controller was designed by the proposed algorithm.
• Switching plane was generated by the boundary of attraction domain.
• Performance was improved by the switching control presented.

Speed Regulation of PMSM Based on Port-Controlled Hamiltonian Systems and PI Control Principle
Haisheng Yu, Zongwei Zou and Shanshan Yu
College of Automation Engineering, Qingdao University
Qingdao, China

• A novel state feedback control scheme for speed regulation of permanent magnet synchronous motor (PMSM) is presented based on energy-shaping and port-controlled Hamiltonian (PCH) systems theory.
• Proportional integral (PI) control of speed error is used to estimate the unknown load torque.
• The speed controller is implemented based on space vector pulse-width modulation (SVPWM) control rule.
Research on the Hydraulic Control System of Diamond Wire Saw

Liwen Cao
School of Mechanical and Electrical Engineering, Heilongjiang University, China

- The components and work principle of manual hydraulic control system of diamond wire saw are introduced and the work process and operation methods of hydraulic source and control circuit system are analyzed.
- Then the close-loop control system of radial feed and the velocity control model of hydraulic servo-valve system have been established based on the reasonable process parameters obtained by cutting experiments of the diamond wire saw.
- The analysis results have shown that the hydraulic servo system can meet the design requirements.

Friction Compensation Using Dual Observer for 3-Axis Turntable Servo System

LIU Zhigang, WANG Junzheng and ZHAO Jiangbo
Key Laboratory of Complex System Intelligent Control and Decision, School of Automation, Beijing Institute of Technology, Beijing, 100081, China

- LuGre dynamic friction model is adopted to describe the mathematic model of the pitch axis servo system of the 3-Axis turntable.
- The dynamic LuGre model is built on three unknown parameters. Besides, system torque and inertia are also uncertain due to the motor torque ripple or disturbance.
- A dual sliding mode observer is adopted to estimate these parameters, Lyapunov method is used to design the update laws.
- Adaptive control law is designed to compensate the unknown friction and load disturbance.
- Simulation suggest that the proposed method is global asymptotically convergent, which guarantee the position and speed signals track the desired trajectories asymptotically.

Sliding Mode Control Algorithm Based on T-S Fuzzy Model for a Class of Nonlinear Systems

Ming Yan, Jinhui Yi, Yang Liu, JunXiu Wei, Xiaoling Huang
College of Light Industry, Liaoning University

1. INTRODUCTION
2. T-S Fuzzy Model
3. Design of sliding mode control algorithm
   (1) Design of Sliding Surface
   (2) Design of Reaching Condition
   (3) Design of Sliding Mode Controller
4. Simulation results
5. Conclusion

Static $H_{\infty}$ Loop Shaping Real-time Control of a Double Inverted Pendulum System

Yuyan Liu1, Shiliang Zhou2
Department of Automation1, Department of Nuclear Science & Engineering2, North China Electric Power University, Beijing, China

- This paper introduces a simple technique for designing a static $H_{\infty}$ loop shaping controller.
- Sufficient conditions are established in Linear matrix inequality form.
- The genetic algorithms are adopted to optimize the loop-shaping weighing functions.
- The order of controller is equal to sum of the orders of the weighing functions. Real-time experimental results on a double inverted pendulum system demonstrate the validity and applicability of the proposed approach.
WPP: Automation III
Session Chair: Chao Hu and Yanjun Shen
HQHT 15:40-16:40 Wednesday, August 5th

**HQHT Hallway (13) 15:40-16:40**

*Design and Simulation of Ship Course Controller Based on Auto Disturbance Rejection Control Technique*

Yaozhen Han¹, Hairong Xiao¹, Changshun Wang¹ and Fengyu Zhou²
¹. Department of Information Engineering, Shandong Jiaotong University, Jinan, China
². School of Control Science and Engineering, Shandong University, Jinan, China

- Theory of auto disturbances rejection control is introduced.
- Ship course motion system and disturbances' mathematic models are establish.
- Based on the models of the ship course system, a new and high robust ship course controller was designed by using ADRC method.
- The ship course control simulation experiments were done under the uncertain environment.

![Ship Course Control Based on ADRC](image)

**HQHT Hallway (14) 15:40-16:40**

*Position Loop Design Method in Multi Axis Motion Controller using Extended DDA Circuit*

Jun Zhang and Xu Wang
Information Science and Technology Institute of Northeastern University, Shenyang, China

- The core structure of multi axis position motion controller.
- Extended DDA circuit make the foundation of position loop controller.
- Suitable for many kinds of motor interfaces.
- Suitable for MCU & FPGA implementations.

![Structure of PGU](image)

**HQHT Hallway (15) 15:40-16:40**

*An Improved Ant Colony Algorithm for Multi-objective Flexible Job Shop Scheduling Problem*

Li Li, Keqi Wang
Information and Computer Engineering College, Northeast Forestry University, Habin, China

- Introduction.
- General structure of ACA.
- Formulation of multi-objective flexible job shop scheduling problem.
- Our improved ACA.
- Data analysis.

![Flow Diagram of Our Algorithm](image)

**HQHT Hallway (16) 15:40-16:40**

*New delay-dependent criteria for stability and stabilization of uncertain singular systems with time delay*

Jinfeng Gao, Meizhen Lei, and Haipeng Pan
Institute of Automation, Zhejiang Sci-Tech University, Hangzhou, China

- The problem of delay-dependent robust stability analysis and stabilization for uncertain singular systems with time delay are concerned.
- The parameter uncertainty is assumed to be norm-bounded and possibly time varying, while the time delay considered here is assumed to be constant but unknown.
- By decomposing the singular time delay system into slow and fast subsystems and using a new Lyapunov-Krasovskii functional which splits the whole delay interval into two subintervals and defies a different energy function on each subinterval, some sufficient conditions are presented for the singular time-delay system to be regular, impulse free and robustly stable.

**HQHT Hallway (17) 15:40-16:40**

*Static Output Feedback Control for Constrained Uncertain Linear Systems via Moving Horizon Strategy*

Juan Wang, Guoxia Xu, and Jinsheng Sun
Department of Electromechanics Engineering and Information, Dalian Nationalities University, Dalian Liaoning, China

- By searching the condition that guarantees the given performance index based on S-procedure technique, an H-inf static output feedback control method is proposed for constrained system. Moreover, the dissipative constrained conditions and the elliptical set that contains output trajectory are cast as LMI's, and introduced into the optimization problem, then a moving horizon H-inf control using static output feedback is presented. The robust closed-loop properties, inclusive of stability, H-inf performance and the satisfaction of the time-domain constraints are discussed.

**HQHT Hallway (18) 15:40-16:40**

*Synchronization Criterions of A Kind of General Complex Networks with Time Delay*

Degang Xu, Guoxia Xu, and Zheng Su
College of Information Science and Engineering, Central South University, Changsha, China

- This paper discusses the problems of synchronization and pinning control for a kind of general complex dynamical networks with time delay.
- Less conservative criterions for this kind of complex dynamical networks are obtained.
- Pinning control strategies are respectively designed to make these complex dynamical networks synchronized.
WPP: Automation IV

Session Chair: Chao Hu and Yanjun Shen

HQHT 15:40-16:40 Wednesday, August 5th

HQHT Hallway (19) 15:40-16:40

Robust control for Markov Jump Linear System in fixed time interval
Yanjun Shen
College of Science, China Three Gorges University, Yichang, Hubei 443002

- This paper is concerned with the finite-time control problem of continuous-time linear system that possesses randomly jumping parameters which can be described by finite-state Markov processes.
- Sufficient conditions for mean square finite-time stability and mean square finite-time boundedness via state feedback are provided.
- A detailed example is presented to illustrate the proposed methodology.

HQHT Hallway (20) 15:40-16:40

Study on the Intelligent Hybrid Control for Secondary Regulation Transmission System
Kong Xiangzhen and Zang Faye
Shandong Jiaotong University, Jinan, China

- In order to overcome nonlinearity problem of the secondary regulation transmission system, an intelligent hybrid controller method is presented.
- The simulation and experiments for power and speed control prove that the designed controller for the system has rapid response, low overshoot, adaptability.
- The power control and infinite speed variation of the secondary regulation automation are realized. It meets the control requirements of stability and robustness when the system works under complex environment.

HQHT Hallway (21) 15:40-16:40

Research on solution method of GTD scheduling algorithm for WNCS and application
Jun Wang, Lifeng Wei
Shenyang Institute of Chemical Technology, Liaoning, China

- This paper introduced scheduling algorithm of GTD.
- This algorithm resolves real-time problem of cycle communication task in WNCS, and eases overtime phenomenon of cycle communication task caused by wireless network delay partly.
- We proposed the nonlinear programming model for solving scheduling timetable based on the scheduling algorithms.

HQHT Hallway (22) 15:40-16:40

A Novel Control for Linear Elevator Based on Reference Model Sliding Mode
Xin Zhang, Haiyan Yu, Hao Liu
School of Information and Science Engineering, Shenyang University of Technology, Shenyang, China

- To the permanent magnet linear synchronous motor (PMLSM) for vertical hoist system, discontinuous primary PMLSM was adopted.
- In order to achieve anticipated performances and improved system dynamics, a novel compound control scheme for linear elevator driving by PMLSM with the reference model sliding mode control is presented, which integrates advantages of sliding mode control and reference model control.
- The simulation results show that this method can overcome external disturbances and obtain good performance compared with traditional PID control.

HQHT Hallway (23) 15:40-16:40

Robust control based on observer for time delay systems with nonlinear uncertainty
Hou Xiaoli, Guo Xiaoli
Department of Maths and computer science, Zhengzhou University of Light Industry, Zhengzhou, China

- The problem of robust control for time-delay systems with nonlinear uncertainty is considered, a state observer is exploited to reconstruct the state of system.
- Controller is designed by using a new theory of exponential stability and a new analysis method.
- Relationship between state and time-delay state can be explicitly given in new theory and the results is shown dependent on the upper bound of delay.
- The result is more suitable for fast-varying delay.

HQHT Hallway (24) 15:40-16:40

Design and Simulation of Fuzzy PID Controller for the Movable Beam in Gantry Machining Center
XIA YANG, YAN ZHAO, ZHU XIAD and JIETAN CUI
School of Electrical Engineering, Shenyang University of Technology, Shenyang, Liaoning, China

- The mathematic model of the maglev beam system is analysed and built in this design, and the Fuzzy PID control is used for theoretical research and simulation analysis.
- Compared with the traditional PID control, not only the Fuzzy PID control can reduces the overshooting apparently, but also the accommodation time is reduced, and the capacity of resisting disturbance is improved apparently, and the requirement of the machined maglev stiffness is satisfied.
WPP: Automation V
Session Chair: Chao Hu and Yanjun Shen
HQHT 15:40-16:40 Wednesday, August 5th

HQHT Hallway (25) 15:40-16:40
Application Research on Enterprise Integrated Automation Based on OPC & OPC-XML
Qiao Jiaxin
School of Information Engineering, Anhui University of Finance & Economics Bengbu, China

- Enterprise Integrated Automation Based on OPC & OPC-XML
- OPC provides the high performance exchanges in LAN.
- OPC-XML solves the remote interview and cross platform interview.
- The system model is applied to enterprise information integration
- The system model based on OPC and OPC-XML must be applied more widely.

HQHT Hallway (26) 15:40-16:40
Application Research on OPC Server Based on Multi-Fieldbus
Qiao Jiaxin
School of Information Engineering, Anhui University of Finance & Economics Bengbu, China

- OPC Server Based on Multi-Fieldbus
- Fieldbus connects directly with industry field intelligence devices.
- OPC performances data interchange and share of applications and software/hardware.
- The system model is applied to enterprise information integration
- OPC server based on multi-fieldbus can be applied in more fields.

HQHT Hallway (27) 15:40-16:40
Synchronization of Unified Chaotic System with Unknown Parameter
Keyong Shao, Ruiyun Wang, Luanjie Zhou, Yishu Zhan
School of Electric and Information Engineering, Daqing Petroleum Institute Daqing, China

- The synchronization errors by using multiple controllers

HQHT Hallway (28) 15:40-16:40
Research and Design of Remote Real-time Supervisory System Based on OPC in Cement Enterprise
Shaohong Jing, Qingjin Meng
School of Control Science and Engineering, University of Jinan Jinan, China

- A distributed real-time production supervisory designing conception based on OPC and Web technique is presented.
- The OPC technique and its application in the DCS of cement enterprise are introduced, the seamless connection between the application and plant, and the Web distribution of production data are realized.

HQHT Hallway (29) 15:40-16:40
The Analysis and Design of Low Velocity Estimation Based on Observer
Yan Song1,2, Huibin Gao 1, Shumei Zhang1, Yantao Tian1 and Dejun Wang3
1.Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences; 2.Graduate University of Chinese Academy of Science; 3. Communication School, Jilin University Changchun, China

- To solve the problem of the encoder’s finite resolution in low velocity.
- The design of observer is guided by the robustness of error dynamic and the reduction quantized noise.
- The experiment results show that when tracking the velocity of 1°/s, the estimated error decreased dramatically with other three estimators mentioned in this paper. At the same time, the phase lag is also the least.

HQHT Hallway (30) 15:40-16:40
Optimal Flight Control Design in Irregular Sampled-Data Control Systems
Weikun Zhong and Zhongjian Li
School of Automation, Northwestern Polytechnical University Xi’an, shaanxi, China

- A design method for irregular sampled-data control system is researched.
- As the reason of the possibility of data lost and wrong data in the sensors or actuators, irregular sampled-data Control is considered.
- An angle of attack control of UAV is simulated to illustrate the design.
A FPGA-based Auto Focusing System For Object Distance Estimation
Wei Liu, Chao Hu and Max Q.-H. Meng
Shenzhen Institute of Advance Technology Chinese Academy of Sciences, Chinese University of HongKong, China

- Newly auto-focusing algorithm which contains interactive focusing window selection and three step searching algorithm.
- Object distance estimation algorithm by looking-up lens position table.
- All algorithm implemented in a FPGA developing board.
- The best performance of 3% relative errors when the target is around 8 meters far away from the camera.

Research on Traffic Moving Object Detection, Tracking and Track-Generating
Shanming Lin, Jun Tang, Xuewu Zhang and Yanyun Lv
Computer and Information Engineering College, Hohai University, changzhou, China

- Gaussian mixture model object detection based on RGB color distribution.
- Mean Shift Embedded Particle Filter object tracking algorithm.
- Trajectory generation module and simulation results.
- The application to traffic flux detection.

Quality Assessment Based on the Correlation Coefficient and the 2-D Discrete Wavelet Transform
Li Junfeng, Dai Wenzhan
Department of Automatic control, Zhejiang Sci-Tech University, Hangzhou, China

- the 2-D Discrete Wavelet Transform.
- the Correlation Coefficient.
- Image Quality Assessment Based on the Correlation coefficient and the 2-D Discrete Wavelet Transform.
- Experiment and Analysis.

A Modified Calibration Technique of Camera for 3D Laser Measurement System
Huipu Xu, Zi ma, Yuqing Chen
Automation Research Center, Dalian Maritime University, Liaoning, China

- A novel robot 3D laser measurement system which is representative in reverse engineering is designed.
- A modified Tsai algorithm for CCD parameters calibration is presented.
- From the results, it is shown that the modified algorithm has easier computation, faster speed and higher precision than Tsai.

Multi-target Tracking using Mixed Spatio-Temporal Features Learning Model
Ge Yinghui
Faculty of Information Science and Technology, Ningbo University, Ningbo, China

- A multi-target visual tracking method based on mixed spatio-temporal features learning model.
- Particle Filtering is used as algorithm framework.
- An incremental appearance descriptor update strategy to adopt change of appearance.
- HSV histogram and region covariance descriptor are compared.
WPP: Computer vision II
Session Chair: Chao Hu and Yanjun Shen
HQHT 15:40-16:40 Wednesday, August 5th

HQHT Hallway (37) 15:40-16:40
Target Tracking Based on Mean Shift and Improved Kalman Filtering Algorithm
Hongxia Chu, Kejun Wang
College of automation, Harbin Engineering University, Heilongjiang, China
- Domestic and foreign research status for target tracking algorithm is introduced.
- Maximum Fuzzy Entropy Gaussian Clustering is used to improve Kalman Filter algorithm.
- Model foundation, target positioning and similarity function is represented about Mean Shift target tracking algorithm.
- Improved Kalman Filtering algorithm is combined with Mean Shift.
- Conclusion and analyzing.

HQHT Hallway (38) 15:40-16:40
A novel registration method that incorporates template matching and mutual information
Shanming Lin, Xiaoyan Zhu, Ping Yan, Jianhua Zhou
Computer and Information Engineering College, Hohai University, Changzhou, China
- Analyze the advantages and disadvantages of template matching and mutual information registration.
- Propose a novel method that incorporates the advantages of mutual information and template matching and the experimental results show good effectiveness.

HQHT Hallway (39) 15:40-16:40
Algorithm Research on Location of Bottle Mouth and Bottom in Intelligent Empty Bottle Inspection System
Sile Ma1, Bin Huang1, Junmei Guo2, and Huajie Wang1
1. School of Control Science and Engineering, Shandong University, Jinan, China
2. School of Electronic Information and Control Engineering, Shandong Institute of Light Industry, Jinan, China
The bottle mouth and bottom location is one of the key technologies in the empty bottle inspection system design. In this paper, we put forward different location algorithms for the bottle mouth and bottom by their different characters. Experiments show that this method can effectively improve the precision of the location of the bottle mouth and bottom and it has great practical value.

HQHT Hallway (40) 15:40-16:40
Design of Automatic Target-Scoring System of Shooting Game Based On Computer Vision
Xinnan Fan, Qianqian Cheng, Penghua Ding, Xuewu Zhang
Computer and Information Engineering College, Hohai University, Changzhou, China
- Propose a technical scheme of the Automatic Target-scoring System in shooting matches based on computer vision.
- Analyze and design the automatic target-scoring software and the experimental results show that the system can recognize the overlapped holes on real time and correctly.

HQHT Hallway (41) 15:40-16:40
A Novel Method of Face Detection Based on Fusing YCbCr and HIS Color Space
Xue-wu ZHANG, Ling-yan LIANG, Dun-qin DUAN, Wei-liang XIA
Computer and Information Institute Hohai University, Changzhou, China
- A face detection method for the color image with complex background is presented, which is a mixed skin-color segmentation model in both YCbCr and HIS color space constructed.
- Experimental results show that the proposed approach can effectively prevent the side effects on the image caused by light condition, reduce the undetected rate, increase the speed of the face detection.

HQHT Hallway (42) 15:40-16:40
The Hausdorff Distance Template Matching Algorithm Based On Kalman Filter for Target Tracking
Faliang Chang, Zhenxue Chen, Wencheng Wang, Lei Wang
School of Control Science and Engineering, Shandong University, Jinan, China
- The Hausdorff distance template matching algorithm is one of the most popular algorithms.
- The computation of needs calculating the distance between each point of and each point of, and it takes a long time to compute the Hausdorff distance.
- The method of small region filtration is to reduce the computing time.
- The experiment results show that the algorithm reduces the time greatly.
A Novel FPGA-Based Wireless Vision Sensor Node
Chao Hu1, Zhiyong Liu1, Yingzi Pan1, Zhenxing Zeng1 and Max Q.-H. Meng1, 2
1. Shenzhen Institute of Advance Technology, Chinese Academy of Sciences
2. Department of Electronic Engineering, The Chinese University of Hongkong

- Custom image capture IP core based on Avalon bus was designed and implemented.
- An efficient HW/SW codesign architecture for JPEG encoder and its FPGA implementation was presented.
- Wireless communication based on FPGA is implemented using the nRF24L01 wireless RF chip.
- Custom peripheral can be added into SOPC as component and the system has been tested well on the Cyclone II EP2C35.

The System Diagram

Reversible image hiding algorithm based on pixels difference
Honge Ren, Chunwu Chang and Jian Zhang
Department of Information and Computer Engineering, Northeast Forestry University Harbin, China

- Using the relevance of two adjacent pixels to hide data by modifying pixel gray scale values.
- Hiding capacity can be up to 28 817-88 330 b when the PSNR of carrier image is more than 48 dB.
- The PSNR of carrier image after restoring is ∞.

Detecting Human and Judging Their Pose in Video
Guishan Xiang
School of Information and Electronic Engineering, Zhejiang University of Science & Technology Hangzhou, China

- Researched human detection method based on background subtraction method.
- Researched major axis localization method based on projection histogram.
- Researched pose judgment method based on projection histogram.

An Efficient Video Copy Detection Method
Zheng Cao, Ming Zhu
The Key Lab of Network Communication System & Control, Chinese Academy of Sciences University of Science and Technology of China Hefei, China

- Image signature based on spatial statistics of YCbCr components.
- Video signature computed by the ordinal measure of image signature and image frame temporal order.
- Video similarity measured by the distance of video signature.
- Efficient search approach via Clustering Index Table based on video signature clustering.

Detection of 3D Curve for Shoe Sole Spraying Based on Laser Triangulation Measurement
Yuzhen Jin1,2, Zuchao Zhu1, Lei Zhang2 and Chuanyu Wu2
1) Zhejiang University, Hangzhou, Zhejiang Province, China
2) Zhejiang Sci-Tech University, Hangzhou, Zhejiang Province, China

- It presents the implementation of a new apparatus for adhesive spray of the shoe upper.
- A method based on computer vision with structured light including in: median filtering, bi-level thresholding, opening and closing, mid-line of the laser stripe extraction, has been developed.
- The 3D scan curves and closed contour line could be interpolated as B-spline curves.

WPP: Computer vision III
Session Chair: Chao Hu and Yanjun Shen
HQHT 15:40-16:40 Wednesday, August 5th
WPP: Evaluation and optimization I
Session Chair: Chao Hu and Yanjun Shen
HQHT 15:40-16:40 Wednesday, August 5th

HQHT Hallway (49) 15:40-16:40
The Optimization Design Method of Throttle Slice Thickness of Telescopic Shock Absorber
Changcheng Zhou1, Jie Meng1, and Zhiyun Zheng2
1 School of Transport and Vehicle Engineering, Shandong University of Technology
Zibo, China
2 College of Information Engineering, Zhengzhou University, Zhengzhou, China
- Analysis of damping components.
- Design mathematic model of throttle slice thickness based on single velocity point.
- Optimization design target function.
- Optimization design of throttle slice thickness.
- Design instance of shock absorber.
- Performance test and verifying.

HQHT Hallway (50) 15:40-16:40
Research of Multi-axis Force Sensor Static Decoupling Method Based on Neural Network
Huabin Cao 1, Yong Yu 1, Yunjian Ge 1
1 Institute of Intelligent Machine, Chinese Academy of Sciences, Hefei, Anhui Province, China
- Multi-axis force sensor is one of the most important sensors applied in the realization of intelligent robot.
- Coupling exists in multi-axis force sensor.
- A static decoupling method based on neural network is put forward.

HQHT Hallway (51) 15:40-16:40
SOC Prediction Based on Evolutionary Network
Bo Cheng1, Yanli Zhou, Jinmei Zhang1
1 School of Construction Machinery, Chang’an University, Xi’an, China
- Based on biological immune theory, a new immune algorithm is presented.
- A three-layer feed-forward neural network is designed to predict the state of charge (SOC) of Ni-MH batteries.
- Partial least square regression is used to select input variables.
- Finally, under the state of dynamic power cycle, the proposed approach can provide an accurate estimation of the SOC.

HQHT Hallway (52) 15:40-16:40
Chaotic Co-evolutionary Algorithm Based on Differential Evolution and Particle Swarm Optimization
Meng Zhang, Weiguo Zhang, Yong Sun
College of Automation, Northeastern Polytechnical University, Xi’an, China
- A chaotic co-evolutionary algorithm based on DE and PSO (CCDEPSO) is proposed.
- An information sharing scheme, chaotic initialization and chaotic perturbation based on Tent map are introduced.
- Testing experiments by six benchmark functions show that the global optimization ability of CCDEPSO is better than DE, PSO and CPSO algorithm.

HQHT Hallway (53) 15:40-16:40
An Improved Hybrid MILP/CP Algorithm Framework for the Job-shop Scheduling
Huizhi Ren and Lixin Tang
Liaoning Key Laboratory of Manufacturing System and Logistics, The Logistics Institute, Northeastern University, Shenyang, China
- The Improvement includes Strategies I and II.
- Strategy I can generate effective cuts by analyzing the preferred jobs on the machines.
- Strategy II can generate more than one critical cuts by analyzing the assigned and preferred jobs on infeasible machines.

HQHT Hallway (54) 15:40-16:40
An Adaptive Weight PSO for Rolling Schedules Multi-objective Optimization of Tandem Cold Rolling
Yong Li, Jianchang Liu and Yu Wang
Key Laboratory of Integrated Automation of Process Industry, Ministry of Education, Northeastern University, Shenyang, Liaoning Province, China
- An adaptive weight particle swarm optimization is proposed for multi-objective optimization.
- It is applied to rolling schedules multi-objective optimization of tandem cold rolling.
- The proposed method decreases the values of three objective functions simultaneously compared to actual rolling schedules.
- It has faster convergence speed than the adaptive weight approach GA.
Detection of Weak Magnetic Signal for Magnetic Localization and Orientation in Capsule Endoscope

Mao Li, Shuang Song, Chao Hu, Houde Dai and Max Q.-H. Meng
1068 Xueyuan Avenue, Shenzhen University Town, Nanshan District, Shenzhen, 518056, China

- Design for Magnetic localization and orientation system.
- Include 192 analog signal channels.
- The range of input analog signal is from ±0.5 μV to ±30mV.
- The gain of amplifiers is digital programmable and from 100 to 8,000.
- Applied for the cubic measurement space of 0.5m × 0.5m × 0.5m.

Research on Pointer Location of Multi-pointer Meter

Zhijia Zhang, Yuan Li and Weiqi Yuan
Computer Vision Group of Shenyang University of Technology, Shenyang,110178, Liaoning Province, China

- 1) Filter the effective area by edge detection and mathematical morphology processing method.
- 2) Rules out the possibility of non-sub-dial area through the feature that those pointers are homogeneously distributed at the circle center which is also the center of dial and the root of pointer is a circle.
- 3) Extract accurate pointer area by locating the center of a sub-dial.

Research of cold end Temperature Compensation of Thermal Couple

Quansheng Duan
College of Control Science and Engineering, North China Electric Power University, Beijing, China

- The bi-bridge of compensation solution for thermal couple cold end temperature was recommended.
- The improved compensator was composed of main bridge and assistant. The main was designed according to the traditional method while the assistant was designed equilibrium at the point of the main bridge perfect compensation.
- The input-output characteristic curve of the improved compensation could be made approaching the matched thermal couple’s.
WPP: Intelligent control I

Session Chair: Chao Hu and Yanjun Shen
HQHT 15:40-16:40 Wednesday, August 5th

HQHT Hallway (61) 15:40-16:40

Applying Hierarchical Reinforcement Learning to Computer Games
Du Xiaoqin, Li Qinghua and Han Jianjun
College of Computer Science, Wuhan University of Science and Engineering
Wuhan, China

• Existing problems in game design.
• Hierarchical finite state machine: HFSM.
• Hierarchical reinforcement learning method: HAMs.
• HFSM vs HAMs for game design.
• Advantages:
  - Programming in detail is unnecessary;
  - Easy to implement;
  - Learning ability;
  - Efficiently;

HQHT Hallway (62) 15:40-16:40

Adaptive Fuzzy Control Based on Genetic Algorithm for Vertical Electric Furnace
Hongxiong Li, Changbo Pan and Fei Teng
Automation College, Beijing Union University
Beijing, China

• The adaptive fuzzy control based on the GA is used for the vertical electric furnace.
• An improved genetic algorithm is presented for optimizing the fuzzy controller in real-time.
• This algorithm is used to eliminate coupling between the upper and the lower temperature regions of the vertical electric furnace in real-time.
• In the industrial control network, the experiments of controlling the vertical electric furnace are performed by using the proposed algorithm.

HQHT Hallway (63) 15:40-16:40

Application of MEC-Based Fuzzy Control in Boiler of Sludge Combustion and Power Generation
Qingsong Liu, Taiti Cao
Jiaxing University, Zhejiang, P.R. China

• Analysis of the structure for fuzzy bed-temperatures control system.
• Improvements of MEC.
• MEC-based fuzzy control design.
• Results of simulation and comparison between MEC and improved GA.

HQHT Hallway (64) 15:40-16:40

PSO Algorithm-Based Schedule Optimization for Tandem Cold Mills
Haijun Che, Qing Zhang, Jingming Yang and Xinyan Han
Key Lab of Industrial Computer Control Engineering of Hebei Province, Yanshan University
Hebei, China

• This paper presents Particle Swarm Optimization (PSO) algorithm schedule optimization procedure for tandem cold rolling mills.
• Adopt the power distribution cost function as objective function, make the rolling force, rolling power, rolling torque, speed and other parameters meet certain requirement.
• SUMT replaces a constrained optimization problem with a sequence of unconstrained optimization problem.

HQHT Hallway (65) 15:40-16:40

Direct Adaptive Fuzzy Control for a class of Nonlinear Systems with Unknown Bounds
Yongping Pan, Daoping Huang and Zonghai Sun
College of Automation Science and Engineering, South China University of Technology, Guangzhou, China

• Developed a fuzzy approximation error estimator as adaptive compensator.
• it is not required that the optimal approximation error (OAE) is square-integrable or its supremum is known in the stability analysis.
• Proved that controlled object being bounded is the sufficient condition of the OAE being bounded.
• Achieves smooth controller output, small tracking error and strong robustness.

HQHT Hallway (66) 15:40-16:40

Asynchronous Consensus Protocols for Multi-Agent Systems
Qin Li and Zhong-Ping Jiang
Polytechnic Institute of New York University, Brooklyn, NY 11201, USA

• Objective: design of asynchronous decentralized algorithms to realize heading consensus for a group of multi-agents with same speed.
• Algorithm 1 (leaderless scenario):
  - Pairwise communication is adopted.
  - Almost global consensus is reached under certain connectivity condition
• Algorithm 2 (leader based scenario):
  - One agent acts as a group leader who sticks to its original heading.
  - Pairwise communication is not required.
  - Global consensus is reached under certain connectivity condition.
Urban traffic has become a worldwide problem with the economy developing rapidly, which synthesizes out-of-order jam, energy consumption and GHG emission. An autonomic model is proposed based on the micro behavior simulation of urban traffic, in which an information decision factor is introduced. Thus the travel patterns and choice of the road trip have been controlled. Micro behavior simulation of urban traffic, autonomic model is proposed based on the energy consumption and GHG emission. An rapidly, which synthesizes out-of-order jam, problem with the economy developing.

### Virtual Detector in Adaptive Traffic Signal Control System Based on Support Vector Machine

Ciyun Lin1, Zhaosheng Yang2, Bowen Gong1, and Yangchong Zu2  
1. Dept. Traffic and Transportation, Jilin University, Jilin, China  
2. Traffic Management Research Institute, The Ministry of Public Security, Jiangsu, China

- Definition of virtual detector
- Platoon dispersion analysis
- Detectors data coefficient analysis
- Multi-sensor data fusion and regression
- A simulation program for adjacent intersections signal control

### An Autonomic Traffic Model Based on Micro Behavior Information Decision

Guiju Jiao1, Chen Guo1, Yining Qin1, Xiaojun Hu1, Xumin Ou1  
1 Information Science & Technology College, Dalian Maritime University, Liaoning Dalian 116026, CN

Urban traffic has become a worldwide problem with the economy developing rapidly, which synthesizes out-of-order jam, energy consumption and GHG emission. An autonomic model is proposed based on the micro behavior simulation of urban traffic, in which an information decision factor is introduced. Thus the travel patterns and choice of the road trip have been controlled and optimized dynamically. Simulation with NetLogo verifies that the model can realize the optimization among traffic, energy and greenhouse gases emission and some practical use for solving the existing traffic problems.

### Longitudinal Distance Control for Vehicle Following Model Based on Tracking Differentiator

Zhigang Li and Qiquan Bai  
Department of Automatic Engineering, Northeastern University at Qinhuangdao, Qinhuangdao, China 066004

- Vehicle following for traffic safety has been an active area of research. Longitudinal distance automatic control is key for vehicle following mode in autonomous cruise system.  
- Tracking-differentiator is designed and applied for the longitudinal distance sliding mode control system in this paper. It provides the relative acceleration information needed in calculating the subject vehicle desired acceleration for longitudinal distance sliding mode control system.  
- Theoretical analysis and computer simulation prove that the designed linear tracking-differentiator can track the vehicle relative velocity measured by sensor and effectively supply the relative acceleration information for distance control.

### A Practical Method of Road Detection for Intelligent Vehicle

Dechao GAO, Wei Li, Jianming Duan, and Banggui Zheng  
College of Electronic Information & Control Engineering, Shandong University, Jinan, China

- practical method for road detection is implemented to detect the lane lines and preceding vehicles  
- distances from host vehicle to left and right lines and preceding vehicles are estimated.  
- algorithm is feasible for different road conditions and detect lane lines and vehicles robustly and efficiently.

### Generalized Disjunctive Programming Model for Multi-periodic Continuous Process Scheduling

Ran Ding, Qiqlang Li and Tao Liang  
School of Control Science and Engineering, Shandong University, Jinan, China

- In continuous production process, there are many complex equipments and special requirements such as continuity and stability, which are very difficult to be presented in classical MINLP formulations. So the production scheduling for continuous process is more difficult than that for discrete process or batch process. In continuous process, experience rules usually play very important roles. But it is impossible to obtain the optimal solution just according to the rules. A novel Generalized Disjunctive Programming model for multi-periodic continuous process scheduling is proposed. In this model, some logistic constraints and experience rules are represented in disjunctive forms, which make the model more completely. An example is used to illustrate the effectiveness of this method.

### Stability Analysis on Hybrid Optimal Velocity Model with Relative Velocity

Ruling Yu  
School of Control Science and Engineering, Shandong University, Jinan, China

- Propose a new backward looking car following model with a consideration of the relative velocity (HOVM).  
- Analyze the previous car following models.  
- Propose HOVM which takes into account the forward two vehicles and the following one vehicle with a relative velocity.  
- Based on HOVM, the stability of the uniform flow is strengthened.
Thursday August 6, 2009

TPP System Modeling I
TPP Robotics and Control I
TPP Logistic management I
TPP Evaluation and optimization II
TPP Evaluation and optimization III
TPP Instrumentation II
TPP Intelligent control II
TPP Intelligent control III
TPP Intelligent control IV
TPP Intelligent control V
TPP Intelligent control VI
TPP Intelligent control VII
3. The improved algorithm includes the improvement of output function, adoption of the attachment momentum method, the dynamic change of the step length and the elimination of the static error.

4. Having carried on the simulation, the result indicates that the improved algorithm has very good effect in the speed of convergence. The validity of the algorithm has been verified experimentally.

5. The improved PID neural network control system can realize the systematic stability.

Supported by the nature science fund of Shandong province (Y2008F54), China.

A New Resolution of Workspace Problem of Parallel Machine Tool
Chunxia Zhu, Lixin Gou, Jiao Han and Lijing Wang
Department of Precision Instruments and Mechatronics
Tiangou University
Beijing 100084, China

1. In this paper a simple and practical method to resolve workspace of parallel machine tool is put forward, which is used for simulating the workspace of parallel machine tool by using virtual prototype model.

2. This paper is organized as follows: Firstly it introduces the general solution and new solution put forward in this paper; Secondly, the example for solving the workspace of 3TP parallel machine tool is given by using two methods put forward and compared with each other. Lastly, conclusions are given in last Section.

Research on Controllable Damping Technology and Simulation of Hybrid Machine Tool
Lida Zhu
Northeastern University

1. Aiming at 3-TPS hybrid machine tool characteristics, controllable damping technique is adopted to control vibration of hybrid machine tool, which not only can enhance stability of machine tool, but also effectively restrain vibration influence in machining process. Controllable damper influenced on machine tool is analyzed in theory; then taken vibration testing in dynamic machining process to verify the effect of this method which indicates adjustable damping control technique can enhance dynamic characteristic of machine tool.

Mechanism Analysis of a Novel Four-Degree-of-Freedom Parallel Manipulator Based on Larger Workspace
Hairong Fang, Jianhong Chen & Congzhe Wang

Aiming at improving the problems of traditional parallel robot, a large-scale, small workspace parallel manipulator was designed. A systematic method is developed to obtain bigger workspace, under the concept of generalized pair and the principle of the equivalent kinematic chain; the concept was used to analyze the DOF, the workspace shape of the traditional and this mechanism were defined by drawing bigger workspace than traditional manipulator can see from the figure. In addition, the movement of the equalized form of the parallel mechanism is simulated with the MATLAB-SimMechanics.
A Preoperative Ultrasound Planning of Robotic System for Hepatic Microwave Coagulation

Jing Xu1, Zhangjun Song2, and Zhenzhong Jia3
1. Michigan State University, East Lansing, Michigan, USA
2. Shenzhen Institute of Advanced Integration Technology, Shenzhen, China
3. Department of Mechanical Engineering, University of Michigan, Michigan, USA

This paper proposes a needle insertion robotic system for ultrasound guided hepatic microwave coagulation.

The specific absorption rate of microwave energy can be calculated and corresponding temperature field can be visualized in the 3D surgery scene generated by the surgical planning system. Such information can be used to help the surgeon adjust the operation to improve the treatment effect.

Experiments for the system accuracy test demonstrate that the mean value of the error is less than 2mm. The temperature field distribution is verified by a 5.6% difference between real and predicted coagulation volume.

Multi-Objective Path Planning for Unrestricted Mobile

Feng Guo, Hengrui Wang, and Yantao Tian
Institute of Automation, School of Communication Engineering, Jinan University, China

• Problem of multi-objective path planning is investigated in this paper for the ball and plate system.

• The purpose of multi-objective path planning is to obtain the safe and shortest path for the ball to track.

• Weights for multi-objectives are calculated by entropy method for each grid node.

• Dijkstra algorithm is employed to solve the multi-objective path planning problem finally.

Optimal Robot Path Planning Based on Danger Degree Map

Yinghua Xue, Guohui Tian, and Bin Huang
School of Control Science and Engineering, Shandong University, Jinan, China

• Propose a new environment model called danger degree map (DDM).

• Analyze the advantages and weakness of equidistant distributed PSO.

• Propose non-equidistant distributed PSO method based on the rate of change of barrier.

• The path planning based on DDM has a rapid convergence, can avoid obstacles automatically, and is more reliable and flexible than conventional PSO.

Optimized Planar Grasping Synthesis Algorithm for Multi-Fingered Robotic Hand

Ze Yu and Jason Gu
Robotics Research Group, Electrical and Computer Engineering Department, Dalhousie University, Halifax, Canada

• Developed an optimized algorithm for 3-fingered robot hand’s planar grasping configuration.

• Modified the existed configuration quality measure criteria, with which better configuration can be found among all possible candidates.

• Proposed algorithm is applicable for both polygonal and curved objects and can be expected to be used for more complicated robotic hands.
Ordering and Pricing decisions in a Two-echelon Supply Chain with Fuzzy Demands Based on Consumer Decisions Time Guarantee
Chenglin Shen¹, Xinmin Zhang², Ke ma³
¹School of Business, Tianjin Polytechnic University, ²Tianjin Institute of Pharmaceutical Research
• In this paper, we propose an optimal technique for dealing with the fuzziness aspect of demand uncertainties. A triangular fuzzy number is used to model the external demand, and optimal decisions models for both an independent member in the supply chain and an integrated supply chain are developed. The closed form solutions for both models are achieved and optimal technique is demonstrated by using a single period supply chain problem. Based on the closed form solutions, the behaviors and relationships of the manufacturer and the retailer are analyzed, and a cooperative policy is proved to facilitate optimization of the whole supply chain.

The Empirical Research on Cluster Supply Chain Flexibility and Logistics Capacity
Weifeng Yang, Zhijun Wu, Ji zi Li
College of Economic and Management, Wuhan University of Science and Engineering
Wuhan, China
• What is the relationship between cluster supply chain flexibility and logistics capability?
• What is the role of information sharing on the relationship between cluster supply chain flexibility and logistics capability?

Profit Allocation Mechanism for VMI under Risk Factors
Dan WANG, Shaoqiang YU
Dalian Maritime University
• Introduction
• Operation Process Of VMI
• Profits Brought By VMI
• Profit Mechanism For VMI
• Case Study
• Conclusions

The Impact of Learning on Integration Capability and Performance: A Knowledge-based View
Yong Liu, Yong Ji Jia and Chang Jun Wang
Glorious Sun School of Business and Management, Donghua University
Shanghai, China
• The effects of learning on integration capability and firm performance are empirically examined using SEM.
• Integration capability fully mediates the relationships between external learning and firm performance, and partially mediates the relationships between internal learning and firm performance.
TPP: Evaluation and optimization II
Session Chair: Guohui Tian and Xianming Li
HQHT 15:00-16:00 Thursday, August 6th

HQHT Hallway (19) 15:00-16:00

Study of cascade PID controller Parameter Optimization based on IMEA for thermal system
Qingsong Liu, Suxiang Qian
Jiaoning University, China

• Analysis of cascade PID control system based on restrictions of stable region.
• Improved Mind Evolutionary Algorithm.
• IMEA-based cascade PID parameter optimization for the main steam temperature system
• Simulation and Analysis

Controller parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>IMEA</th>
<th>MEA</th>
<th>PID</th>
</tr>
</thead>
<tbody>
<tr>
<td>k1</td>
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<td>0.28</td>
<td>0.01</td>
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<tr>
<td>k2</td>
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<td>14.84</td>
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<tr>
<td>k3</td>
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HQHT Hallway (20) 15:00-16:00

Statistical Characteristic and Parameter Characterization of 3D Surface Micro-topography on Micro-EDM
Haijuan Ding, Libin Guo and Hai Cui
College of Mechanical and Electrical Engineering, Harbin Engineering University Harbin, China

• The characteristic of the 3D surface micro-topography of micro-EDM plays an important role on the component function properties. The results show that it is reasonable to characterize the two types of micro-EDM surface micro-topography using the statistical functions and 3D characterization parameters. A conclusion has been obtained that the micro-EDM surface is isotropic and has much better bearing capacity and wear resistance performance than the micro-WEDM surface.

2D ACF of Micro-EDMF Surface

HQHT Hallway (21) 15:00-16:00

Experimental Research on Identification of Oil-Film Dynamic Coefficients of Large-size Journal Bearings
Zhang Mingzhu, Yule, Xu Zili and Xu Rongdong
Institute of Mechatronics and Information Systems, Xi’an Jiaotong University Xi’an, Shanxi, China

• By using the characteristic that the support stiffness of the bearing pedestal of balancing machine are changeable.
• This method does not need any additional excitation and thinks about the influences of the vibration mass on the results.
• The related structural coefficients of bearing pedestal can be obtained by dynamic stiffness test.
• This method is verified by the test data of a 300 MW turbo-generator and be proved to be feasible and has much value in engineering applications

Experiment on the spot

HQHT Hallway (22) 15:00-16:00

Characterizing an Equitable Allocation of Fixed Costs and Resources via Data Envelopment Analysis
Ruiyuan Lin
Department of Mathematic and information Science, Wenzhou University Wenzhou, China

• In many applications of data envelopment analysis (DEA), there is often fixed costs or resources, which is imposed on all decision-making units (DMUs). How can this cost or resource be assigned in a reasonable way to variousDMUs?
• To obtain an appropriate allocation, this paper proposes a DEA based approach, which is based on two assumptions: efficiency invariance and minimal deviation.
• For illustrating the method, numerical results for examples from the literature are presented.

Unified Optimization of H-infinity - Guaranteed Cost Control for Linear Systems with Time-delay
Lei Liu, Guoshan Zhang, Zhiqiang Yue
School of Electrical Engineering and Automation, Tianjin University Tianjin, China

• H-infinity-guaranteed cost state feedback controller design
• Unified optimization of H-infinity performance index and the upper bound of the cost function
• Several examples to demonstrate the effectiveness and feasibility of the proposed results
TPP: Evaluation and optimization III
Session Chair: Guohui Tian and Xianming Li
HQHT 15:00-16:00 Thursday, August 6th

HQHT Hallway (25) 15:00-16:00
Dispatching Optimization and Routing Guidance for Emergency Vehicles in Disaster
Bowen Gong, Zhaosheng Yang, and Ciyun Lin
Department of Traffic and Transportation, Jinlin University, Changchun, China
- the Framework of Emergency Response System.
- the Integrative Spatial-temporal database.
- the Dispatching Strategies of Emergency Vehicles Based on Hierarchical Cluster.
- Centrally Dynamic Route Guidance System Based on Parallel Computing Technology.
- Simulation Based on Changchun network.

HQHT Hallway (26) 15:00-16:00
The Port Effect on Liaoning Economic Development
Li Jing, Xiao Qing
School of Transportation Management, Dalian Maritime University, Dalian, China
- With the model of vector auto regression (VAR), the effect of port development on the GDP, employment and FDI of Liaoning province are researched.
- The research shows the ports don’t play important roles in GDP, while affect the FDI and employment in Liaoning province importantly.
- Dalian Port play more important role in economic development in Liaoning province.

HQHT Hallway (27) 15:00-16:00
Evaluation of the Logistics Cost of cities Based on DEA Model
Xiaofeng Zhao and Qi Tang
Department of Management, Tianjin Polytechnic University, Tianjin, China
- Introduction: Background and the research condition.
- Introduce the DEA model to help to evaluate the logistics cost.
- Collect the actual data and adopt the DEA model to analyze the logistics cost.
- Then according to the data and analysis results, we can analyze the causes of relative high logistics cost and find the keys to improve.

HQHT Hallway (28) 15:00-16:00
Modified Particle Swarm Optimization Based on Immune Clone Principle for Analog-Matching of Equivalent
Yong Sun, Weiguo Zhang, and Meng Zhang
College of Automation, Northwestern Polytechnical University, Xi’an, Shaanxi, China
- Low order equivalent system of aircraft can be calculated and evaluated flying qualities of high order system.
- A modified particle swarm optimization based on immune clone principle is proposed aiming at analog-matching of equivalent system.
- The advanced algorithm has important significance in online evaluation of aircraft flying qualities.

HQHT Hallway (29) 15:00-16:00
Optimization of the Logistics node layout model based on SGA
Liupeng Jiang, Xuejun Feng, and Wei Wang
Transportation and logistics engineering institute, Hohai University, Jiangsu, China
- Build an optimal logistics node layout model with considering the land constraints and scale economy of freight.
- Do computational analysis to solve the model by SGA.
- Use example to analyze the feasibility of above-mentioned model.
- The paper only considered the reasonable arrangement of logistics nodes, the classification question of logistics nodes, multi kinds and multilevel logistics nodes layout optimization question are next steps to study.

HQHT Hallway (30) 15:00-16:00
A Fuzzy Decision Making Model to Select the Location of the Distribution Center in Logistics
Xiaofeng Yu, Xiaowei Zhang, and Li Mu
School of Hydraulic and Electric Engineering, Heilongjiang University, Harbin 150086, China
- Seeking best logistics center location (LCL) is a challenge problem and affected by many factors, these factors consist of many quantitative indicators and qualitative indicators, so the LCL belongs to the fuzzy semi-structured decision-making problem.
- In order to solve the problem, this paper presents the new optimal selection for alternative programs of logistics center using the fuzzy decision-making model (FDMM), this algorithm based on Engineering Fuzzy Set Theory (EFST), has been intensively tested in real system.
- The paper introduces the FDMM and its three characteristics, and then takes an example to discuss the specific application of the model in LCL.
**TPP: Instrumentation II**

Session Chair: Guohui Tian and Xianming Li

HQHT 15:00-16:00 Thursday, August 6th

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**HQHT Hallway (31) 15:00-16:00**

Theoretical Analysis and Experimental Investigation of Fiber-optic Coupler’s Strain Characteristic

Jian Xu, Bin Ma, Xin-guo Zhou

(1) School of Computer and Information Engineering, Shandong University of Finance, Jinan, 250013, China
(2) Department of Information Science and Technology, Shandong University of Political Science and Law, Jinan, 250014, China
(3) School of Control Science and Engineering, Shandong University, Jinan, 250061, China

- Introduction
- Theoretical Analysis of Fiber-optic Coupler
- Experiment Research of fiber-optic coupler’s strain, temperature and transverse characteristics
- Experiment analysis and conclusion

![Picture of experimental device](image)

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**HQHT Hallway (32) 15:00-16:00**

Technological Study on Distributed Fiber Sensor Monitoring of High Voltage Power Cable in Seafloor

Qi Jiang, Qingmei Sui

School of Control Science and Engineering, Shandong University, Jinan City, Shandong Province, China

Temperature online monitor in cable from distributed optic fiber sensor

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**HQHT Hallway (33) 15:00-16:00**

Design of Intrinsically Safe Intelligent Water-level Monitor Used in Coal Mine

WU Yanrong

School of Information and Electric Engineering, Shandong University, Jinan, China

- Intrinsically Safe Intelligent Water-level Monitor Used in Coal Mine to master the dynamic change law of groundwater
- The monitor has the functions of automatic observation of water level periodically, real-time display of groundwater level, data storage and communication with the computer. The monitor is consisted of CPU, sensor, LCD, real-time clock, EEPROM, keyboard, RS232 interface and other circuits.

![Structure of the system](image)

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**HQHT Hallway (34) 15:00-16:00**

Study on Application of 3-D Laser Scanning Technology in Forestry Resources Inventory

Liu Zhang

College of Mechanical and Electrical Engineering, Northeast Forestry University, Harbin, China

- The study concentrates on the automatic detection of trees and the subsequent determination of tree height and DBH.
- Reliability and precision of techniques for automatic point cloud processing were analysed.
- The test shows that 3-D laser scanning technology has a wide application prospects in Forestry Resources Inventory.

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**HQHT Hallway (35) 15:00-16:00**

The Array of Micro-reactor PCR Chips and Its Control System

Xianming Li, Haifa Liu

School of Control Science & Engineering, Shandong University, Jinan, China

- The design of low cost micro-reactor polymerase chain reaction (PCR) chips.
- The temperature control plan of micro-reactor PCR chip array.
- Micro-heater and sensor array based on flexible board.
- The control system of PCR chip array based on industry control computer.
- Statistics process control to the contact thermal resistance between PCB and PCR chip array.

![Schematic drawing of the chip](image)

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**HQHT Hallway (36) 15:00-16:00**

Temperature Measurement System for Ceramic Kilns with Wireless-Communication Based on nRF9E5

Yu Zhang, Shulian Yang, Lei Han and Lidan Hou

School of Mechanical Engineering, Shandong University of Technology, Zibo, China

- The wireless transmission of measurement signal is realized via the nRF9E5 chip for the verification requirement on the temperature measurement system of ceramic kilns.
- The developed system provides a small size, high stability and high reliability through well-designed communication protocol.

![Structure of Wireless Temperature Measurement System](image)
The Negative Pressure Control of Ball Mill Based on T-S Fuzzy Model
Xinli Fang, Tao Shen
Institute of Automation, Jinan University
Jinan, China

- The negative pressure of the cement ball mill fluctuates badly, this article introduces the T-S fuzzy strategy to deal with the problems.
- From the real use in cement factory it shows the T-S arithmetic can bring benefit effects of the negative pressure.

Real-Time Controlling of Inverted Pendulum by Fuzzy Logic
Liu Yanmei1, Chen Zhen1, Xue Dingyu2, Xu Xinhe2
1. Shenyang Institute of Aeronautical Engineering, Shenyang 110136
2. School of Information Science & Engineering, Northeastern University, Shenyang 110004

- The basic aim of our work was to balance a real pendulum in the position in center.
- The fuzzy logic controller is designed in the Matlab-Simulink environment.
- In this paper, the inverted pendulum mathematical model is built. MATLAB based Hardware in Loop simulation system is designed. A novel expert fuzzy control scheme was proposed.
- The proposed control scheme was implemented and showed good performance in the real-time fuzzy control of the inverted pendulum.

HAM Homomorphism for State Abstraction
Du Xiaoqin, Li Qinghua and Han Jianjun
College of Computer Science, Wuhan University of Science and Engineering
Wuhan, China

- Hierarchical reinforcement learning method: HAMs.
- Existing problems in HAMs.
- Homomorphism in HAMs.
- Contributions:
  - Providing formal definitions of homomorphism in HAMs;
  - Proving the invariance of the optimal solution for HAMs;
- Advantages:
  - Forming useful abstractions at different levels of a hierarchy;
  - Speeding up learning;

Method for Subway Operation Adjustment Based on Multi-Agent
Fei Lu, Zhihu Zhang
School of Control Science and Engineering, Shandong University
Jinan, China

- Introduction.
- Model of subway train operation adjustment under moving block system.
- Algorithm of operation adjustment based on multi-agent.
- Simulation.

Fuzzy Control Used in Variable Speed Wind Turbine
Xinyan Zhang, Xiaobo Zhang, Peiyi Zhou, Jing Cheng and Weiqing Wang
Electrical Engineering College, Xinjiang University
Xinjiang, China

- The fuzzy relations between the variables and the fuzzy rules were stated in detail.
- Simulation model and results are obtained.
- By using fuzzy controller, wind turbine generator system has better anti-interference property compared with the PID controller.
- The fluctuation of the power is minimized, the maximum power is traced and the rated power is maintained.

Robust Adaptive Beamforming under Quadratic Constraint in the presence of Mismatches
Xin Song, Jinkuan Wang, Bin Wang, Yinghua Han
Optimization and Smart Antenna Institute, Northeastern University at Qinhuangdao, China

- The proposed algorithm is based on explicit modeling of uncertainties in the desired signal array response and data covariance matrix.
- To decrease computation complexity, the weight vector is obtained by gradient-descent method.
- It provides an improved robustness against mismatches.
TPP: Intelligent control III

Session Chair: Guohui Tian and Xianming Li

HQHT 15:00-16:00 Thursday, August 6th

HQHT Hallway (43) 15:00-16:00

Applications of Immune Genetic Algorithm in Frequency Speed Control Pumping Station

Jin Wang  
Changchun Institute of Technology

Hong Zhang  
Changchun Institute of Technology

Xing-ping Meng  
Changchun Institute of Technology

The paper analyzed the characteristic of speed water pump. Mathematical model was established and it simplified inequality constraint conditions. Immune genetic algorithm (IGA) to handle constrained problems was proposed. Simulation results show that it is an effective algorithm to solving optimal problem of frequency speed control pumps in water circulating system.

Circulating cooling water system of high speed wire factory was in trouble for pumps working in higher energy consumption and lower efficiency.

HQHT Hallway (44) 15:00-16:00

Controlling Study of D-STATCOM Based on Reinforcement Learning Adaptive PID

Xing-ping Meng  
Changchun Institute of Technology

Hong Zhang  
Jilin Electric Power Supply Company

Liang Zhao  
Changchun Institute of Technology

In distribution power system, these power quality problems mainly arise due to the pulsed loads, which causes the degradation of the entire system performance.

A novel adaptive control strategy for the Distribution Static Compensator (D-STATCOM) is based on the Reinforcement Learning Adaptive PID (RLA-PID). With this control method, the compensator can stabilize the PCC voltage around a prescribed value. A distributes power system is developed in MATLAB environment, the validity of the method proposed is verified.

HQHT Hallway (45) 15:00-16:00

A New Hybrid Algorithm for Image Segmentation Based on Rough Sets and Enhanced Fuzzy C-Means Clustering

Wei Zhang1, Yu-zhu Zhang2, Cheng Li1  
1. Qingdao University of Science and Technology; 2. Luoyang Institute of Science and Technology

In this paper, in order to speed up the segmentation process, an improved hybrid algorithm called rough-enhanced fuzzy c-means (REnFCM) algorithm is presented for segmentation of brain MR images.

In this paper, in order to speed up the process, a new algorithm is proposed. The result shows a higher segmentation speed and accuracy.

HQHT Hallway (46) 15:00-16:00

Fault Diagnosis of High Voltage Direct Current System Based on Particle Filter

Xi-mei Liu, Chao Zhang, Hong-mi Guo  
College of Automation and Electronic Engineering, Qingdao University of Science and Technology, Qingdao, Shandong Province, China

A new particle filter based fault diagnosis method for nonlinear stochastic system with non-Gaussian noise and disturbances is proposed by combining particle filter algorithm and fault diagnosis theory. Experimental results show the method is efficient and applicable to HVDC system.

Error Analysis and Compensation of Single-beam Laser Triangulation Measurement

Bing Li, Jianlu Wang, Fei Zhang and Lei Chen  
State Key Laboratory for Manufacturing Systems Engineering, Xi’an Jiaotong University, Xi’an, China

This paper realized the profile measurement through controlling motion path of the probe with the change of the profile and eliminated the effect of the small depth of field. The influence of the depth of field on the measurement is decreased and the precision of the profile measurement is enhanced through the error compensation on the range of the probe depth of field.

Self-Tuning Fuzzy PI+PD Controller for PMSM Servo System

Xianqing Cao, Meng Bi  
College of Information Engineering, Shenyang Institute of Chemical Technology, Network Management Center, Shenyang University of Technology, Shenyang, China

In order to overcome the parameter uncertainties, enhance the fast tracking performance of PMSM servo system, a self-tuning fuzzy PI+PD controller is proposed.

An load torque observer is adopted and the observed torque is feedforward to compensate the load torque disturbance.
Robust Multi-objective and Nonlinear Control of High-rise Elevator Vertical Motion System Based on T-S Fuzzy Model Using PDC and LMIs

Hayan Yu, Xin Zhang, Hongxia Li
School of Information and Science Engineering, Shenyang University of Technology
Shenyang, China

- An linear matrix inequality(LMI)-based and Takagi-Sugeno(T-S) model-based fuzzy approach is employed.
- Parallel distributed compensation (PDC) scheme
- State feedback robust controller was gained based on LMI method.

Implementation of a New Fuzzy Control Strategy on EHB System

Hui Xu, Chuan-xue Song, Shou-cao Li, and Chang-fu Zong
College of Automobiles Engineering, Jilin University
Changchun, Jilin, China

- EHB systems in which the mechanical link between the braking cylinder and braking pedal of an automobile are replaced by a control system seem to offer great advantages on enhanced system performance. In this paper, an EHB control system configuration is presented. The proposed system provide ideal brake force according to the driver’s breaking intention and a PID Controller to regulate the wheel brake cylinder pressure. Simulation result shows very good performance in the experimental braking.

Research of a Boundary Prolongation Method in Runoff Forecast Based on Wavelet Transform

Yang-ying Zhu, Wei Pei, Zai-long Man, and Jing Wang
Civil Engineering department, Dalian Fisheries University
Dalian, China

- A new analogical boundary extension mode is proposed based on the similarity measurement.
- The mode can characterize the self-correlation of runoff sequence excellently with the local similarities on the wavelet multi-scale spaces.
- The case study indicates that the extension mode is very effective for the runoff sequence with obvious tendency.
- The boundary extension errors are low and the forecast precision is improved.

A stable self-learning PID control based on the artificial immune algorithm

Yang Liu
Department of Electrical and Electronics, Shandong University of Technology
Zibo City, Shandong Province, China

- The model is adapted by artificial immune clustering algorithm to learn plant dynamic change.
- the PID control parameters are adapted by the Lyapunov method to minimize a cost function.
- The artificial immune algorithm is effective to PID tuning.

Design, Control and Test of a Magnetorheological Fluid fan Clutch

Hu Hongsheng, Wang Juan, Cui Liang, and Wang Jiang
Mechanical and Electrical college, Jiaxing University
Jiaxing, China

- Introduction.
- Torque transfer model of MR clutch.
- Magnetic circuit optimization of MR clutch.
- Control strategy simulation and controller design.
- Test of MR clutch.
- Conclusions.

Chaos System Filter on State-space Model and EKF

Chen Yong, LiXiu, HuangQ, and ZhangChanghua
University of Electronic Science and Technology of China, Chengdu, China

- Chaos motion is a exclusive form of nonlinear dynamics system, it widely exists in nature. Such as physics, chemistry, biology, geology, as well as technique science, etc.
- The exclusive characteristic chaos system is that the evolvement of system is very sensitivity to initial conditions, so that the future of chaos system is uncertain in long range.
- Based on states space theory and EKF, Chaos system filter on state-space model and EKF is proposed in the paper. The states of chaos system are forecasted by the filter. At last, it takes Lorenz system for example, founds the state-space model of Lorenz system and effectively estimated to the three attractor of Lorenz system through the proposed filtering algorithm. Simulation results on MATLAB show the proposed filtering algorithm is an effective method to estimate parameters of chaos system and filter.
TPP: Intelligent control V

Session Chair: Guohui Tian and Xianming Li

HQHT 15:00-16:00 Thursday, August 6th

HQHT Hallway (55) 15:00-16:00

**Advanced Suspension Systems for Improving Vehicle Comfort**
Jiamin Sun, Qingmei Yang
1. College of Automation, Beijing Union University, Beijing, China
2. Beijing University of Civil Engineering and Architecture, Beijing, China

- An advanced controller with rectification factor is designed.
- Contrasting with common fuzzy algorithm, there is no membership function choice of fuzzy subset for input and output of controller.
- The rectification factor is adjusted online according to LMS adaptive method.
- For the sprung mass acceleration, the simulation results show that LMS adaptive fuzzy control algorithm has obvious effect on the vibration control of suspension system.

HQHT Hallway (56) 15:00-16:00

**The Title of My Paper on Digital Welding Power Sources**
Bin Duan, Tongjing Sun, Zhenhua Li, and Gaoqing Mei
Department of Control Science and Engineering, Shandong University, Jinan, China

- The digital welding machine works in a complicated harsh environment and needs a fast algorithm for the multi-parameter coupling nonlinear welding process.
- Artificial neural network is used to search optimal combination of PID parameter.
- Several expert rules are proposed to improve the performance of ANN-PID.
- The new algorithm can avoid shortcomings of BP algorithm and meet the online real-time control.

HQHT Hallway (57) 15:00-16:00

**Neural Networks with Weight Function and Application**
Zhang Naona, Lu Xiube, Zhang Dejiang, Chen Fang
College of Electrical and Electronic Engineering, Changchun University of Technology, China

- Simple network topology constituted by input layer and output layer only.
- Used in establishing the Energy Consumption Forecasting Model of DAGUSHAN Ore Dressing Plant.
- Different interpolation functions are selected to be the weight functions.
- Simulation examples show the good performance of this method that little calculation work, with no local minimum and slow convergence problems. Model mentioned above has minor error and the better prediction effect is obtained.

HQHT Hallway (58) 15:00-16:00

**Delay-dependent Variable Structure Control for Uncertain Neutral Delay Systems**
Youguo He, Lei Zhao, Yang Gao and Jian Zhou
Faculty of Information Engineering, Shenyang University, Shenyang, China

- The Variable Structure Control problem of a class of uncertain neutral delay systems is considered.
- The paper gives a delay-dependent sufficient condition in terms of linear matrix inequalities such that the closed-loop system is guaranteed to be asymptotically stable.
- The control method guarantees that the trajectory of system arrives at the sliding surface in finite time interval and is kept here thereafter.
- A simulation is given to illustrate the effectiveness of the approach.

HQHT Hallway (59) 15:00-16:00

**An Intelligent Approach for Construction Domain Ontology**
Yan Yaxin, Jiang Zhenhuan, Liu Xinhua and Zhang Xutang
School of Management, Harbin Institute of Technology, Harbin, China

- Merged process knowledge ontology for a cylinder.

HQHT Hallway (60) 15:00-16:00

**A Distortion Tester of Geophone Based on FPGA**
Changdi Lv, Di Fan, Bo Shi and Wei Wang, and Zhihai Liu
Shandong University of Science and Technology, Geophysical Exploration of Shengli Petroleum, Qingdao China

- Moving coil geophone is a linear second order sensor approximately.
- 32 points rectangle window is adopted in our FFT because of its low analysis error and simplified computation.
- The DDS and FFT are realized on the FPGA.
- Experiments results show that the measurement is sample and test precision is high.
TPP: Intelligent control VI

Session Chair: Guohui Tian and Xianming Li

HQHT 15:00-16:00 Thursday, August 6th

HQHT Hallway (61) 15:00-16:00

Research on a Direct Track Intelligent Control Method of Large Ship
Xiaoyun Zhang, Yuanhui Wang, Yufeng Sun and Shuying Li
Harbin Engineering University, Harbin, China

- Calculate the track deviation.
- Fuzzy - PID control strategy is used for direct track at the turning point.
- The track fuzzy controller is a two-dimensional controller.
- The results are simulated on the basis of a certain large surface ship.

Application of Improved Neural Network Optimizing PID Control in Hydroelectric Generating Unit
Shuqing Wang, Hui Liu & Zipeng Zhang
Hubei University of Technology, Wuhan, China

- Design of the control system for hydroelectric generating unit.
- PID controller for hydroelectric generating unit.
- Improving of neural network PID controller.
- Simulation analysis of neural network control

HQHT Hallway (62) 15:00-16:00

Phosphorus Endpoint prediction of AOD furnace ferroalloy melting Based on Wavelet Neural Network
Wang Dongmei, You Wen, Lin Xiaomei, Tian Yantao
Changchun University of Technology, Jilin University

- The network structure of wavelet neural networks
- Learning Algorithm of wavelet neural networks
- The BP neural network model of endpoint phosphorus value
- The wavelet neural network model of endpoint phosphorus value
- The analysis and comparison of the result of simulation.

New Internal Model Control Method for Multivariable Coupling System with Time Delays
Jin Qibing, Quan Ling and Yuan Qin
College of Information Science & Technology, Beijing University of Chemical Technology, Beijing, China

- Introduced the principle of decoupling internal model control.
- The proposed IMC controller design method was described.
- The improved ISE index and NLJ algorithm were adopted to optimize the parameter of the filter.
- Two examples are given to illustrate the effectiveness of the proposed method.

HQHT Hallway (64) 15:00-16:00

Prediction Model of Quality Indices Based-on RBF Neural Network in the Raw Slurry Blending Process
Bai Ru1, Tong Shaocheng1, Zhang Jian1, Chai Tianyou2
1 College of Electrical Engineering, Liaoning University of Technology, Jinzhou, China, 2 Research Center of Automation, Northeastern University, Shenyang, China

- An intelligent prediction model of quality indices of raw slurry is proposed.
- The prediction model of calcium ratio is comprised of 6 modules.
- Long-term running results show that the intelligent prediction software can predict the value and trend of calcium ratio on-line with high accuracy.
Double Inverted Pendulum System Control Strategy Based on Fuzzy Genetic Algorithm

Ding Chengjun, Duan Ping, Zhang Minglu
School of Mechanical Engineering, Hebei University of Technology, Tianjin, China

- Using Genetic Algorithm to optimize the weighting coefficient and membership function parameters.
- Then, using the optimizing result to control the double inverted pendulum system.

The membership function curve of control variable $u$

The Recognition of Working Condition of Cement Rotary Kiln Based on Information Fusion

Zhugang Yuan
Department of Control Science and Engineering, Harbin Institute of Technology, Harbin, Heilongjiang, China

- In this article the tendency type of the main examination parameters is recognized with an improved ART-2 cluster parsing algorithm.
- The rotary kiln is a non-linear controlled object with multi-factors, slow time-variable, big time lag and close coupling, and it is difficult to establish its precise mathematical model.

Cooling High-speed Chips Using Intelligent Control Technology

Baosheng Yang, Xiushui Ma
Department of Computer Science and Technology, Suzhou University, Suzhou, China

- In order to keep high-speed chips within good performance, some cooling methods are necessary.
- Fans can dramatically reduce the temperature of a chip. But the continual noise from the full-speed cooling fan is inevitable.
- The temperature sensor IC measures the chip temperature and adjusts fan speed accordingly.
- The effects of noise in the work place can be solved in this way.

L$_2$ Robust Control for Brushless Doubly-Fed Wind Power Generator

Fengge Zhang, Shi Jin and Xiuping Wang
College of Electrical Engineering, Shenyang University of Technology, Shenyang, China

- The essence of maximum wind energy tracking is transformed into generator speed control problem.
- L$_2$ robust control is adopted to design a speed controller for variable speed constant frequency brushless doubly-fed wind power generation system.
- The proposed robust controller enables the generation system to be better in robustness against parameters uncertainties, to rapidly track wind speed, and further to track maximum wind energy.

Robust Fuzzy Control for Permanent Magnet Synchronous Motor Chaotic Systems with Uncertain Parameters

Yan Zhao, Tieyan Zhang, Quye Sun, Tianlong Zhang
1. Department of Automatic Control Engineering, Shenyang Institute of Engineering, Shenyang, Liaoning, China
2. School of Information Science and Engineering, Northeastern University, Shenyang, Liaoning, China

- The T–S fuzzy models of a class of PMSM chaotic systems are derived.
- Based on the T–S fuzzy PMSM chaotic systems, a simple fuzzy stabilization controller is designed.
- The robust stability criterion is presented.

Fuzzy Neural Networks Pattern Recognition Method and its Application in Ultrasonic Detection for Bonding Defect of Thin Composite materials

Xu Yan-hong, Zhang Ze, Liu Kun and Zhang Guan-ying
College of Electronic Information Engineering, Inner Mongolia University, Hohhot, China

- New fuzzy neural network pattern recognition method established.
- Combination of fuzzy pattern recognition and neural network pattern recognition.
- Realization of quantification recognition and quantification detection.
Friday August 7, 2009

Afternoon

FPP  Transportation system II
FPP  Management systems on logistics
FPP  System Modeling II
FPP  System Modeling III
FPP  System Modeling IV
FPP  System Modeling V
FPP  Modeling and simulation I
FPP  Modeling and simulation II
FPP  Modeling and simulation III
FPP  Modeling and simulation IV
FPP  Modeling and simulation V
FPP  Modeling and simulation VI
FPP  Modeling and simulation VII
1. Overlapping Clustering Routing Algorithm Based on L-PLC Meter Reading System
   Zhenchao Wang, YiJin Wang and Jing Wang
   College of Electronic and Information Engineering HeBei University
   BaDing, China

   - The algorithm is based on overlapping clustering, so it can establish multiple shortest routings.
   - A new rule is given that a node can respond to clustering command from all nodes but its sub-nodes.
   - In order to record information of all paths, we build a routing table as matrix, and acquire paths through searching the routing table.

2. Analysis to Detecting Methods of Analogue Based on Variable Threshold Value Neuron
   Jian Tang and Bo Sun
   Institute of Special Equipment, Shenyang Ligong University
   Shenyang, China

   - Detecting nonlinear analogue, anyone detection value relates to three neighbouring samples at most. So the algorithm saves time. The measuring error based on piecewise variable slope training method is less than that based on piecewise linearization ones.
   - Variable threshold neuron can not only detect monotonic non-linear analogue but also for general non-linear analogue. The two training methods to threshold and weight are cross reference on operating conditions. The piecewise variable slope training method to threshold and weight is much superior to piecewise linearization method in the area of analogue detection.

3. A Novel Algorithm of License Plates Automatic Location Based on Texture Feature
   Zhen-Xue Chen, Cheng-Yun Liu, Fa-Liang Chang and Jian-Guang Xu
   School of Control Science & Engineering, Shandong University
   Jinan, China

   - Locating the vehicle license plate plays an important role in the vehicle license plate automatic recognition system.
   - A novel locating approach based on the texture feature is presented in this paper.
   - This paper makes one dimension cycle clear method for map of horizontal projection.
   - This method can effectively filter the noise and clutter around car license plates, and accurately locate them.

4. Research on Road Express Freight Transportation Network layout in Shandong Province
   Zhang Yuan, Ma Xiang-juan, and Wu Wei-Yang
   Department of Transport and Logistics, Shandong Jiaotong University
   Jinan, China

   - Analyze of Shandong Traffic Location Lines: two horizontal lines and four vertical lines.
   - Three categories: the most important nodes, the more important nodes and other nodes.
   - Put forward the Shandong express freight transportation network layout.
**Session Chair: Jason Gu and Simon Yang**

**HQHT 15:40-16:40 Friday, August 7th**

**HQHT Hallway (5) 15:40-16:40**

**Exponential Stability of a Class of Impulsive Neural Networks with Variable Delays**

Jianfu Yang¹, Fengjian Yang¹, Jicheng Tao², Wei Li¹, Dongqing Wu¹
1 Department of Computer Science, Zhongkai University of Agriculture and Engineering, Guangzhou, P. R. China
2 Department of Mathematics, China Jiliang University, Hangzhou, P. R. China.

The main purpose of this paper is to study the globally exponential stability of the equilibrium point for a class of impulsive neural networks with time-varying delays. Without assuming global Lipschitz conditions on the activation functions, applying idea of vector Lyapunov function, combining Halanay differential inequality with delay, the sufficient conditions for globally exponential stability of neural networks are obtained.

**HQHT Hallway (6) 15:40-16:40**

**Apparel Enterprise Application Integration Model Based on Service-Oriented Architecture**

Zhang Jujian
Computer Information Center, Beijing Fashion Institute
Beijing, China

- This paper sets up an entire frame of apparel enterprise application integration based on SOA
- Describes the designing of the structure model of apparel enterprise application integration
- As an example of apparel production, inventory, sales business activities, it also discusses the methods of realizing application integration.

**HQHT Hallway (7) 15:40-16:40**

**Preprocessing to Weld Line Based on Roller Forming for Tailored Blank Laser Welding System**

Junyi Wang, Zhigang Xu, Limin Xin, Feng Li
Shenyang Institute of Automation, Chinese Academy of Science

- reduce the width of the gap between the steel sheets.
- Roller forming process by plastically deforming the thicker sheet.
- Mathematical model of roller forming is founded by experiment and function fitting

![Tailored blank laser welding system](image)

**HQHT Hallway (8) 15:40-16:40**

**Design of Lifting Permanent Magnet Based on Neural Network**

Ning Ding¹, Yunpeng Wang², Shiwu Li², and Dingtong Zhang
1Mechanical Engineering College, Changchun University, Jilin, China
2Transportation and Traffic College, Jilin University, Jilin, China

- The Rare Earth Lifting Permanent Magnet is presented, which can completely eliminate the disadvantages found in conventional lifting electromagnets.
- A neural network model of magnet circuit design is developed.
- A drive system is invented, which can make Rare Earth Lifting Permanent Magnet load and unload the ferromagnetic object automatically without supplying any electricity at all.

**HQHT Hallway (9) 15:40-16:40**

**Analysis and evaluation between Maritime industry and the socio-economic relationship in Liaoning Province**

Jing Liang, and Zhanwei Zhao
Transportation Management College, Dalian Maritime University, Dalian, China

- The current Maritime industry and the regional economy development status are summarized and commented on.
- Granger causality between shipping service and the three significant variables of social economic development is carried out.
- The econometric model is established according to the result of Granger causality test to analyze the impact on the social economic relations imposed by the shipping service.
- Constructive suggestions upon the shipping service and related industry are put forward.

**HQHT Hallway (10) 15:40-16:40**

**Analysis of Correlation between Shandong’s Transport and GDP**

Qian Wang, Ling Ren
School of Economics & Management, Yantai University

- Introduction
- Time series analysis of total transport volume
- Correlation between transport volume and Shandong’s GDP
- Conclusions

Correlation function of freight volume and passenger volume

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**FPP: Management systems on logistics**
FPP: System Modeling II
Session Chair: Jason Gu and Simon Yang
HQHT 15:40-16:40 Friday, August 7th

HQHT Hallway (11) 15:40-16:40
Propagation of Stress Wave in Nickel Single Crystals Nanofilm via Molecular Dynamics
Jia yan, Liu heng and Yu lie
Institute of Mechatronics and Information Systems, Xi’an Jiaotong University, China

- Molecular dynamics is applied to study the propagation of stress wave in metal single crystal nano-film
- The simulation result shows the stress transfer in the nano-film is according to the way of wave, and there is time lag in the progress of stress wave propagation. The wave speed is different as the lattice direction is difference.

Schematic of the simulation system

HQHT Hallway (12) 15:40-16:40
Propagation of Stress Wave in Nickel Single Crystals Nanofilm with Cavity via Molecular Dynamics
Jia yan, Liu heng and Yu lie
Institute of Mechatronics and Information Systems, Xi’an Jiaotong University, China

- Molecular dynamics is applied to study the propagation of stress wave in metal single crystal nano-film without and with cavity
- The simulation result shows the properties of the propagation of stress wave in metal single crystal nano-film without and with cavity, and the effect of cavity on the propagation of stress wave

Schematic of the simulation system

HQHT Hallway (13) 15:40-16:40
Chirping Noise of Laser Diodes under Small Signal Modulation
ZANG Huai-quan1, DUAN Hui1
Key Lab of Industrial Computer Control Engineering Yanshan University Qinhuangdao, He Bei Province, China

- Direct intensity modulation of DFB laser diodes brings about chirping, which affects the performance of optical transmission systems.
- Chirping characteristics of DFB laser diodes under small signal modulation are studied.
- The qualitative comparison between the frequency chirping of laser and IM response is made.
- The theoretical relationship of the ratio between the chirping and modulation power has been derived.

HQHT Hallway (14) 15:40-16:40
Remote vs. Simulated, Virtual or Real-Time Automation Laboratory
Zorin Popescu1, Razvan Aguridan1, Cosmin Ione1, Liviu Popescu1, Qinghao Meng1, Adina Ionete1
1-University of Craiova, Romania, 2-Tianjin University, China, 3-Ejprest SRL, Romania

- This work deals with virtual, remote, real-time and simulated experiments for a workstation (FMS-200)
- Aims: to train the students or engineers in the field of automation; to offer a technology for industrial developments
- The purpose of the remote experiment is to give the users access in two situations:
  - users enrolled in some form of distance learning;
  - laboratory experiments on expensive difficult to install equipment.

HQHT Hallway (15) 15:40-16:40
The Research of Building Logistics Cost Forecast Based on Radial Basic Probabilistic Neural Network
Meijuan Gao, Jingwen Tian, and Shiru Zhou
College of Automation, Beijing Union University, Beijing, China

- Introduction
- Radial Basic Probabilistic Neural Network (RBPNN)
- Building Logistics Cost Affect Factors
- Building Logistics Cost Modeling Based on RBPNN
- Conclusion

HQHT Hallway (16) 15:40-16:40
Research and Realization of Simulation Control System for Rudder and Ship with Autopilot
Hairong Xiao1, Yaschen Han1, Changshun Wang1 and Fengyu Zhou2
1-Department of Information Engineering, Shandong Jiaotong University, Jinan, China, 2-School of Control Science and Engineering, Shandong University, Jinan, China

- Various math models are established during the process of ship movements.
- The design project and realization approach to simulate ship - rudder control system with course & track autopilot in real navigation environment are introduced which combine digital simulation with physical simulation.
- The main control software and single-chip microcomputer system used for the actual ship simulation system are developed.

The framework of simulation system
Globally Exponential Stability of Cellular Neural Networks with Distributed Delays and Large Impulses

Jianfu Yang, Fengjian Yang, Jicheng Tao, Wei Li, Dongqing Wu
1 Department of Computation Science, Zhongkai University of Agriculture and Engineering, Guangzhou, P. R. China.
2 Department of Mathematics, Jiliang University, Hangzhou, P. R. China.

The main purpose of this paper is to study the globally exponential stability of the equilibrium point for a class of cellular neural networks with distributed delays and large impulses. With assuming global Lipschitz conditions on the activation functions, applying the idea of vector Lyapunov function, combining Halanay differential inequality with delay, the sufficient conditions for globally exponential stability of neural networks are obtained.

Function Modeling and Simulation of Outer Characteristic of Telescopic Shock Absorber for Automobile

Changcheng Zhou, Yuanyi Liu
School of Transport and Vehicle Engineering, Shandong University of Technology, Zibo, China

- Analysis of damping components.
- Velocity points at which the valves open firstly and maximally.
- Mathematical modeling of shock absorber outer characteristic.
- Simulation of outer characteristic of shock absorber.
- Performance test.

A Practical Maximum Power Point Tracker for the Photovoltaic System

Jiying Shi, Chunling Li, Lili Zhang, and Chengshan Wang
School of Electrical and Automation Engineering, Tianjin University, Tianjin, China

- A practical technique combining a loss-free resistor with an incremental conductance tracking algorithm to efficiently track the maximum power point of a solar array has been presented.
- The proposed tracker introduces a variable searching steps strategy based on feature of the converter and the tracking method.
- Both of the results of the analysis and simulation manifest that the conversion efficiency is improved obviously.

The System Identification for Multivariable System in Frequency Domain

ZHAO Yong-guo, CAI Wen-juan, and JIA Lei
Institute of Automation, Shandong Academy of Science, Jinan, China

- Step changes in the controller set point are performed on the process.
- The process frequency-response matrix is estimated. An accurate transform-function matrix can be identified.
- It only requires response data of process input and output, and no prior knowledge of the process dynamics is needed.

Function Modeling and Simulation of Deformation of Multi-Throttle-Slices for Telescopic Shock Absorber

Changcheng Zhou, Leilei Zhao, and Yuanyi Liu
School of Transport and Vehicle Engineering, Shandong University of Technology, Zibo, China

- Mathematical model of deformation of single throttle-slice.
- Formula of slice deformation at any radius $r = \frac{g}{2}$.
- Equivalent thickness of multi-slices.
- Deformation of multi-slices.
- Simulation certification.

Design on Radar Signal Simulator of Automotive ACC

Si Hai, Zhan Wen Zhang, Liu Zhao-du, He Wei, and Li Jingliang
Beijing Automotive Technology Center, Beijing Institute of Technology, Beijing, China

- The valid target data can be outputted from radar simulator.
- The effect of ACC control algorithm is well validated after revising the wheel velocity measurement and improving integral algorithm and can be applied to ACC control.
- The radar signals can meet the ACC controller and accordingly the safety and efficiency of the exploitation of the ACC system and the real vehicle experiment can be ensured.
FPP: System Modeling IV
Session Chair: Jason Gu and Simon Yang
HQHT 15:40-16:40 Friday, August 7th

HQHT Hallway (23) 15:40-16:40
Boxed Milk Metamorphism Detecting Method Base on wavelet and Hilbert Transform
Xianjiang Shi, Xingjie Zhao, and Guanghui Xiao
Department of Mechanical and Engineering, Harbin University of Science and Technology, Harbin, China

- Wavelet de-noising method is used to eliminate signal noise.
- Hilbert transform is used to achieve signal envelope curve and the system damping ratio.
- The results showed the method greatly improved system damping ratio of detection accuracy.

HQHT Hallway (25) 15:40-16:40
Calculation Force Control Based on Linearization Feedback Model of SMISMO Control System
Yingjie Liu, Bing Xu, Huayong Yang, and Dingrong Zeng
State key laboratory of fluid power transmission and control, Zhejiang University, Hangzhou, China

- Simulation model of SMISMO control system.
- Proposed control strategy for trajectory control of piston in the cylinder.
- Controller is tested by simulation and experiment, good results is achieved, it is promising for industrial application.

HQHT Hallway (27) 15:40-16:40
Design of BPNN Speed PI Controller based on GA
Yinquan Hu, Heping Liu and Wencui Yi
State Key Laboratory of Power Transmission Equipment & System Security and New Technology, Chongqing University, Shapingba District Chongqing, China

Following the performance and disturbance rejection performance of motor is directly related to the application of DC speed control system in DC motor control. DC speed control system uses regular speed, current double closed-loop speed control, the inner ring and the outer ring generally use PI regulator. However, the rotational speed will produce inevitably overshoot and disturbance rejection performance is not good in double-loop speed control system. This paper describes design method of a BP neural network speed PI controller based on genetic algorithm, which eliminate the DC speed control system rotational speed of the overshoot, and improve the system dynamic performance, and use Matlab simulation software to verify its advantages.

HQHT Hallway (24) 15:40-16:40
Identification of PMSM Based on EKF and Elman Neural Network
Wang Song*, Shi Shuang-shuang†, Chen Chao‡, Yang Gang*, and Qu Zhi-jian‡
1. School of Electrical Engineering, Beijing Jiaotong University, Beijing, China
2. School of Mechatronics & Electrical Engineering, Shandong University at Weihai, Weihai, China
3. Institute of Information Engineering Technology, Academy of Navy Equipment, Beijing, China

- Identifying parameters of PMSM is very important.
- Use modified EKF to estimate motor parameters and supply training data for Elman NN.
- Construct a Elman NN through training and simulating, obtain the identified values of parameters.
- Validate the generation ability of our Elman NN with another case.

HQHT Hallway (26) 15:40-16:40
TBM Motion Simulation based on VR System
Jianyu Yang, Hu Li, Jun Cheng, and Wanshan Wang
School of Mechanical Engineering and Automation, Northeastern University, Shenyang, China

- A practical method for numerical prototype motion simulation based on OpenGL Performer was proposed.
- A main simulation procedure was designed for processing event trigger, and a motion simulation of TBM key component was developed.
- A motion analyzing method was expressed, based on the TBM erector, and a realizing method based on OpenGL Performer toolkit was expatiated.
- Introduced a model transforming and processing method with Deep Exploration and Multigen Creator.

HQHT Hallway (28) 15:40-16:40
Research on Machining Simulation of Turn-milling Center based on DVR
Weili Liang, Tianyu You, Yan Yu, Lida Zhu, Wanshan Wang
School of Mechanical Engineering and Automation, Northeastern University, Shenyang, China

- A practical method for numerical prototype motion simulation based on OpenGL Performer was proposed.
- A main simulation procedure was designed for processing event trigger, and a motion simulation of TBM key component was developed.
- A motion analyzing method was expressed, based on the TBM erector, and a realizing method based on OpenGL Performer toolkit was expatiated.
- Introduced a model transforming and processing method with Deep Exploration and Multigen Creator.
The method can realize 5-Dimensional localization and tracking for the target object in the limited area, like indoor and in-vivo scenarios.

A sliding-mode observer for estimating stator flux is introduced.

The work deals with the Bond Graph technique, and can be used in illustration of the power of BondGraph model of the bioprocess.

The newly proposed DWT-OA method, is proposed.

Using DWT and Lifting WT, noisy signal and denoised signal are compared.

Using DWT and Lifting WT, noise reduction is introduced.

This paper proposes a new localization algorithm for the localization of an object in the limited area, like indoor and in-vivo scenarios.

This paper introduces the HMM - SVM method to identification of nonstationary time series of the vibration signal of cutting process.

A new time-frequency algorithm for octave analysis of vehicle noises is developed.

The DTC-SVM system is introduced.

The prototype of our localization model based on input-output linearization technique for induction machine drives is developed.

A sliding-mode observer is developed.

The work deals with the Bond Graph technique, and can be used in illustration of the power of BondGraph modeling of nonlinear bioprocesses.

The DWT-OA algorithm is accurate for octave analysis of vehicle noises.

A sliding-mode observer for induction motors is developed.

The DTC-SVM system is introduced.

• The procedure represents a valuable illustration of the power of BondGraph technique, and can be used in order to obtain models of bioprocesses with high level of complexity

• SVM-DTC not only preserve DTC transient merits, but also produce better quality steady-state performance in a wide speed range.

• The SVM-DTC system based on input-output linearization technique for induction machine drives is developed.

• A sliding-mode observer for estimating stator flux is introduced.

• Use DWT, lifting WT and UWT in denoising the sine and noise signal respectively.

• Use DWT, lifting WT and UWT in denoising the oil pipeline pressure time series with noise.

• Signal denoising methods based on lifting WT and UWT are much more effective than that on DWT in locating the singular point.

• Signal denoising methods based on lifting WT and UWT are much more effective than that on DWT in locating the singular point.

• Daubechies wavelet is determined for octave analysis of vehicle noises.

• A new time-frequency algorithm for sound octave analysis, so-called DWT-OA method, is proposed.

• Daubechies wavelet is determined and applied for OA of nonstationary vehicle noises.

• The DWT-OA algorithm is accurate for octave analysis of vehicle noises.

• Signal denoising methods based on lifting WT and UWT are much more effective than that on DWT in locating the singular point.

• Introduce the wavelet theory.

• Use DWT, lifting WT and UWT in denoising the sine and noise signal respectively.

• Use DWT, lifting WT and UWT in denoising the oil pipeline pressure time series with noise.

• Signal denoising methods based on lifting WT and UWT are much more effective than that on DWT in locating the singular point.

A sliding-mode observer for induction motors is developed.

The prototype of our localization model based on input-output linearization technique for induction machine drives is developed.

A sliding-mode observer for estimating stator flux is introduced.

The work deals with the Bond Graph technique, and can be used in illustration of the power of BondGraph modeling of nonlinear bioprocesses.

The DTC-SVM system is introduced.
FPP: Modeling and simulation I
Session Chair: Jason Gu and Simon Yang
HQHT 15:40-16:40 Friday, August 7th

Linear Motor Control Based on Resistance Identification with Wavelet Transform
Cui Jiefan, Fu Yue, Zhao Nan, Xing Feng and Yang Xia
School of Electrical Engineering
Shenyang University of Technology
Shenyang, China

- The mathematic model of direct thrust control system.
- Wavelet transform used in resistance identification.
- Wavelet analysis used in resistance identification of direct thrust control system.

Research on ramp optimization metering strategy in urban expressway
Xuewen Chen, Yansong Wang
College of Automobile and Traffic Engineering, Liaoning University of Technology, Jinzhou, China
College of Automobile Engineering, Shanghai University of Engineering Science, Shanghai China

- Introduction.
- On-ramp metering method.
- The phase adjustment method.
- The congestion dissipation control.

The Implement of High Speed Data Acquisition System Based-on SOPC Technology
Chuanfei Qiu, Quanzhi Zhou, Changjun Wei and Fei Xu
Wuhan Mechanical Technology College
Wuhan, China

- Comes up with the solution that implementing high speed data acquisition system with SOPC technology.
- Embeds a Nios II CPU in FPGA, and mounts customized user logic on Avalon switch fabric.
- Successfully implements the high speed data acquisition system.
- Includes functions of measuring the parameters of input signal, waveform rebuilding and drawing.

A Novel Parameter Adaptive Nonlinear Model of Proportional Valve
Zhengjun Wang, Junzheng Wang, Wei Shen, and Shoukun Wang
School of Automation, Beijing Institute of Technology
Beijing, China

- Aiming at controlling the nonlinear coupled variables force and velocity precisely in the electro-hydraulic proportional loading system.
- An open-loop control method based on a nonlinear model, achieves high precision and adapts the parameters change online.
- The experimental results show that the maximum error of force and velocity are less than 4.38% and 5.47%, respectively.
- Statistically evaluating with the experimental data proves the precise and efficient of the model.

Modeling and Simulation of Loading and Unloading Scheduling System Based on Agent and Petri Net
Lijeng Ren1,2, Wen Wang, Weiping Fu, Wei Yang1 and Can Li1
1 School of Machinery and Precision Instrument Engineering, Xi’an University of Technology, Xi’an, 710048, P.R.China
2 CNPC LanZhou chemical company, Lanzhou, 730000, P.R.China

- the model established by the integrated method and its run rules are defined.
- the scheduling elements of the system are classified, and the object class relation are obtained.
- the APN (Agent-Petri Net) model of the scheduling system is set up based on the corresponding relations between each object sub-net module and each function agent, which consists of five different function agents. The system model is realized under JADE platform.

Simulation of Soft Tissue Using Mass-Spring Model with Simulated Annealing Optimization
Shaoping Xu, Xiaoping Liu, Hua Zhang
School of Mechatronics Engineering, Nanchang University, Nanchang, China

- A new tensor-mass model (TMM) incorporating visco-elasticity was developed.
- Deformation calculated by the TMM is used as a reference to obtain the parameters for the Spring-Mass Model (SMM)model.
- We propose a simulated annealing identification method and it can tune the parameters automatically until the deformation of the mass-spring model is close enough to the one defined by the new modified TMM.
FPP: Modeling and simulation II
Session Chair: Jason Gu and Simon Yang
HQHT 15:40-16:40 Friday, August 7th

Development of Ant Group and immunity Algorithm for Multiple Round Scheduling in Cold Rolling Enterprise
Yong Zhang, Yukun Wang, Jiesheng Wang
University of Science and Technology Liaoning, Anshan, China

- The restraint combination optimization question of the cold rolling production scheduling is typical NP-hard problem
- To establish minimum value model of cold rolling production batch scheduling problem based on TSP

Product Line System Modeling of the Cold-Rolled Mill Based on the Hierarchy Colored Petri Nets
Yong Zhang, Jing Zhu
University of Science and Technology Liaoning, Anshan, China

- The Petri Nets description ability with coloring, what made steel information, equipment condition and routes clearer, thus simplified the Petri Nets model structure, reduced the model complexity.
- This method also could be well used in other complicated process industries. It was shown that these designed object classes were highly consistent with real production and the development efficiency for production planning and scheduling systems has been greatly improved.

Tibetan Language Continuous Speech Recognition Based on Active WS-DBN
Yue Zhao, Yongcun Cao and Xiuqin Pan
School of Information and Engineering, Minzu University of China, Beijing, China

- The research on Tibetan language speech recognition is in the initial stage, and it is time-consuming and costly to annotate the large vocabulary Tibetan languages corpus.
- Active learning can reduce annotation cost by sample selection. Queries-by-Committee is a kind of sample selection method of active learning for SVM. We presented an active WS-DBN model in recently Bilines’s speech recognition research and combined with QBC for Tibetan language continuous speech recognition.
- The active WS-DBN algorithm for Tibetan language speech recognition.
- Experimental results show that active WS-DBN model can reach the same recognition rate as WS-DBN, and is higher than HMM model. At the same time DBN-based Tibetan speech recognition model has better performance of noise suppression.

Extraction of Partial Discharge Signals in Power Transformer Using Complex Wavelet
Guihong Feng, Feng Ji, Bingyi Zhang
Department of Electrical Engineering, Shenyang University of Technology, China

- The generation of complex wavelet.
- The complex information used to extract the feature of the partial discharge.
- Selection of the optimal basic wavelet based the similarity degree between wavelet and PD
- Simulation results show the method has good performance.
A Simulating Model of Automotive Power System Based on the Finite State Machine
Hongbin Li and Dong Li
Key Laboratory of Advanced Manufacturing and Automation Technology, Ludong University, Yantai, China

- A simulating model which can express dynamic characteristics of the automotive power system in every driving phase is proposed.
- Because of the driving torque and the resistant torque on each part of the automotive are different according to the state of the clutch and gearbox, a simulating model is established based on the finite state machine.
- Then, a hard-in-loop half-real simulating system is established using dSPACE, in which the simulating model is working as its kernel.

Compare and Analysis of Passive and Active Suspensions under Random Road Excitation
Jiamin Sun1, Qingmei Yang2
1. College of Automation, Beijing Union University, Beijing, China
2. Beijing University of Civil Engineering and Architecture, Beijing, China

- LMS adaptive controller are designed in two-DOF vehicle suspension model. The results show that the LMS adaptive control strategy has the better control result.
- The calculation of LMS adaptive control algorithm is much little, not only simple algorithm but also remarkably effective, and the method is fit for the active control of the suspension system.
- The generation method of random road temporal signal and the stability of LMS adaptive control strategy need further study.

Study on Fractal Characteristics of Low-Voltage Power Line Communication Channel
Zhenchao Wang, Yuqian Zhao, Yutao Gan and Shibing Zhang
College of Electronic and Information Engineering, HeBei University, Baoding, China

- Hurst index of measured time series are greater than 0.5, fractal dimension is greater than 1.0, L-PLC channel has obvious fractal and chaotic characteristics.
- Statistical moment is a nonlinear function, multi-fractal spectrum is strict symmetrical, the L-PLC channel has strong multi-fractal properties.

Research of VSCF Wind Power Generation Training System Based on Matlab/LabVIEW
Lv Yuegang, Xi Peiyu, Li Nailu and Fan Xiaoxu
Research Laboratory for Wind Power, North China Electric Power University, Beijing, China

- A variable-speed constant-frequency wind power generation training system is proposed.
- In control layer, the simulation model in the simulink platform is proposed, which is based on the actual wind power generation unit.
- In supervisory layer, a vivid HMI in the LabVIEW platform is provided to realize human-machine interaction.
Comprehensive Fault Evaluation on Maglev Train Based on Ensemble Learning Algorithm
Zhijiang Long, Lianchun Wang and Ying Cai
College of Mechaeronics and Engineering and Automation National University of Defense Technology Changsha Hunan Province, China

- First, the structure of the suspension system of maglev train is analyzed and a fault diagnosis model is built.
- Second, ensemble learning is introduced to the train model with learning ability.
- Last, this method is applied to fault evaluation on maglev train suspension system.
- In comparison to single and ensemble classification method, the emulational results prove that the ensemble method works better on the problem, the advantage of the Ensemble Learning algorithm is manifested.
- Practice has proved that this method is competent for precision demand.

Studies on Risk Management of the Urban Infrastructure Projects Based on the PPP Financing Model
Hani Chen1,2, diaqun Ma3, Ba Lui, Tao Qin
1College of Business Administration, Hunan University Changsha, Hunan Province, China; 2chenhani2008@sina.com.cn

- With the acceleration of urbanized advancement in China, governments’ high investment and low efficiency in the urban infrastructure projects have already become a worldwide problem. The PPP financing model suitable for urban infrastructure projects for theirs unique advantages.
- The paper establishes the VAR (Value at Risk) into financing risk assessment of the urban infrastructure projects, and make quantitative risk analysis to the risks; then it applies the method of expert investigation and mark and the fuzzy comprehensive evaluation to setting up the risk assessing model that is based on the VAR.
- We carry empirical analysis about the risk problem of an urban infrastructure project.
- The experimental results indicate that the ensemble method classified is superior to the single classifier.

High-Gain Observers for Estimation of Kinetics in Biological Sequencing Batch Reactors
Dan Selateanu, Emil Pete, Dorin Sendrescu, Monica Roman, and Dorin Popescu
Department of Automatic Control, University of Craiova, Craiova, Romania

- Sequencing Batch Reactors (SBRs) are used for the aerobic treatment of wastewater by activated sludge.
- A key issue for SBRs is the estimation of kinetic rates.
- High-gain observers for the kinetics in two types of SBRs are designed:
  - the treatment of wastewater from chemical industry (toxic compounds).
  - the treatment of typical municipal wastewater, polluted with organic carbon and nitrogen.
Research on Precise Locating Control of Large Inertia Ball Mill

Changsheng Ai, Weixing Jing, Hui Zhang, Xiangbo Ze, Fang Zhao
School of Mechanical Engineering, University of Jinan, Jinan, Shandong province, China

- At the process of ball mill starting, the critical parameters such as rotary inertia and load torque can be gotten.
- With the relationship between starting and stopping, the rotary inertia and load torque and other inherent parameters can also be acquired.
- With the inherent parameters at the process of stopping of ball mill, the optimal position for power off can be predicted.

A Novel Fault Diagnosis Method Design and Application for Civil Aircraft System

Yongqi Chen, Zhiguang Zhong
Intelligence Science and Electromechanical Systems Laboratory, CST Ningbo University, Ningbo, China

For estimating faults of the system with unknown nonlinear term, a novel fault diagnosis method based on nonlinear compensation term and proportional multiple-integral observer is proposed. In this method, the nonlinear compensation term is constructed by support vector machines (SVM), which can reduce the influence of unknown nonlinear part. Proportional multiple-integral observer based nonlinear compensation term can estimate actuator faults when there are sensor faults or output disturbance in the system. The proposed method is applied in civil aircraft system. Simulation experiments are given to demonstrate the efficiency.

Logistics Standards System Based on the Architecture of Supply Chain Logistics Systems

Huishu Piao, Bin Li and Chiyu Wang
Transportation Management College, Dalian Maritime University, Dalian, China

- Level dimension mainly reflects the management systems of supply chain logistics systems, including strategic, tactical and operational level.
- The standard systems framework from the system architecture theory will be helpful to unify and develop the global logistics standards and its systems.
- The effective operating of supply chain logistics systems is based on scientific logistics standardization activities.
- The logistics standard systems framework from theory comparing to the Chinese logistics standard systems from practices.
FPP: Modeling and Simulation VI
Session Chair: Jason Gu and Simon Yang
HQHT 15:40-16:40 Friday, August 7th

**Fidelity Management and Evaluation in Logistics System**
Fu Yu, Liu Yukun, Su Zhiyuan and Zhou Xiaoguang
Automation School, Beijing University of Posts and Telecommunications
Beijing, China

- A method to manage fidelity is developed, and three standards according to which fidelity levels can be described are presented.
- A Book Retrieval Module in a Book Distribution Center Design Project is studied, three models with different fidelity levels are built, and a method to calculate the differences is given.
- A system of evaluation index is developed. Some suggestions about fidelity management and evaluation are given.

**Model and Simulation of Doubly Feed Induction Generator Wind Turbine**
Xing-jia Yao, Lei Tian, Zuo-xia Xing and Xian-bin Su
Wind Energy Institute, Shenyang University of Technology
Shenyang, China

- The model of DFIG and a converter system are proposed.
- The vector control method oriented by the stator flux is used in rotor side converter of the generator.
- The transient characteristics of DFIG when the power system's bus voltage drop 20% and 50% are simulated respectively in PSCAD.
- The DFIG used vector control can improve the power system fault ride through capacity.

**Numerical Simulation of Deformation and Microstructures Evolution for Hexagon Hollow Steels Rolling**
Zhao Yuqian, Yu Enlin, and Yan Tao
College of Mechanical Engineering, Yanshan University
Northeastern University at Qinhuangdao
Qinhuandao, China

- Simulated the forming process of hexagon hollow steels by 3-D rigid-plastic FEM.
- The strain field, stress field, temperature field were calculated in given craft parameters.
- Established the microstructure evolution model for 35SiMnMoV on high temperature deformation.
- The variation of average grain size with rolling velocity was obtained in this paper. The picture of average grain size

**Modeling of Logistics Distribution System Including Reverse Logistics Based on Logical Petri Net**
Qin Ying
Vocational Technical College, Shanghai University of Engineering Science
Shanghai, China

- Logical Petri Net
- Description of workflow in common distribution centers.
- Logical Petri net model of the distribution system.
- Nature of the Petri net model.

**The Extraction of Brain Evoked Potential Based on Fuzzy Clustering and Wavelet Transformation**
Lanlan Yu, Taming Meng, Baina He
School of Electric and Electronic Engineering, Shandong University of Technology
Zibo, China

- Meaning and actuality of BEP extraction.
- Principle of wavelet transformation.
- Principle of fuzzy clustering.
- Experiment work and results analysis of BEP extraction using wavelet transformation and fuzzy clustering.
- Conclusion and expectation.

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FPP: Modeling and simulation VII
Session Chair: Jason Gu and Simon Yang
HQHT 15:40-16:40 Friday, August 7th

On-line Detecting of Rotor Based on Wavelet Digital Filter and Instantaneous Power Bar Breaking
Chen Yong Bai Xiaoping
School of Automation Engineering, University of Electronic Science and Technology of China, Chengdu, China

- Firstly, this paper gives the definition to feature instantaneous power by blending the instantaneous power with the digital notch filter.
- And then, this paper proposes a novel on-line detecting of rotor bar breaking approach based on spectrum analysis of feature instantaneous power.
- Finally, the analysis of theory and simulation results demonstrate that this novel method can get rid of the interference to the fault related characteristic components from the constant weight and thus it keeps high reliability even when the slip is very small.

The Automatic Temperature System With Fuzzy Self-adaptive PID control In Semiconductor Laser
ZANG Hua-quan, LI Qian
Key Lab of Industrial Computer Control Engineering Yanshan University Qinhuangdao, He Bei Province, China

- Design fuzzy self-adaptive PID control temperature control system to control the laser temperature
- The sensor transmitted temperature to high-precision amplifier by through temperature, then signal into the controller, through semiconductor refrigeration controlled temperature
- To Adjust effect of temperature system in real test, select the temperature control curve at 16℃ for example.

Satellite Navigation Observation Equations and theirs Solution Algorithm
Sun Xigang, Ji Yuanfa
Applied Science and Technology College, Guilin University of Electronic Technology
Guilin, China

- The GPS positioning accuracy sometimes is poor for the big GDOP.
- Two sets of measurement equations were put forward in this paper: measurement equations subject to height constraint; hyperboloid measurement equations subject to height constraint;
- Kalman filtering method was designed for solving these two different equations.
- Finally, these two methods were proved fast convergence and high precision through simulation tests.

Using IACO and QPSO to Solve Spatial Clustering with Obstacles Constraints
Xueping Zhang, Taogai Zhang, and Hongmei Zhang
School of Computer Science & Engineering, Henan University of Technology
Zhengzhou, China

- This paper proposed an Improved Ant Colony Optimization (IACO) and Quantum Particle Swarm Optimization (QPSO) method for Spatial Clustering with Obstacles Constraints (SCOC).
- We first use IACO to obtain the shortest obstructed distance.
- And then we develop a novel QPKSCOC based on QPSO and K-Medoids to cluster spatial data with obstacles.

An Overview of Multi-Modal Biometrics Based on Face and Ear
Haijun Zhang, Zengxi Huang, Yibo Li, and Zhichun Mu
College of Automation, Shenyang Institute of Aeronautical Engineering
Shenyang, China

- The paper discusses a new multi-modal biometrics based on face and ear.
- The research significance of multimodal biometrics based on face and ear will be represented first.
- Then we introduce some researchers’ achievements and inadequacies.
- We also propose future exploration and research in this area.

The images used in Chang’s experiment
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<td>FEP Strategy on logistics</td>
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The Pseudorange Measurement Equations and Their Solution for Satellite Navigation

Ji Yuanfa, Sun Xigang, Shi Huli
Applied Science and Technology College, Guilin University of Electronic Technology
Guilin, China

- The common pseudorange measurement equations and their solution for satellite navigation are discussed.
- The Unscented Kalman Filter (UKF) is presented for nonlinear equations.
- Experimental results show UKF can achieve a better level of accuracy than the common measurement equation system computed with the iterative method.

The Research of Man-machine Cooperation in Warehousing System Based on Agent

Yang Wei, Wang Wen and Fu Weiping
School of Mechanical and Instrumental Engineering, Xi'an University of Technology
Xi'an, China

- A new model of man-machine cooperation in warehousing system is put forward, in which each function module is an Agent, and Petri Net is used to analyze the relationship and internal data processing of the Agents.
- The software platform is realized based on Java and VC++, and Jade is the running platform of Agent.
- A detailed description of how man-machine cooperation assists AGV to get rid of the dead interval of path is given here.
- It lays the foundation for further practical man-machine cooperation in the system.

Research on Battery to Ride Comfort of Electric Bicycle Based on Multi-Body Dynamics Theory

Wenhua Du, Dawei Zhang and Xingyu Zhao
School of Mechanical Engineering, Tianjin University
Tianjin, China

- Based on multi-body dynamics theory the dynamic performance of electric bicycle is simulated.
- The influence of the mass and location of battery to ride comfort was discussed.
- The ride comfort is better as the mass of battery increased.
- When the mass of battery is lower, the installation location does little influence to ride comfort, but as it is bigger, the influence is remarkable.

The Model Research of Information Automation System Based on RFID in Logistics Business Enterprise of Warehouse

Minai He and Xinjun Wei
Department of Transportation & Logistics Engineering, Shandong Traffic University
Jinan, China

- Present situation and demand analysis of logistics informationization
- The structure model of network warehouse management information platform
- The Construction of Management Information System in Logistics Business Enterprise of Warehouse based on RFID
- The data management way of network warehouse information platform

Application of Signal Detection and Processing on Active Power Filter

Yan-di Wei, Yong Zhang, Xin-gong Cheng and Xin-feng Liu
1School of Control Science and Engineering, University of Jinan
2Computer Engineering Department, Shandong College of Electronic Technology
Jinan, China

- Signal acquisition and conditioning circuits in Active Power Filter (APF).
- Propose an improved harmonic current detection method with sine/cosine function Lookup table.
- Design of digital low-pass filter with fast response.
- Tuning curve of the generated actual signal conditioning circuit board.

The Prototype of Active Power Filter
FEP: Network-based systems III
Session Chair: Yibin Li and Chengjin Zhang
HQHT 16:40-17:40 Friday, August 7th

HQHT Hallway (6) 16:40-17:40
A Communication Model on Implementing Anycast Service with Multicast Tree in IPv6
Wang Xiaoran
School of Computer Science and Engineering, Changshu Institute of Technology
Changshu, China
• Anycast communication model: Anycast address, architecture of Anycast tree, building an Anycast tree, weight value of Anycast tree.
• Routing analysis
• Performance analysis: total response time

HQHT Hallway (7) 16:40-17:40
A New Control Mechanism for Real-time Video Transmission Based on H.264
Je Zhao, Yuan Li
College of Electronic and Information Engineering, Hebei University
Baoding, China
• This paper proposed a new transmission framework for real-time video stream.
• We use H.264 algorithm as the video codec.
• A control manage sub-system is also introduced.
• The congestion of the network is improved by using this framework.

HQHT Hallway (8) 16:40-17:40
Modeling and Estimation of Networked Control Systems with Packet Losses
Yuan Ge, Qiong Chen, and Ming Jiang
Department of Electrical Engineering, Anhui University of Technology and Science
Wuhu, Anhui, China
• Define the network state as the hidden state of an underlying Markov chain.
• Treat the packet dropping process as a stochastic variable whose PDF depends on the Markov chain state.
• Model such NCS as a DTHMM and estimate the network state by EM algorithm.
• Design the proper control law based on the estimated network state in the future.

HQHT Hallway (9) 16:40-17:40
Research on Peer-to-Peer Network Search Algorithm Based on Improved Ant Colony Optimization
Zhengzhong Gao, Long Li and Songmei Zhang
College of Information and Electrical Engineering, Shandong University of Science and Technology
Qingdao, China
• Present an improved ACO algorithm.
• All the experiments are based on Peersim simulator.
• Added pheromones regulation mechanism in ant colony optimization.
• Searching efficiency can be improved by using the algorithm.

HQHT Hallway (10) 16:40-17:40
Control Target Tracking-oriented Based on Overlapping Clustering
Dongmei Yan1,2 JinKuan Wang1,2
College of Information Science and Engineering, Northeastern University
Dalian, China
• It is possible to extend the lifetime of a network by controlling its topology through clustering.
• Overlapping Clustering find its wide applications such as inter-cluster routing, topology discovery, node localization, and recovery from cluster head failure and so on.
• Utilizing cluster technology can make good use of each sensor nodes’ limited energy and perform tasks coordinately.

HQHT Hallway (11) 16:40-17:40
An Adaptive Control Mechanism for Mitigating DDoS Attacks
Qingtao Wu, Ruijuan Zheng, Jiexin Pu and Shibao Sun
Electronic Information Engineering College, Henan University of Science and Technology
Luoyang, China
• Control charts based-on network connection for monitoring suspicious behaviours.
• Adaptive mitigation which uses self-learning scheme to establish threshold of test statistics.
• Simulation experiments to evaluate the efficiency is conducted.
• Suitability for early DDoS attacks mitigation.
Implementing Communication Between Ad Hoc Network and IPv6 Network by Using Anycast
Wang Xiaonan
School of Computer Science and Engineering, Changshu Institute of Technology Changshu, China

- Key technology: address auto-configuration, routing, etc.
- Communication model: address format, revised DSR protocol, routing without movement, and routing with movement.
- Performance analysis: data reception rate, control message rate

Design and Implementation of Multi-Source Vehicular Information Monitoring System in Real Time
Yufeng Chen1,2, Zhengtao Xiang1, Wei Jian1 and Weirong Jiang1
1School of Elec. and Info. Eng., Hubei Univ. of Automotive Technology, Shiyan, China
2College of Computer Science and Technology, Zhejiang Univ., Hangzhou, China

- Avoiding modifying vehicles and controlling the increase of wiring harness to decrease system complexity.
- A vehicular information real-time monitoring framework is proposed.
- A flexible and reliable communication protocol is designed to exchange multi-source information between modules in the framework.

A Comprehensive Security Policy Research on Web Information System
Fengying Wang, Caihong Li, Lei Zhao,
School of Computer Science and Technology, Shandong University of Technology Zibo, China.

- we discuss whole security policies on Web information system from various aspects.
- Security elements on a Web information system include single-sign-on, cross-domain access, access control, identity authentication, system audit, trust management, identity authentication, database security.

Study on Web Classification Mining Method Based on Fuzzy Neural Network
Jingwen Tian, Meijuan Gao, Yang Sun
College of Automation, Beijing Union University
Beijing, China

- Introduction
- Fuzzy Neural Network
- Web Mining and Mining System Structure Model
- Web Classification Mining Based on Fuzzy Neural Network
- Conclusion
Supply chain coordination with fuzzy demand

Jin Wei, Author1, ..., and Author4
General Courses Department, Academy of Military Transportation
Tianjin, China

Consider a supply chain with one retailer and one manufacturer, the retailer orders a type of products from the manufacturer and sells them to end consumers. We assume that consumers’ demand for this product is uncertain (a fuzzy variable), and assume that all activities occur within a single period. The manufacturer must decide on his product's wholesale price, and the retailer makes the ordering quantity of the product facing uncertain market demand. In this paper, we give a coordination mechanism through profit sharing contract under fuzzy environment, and assume that the manufacturer, as a Stackelberg leader, offers a profit sharing contract to the retailer who faces fuzzy consumers' demand.

Material Balance Model and Scheduling Algorithm of Cold Rolling Production Line

Jun Zhao, Wei Wang, Sujie Tian
Research Center of Information and Control, Dalian University of Technology
Dalian, China

• A total cost objective function, considering a great number of manufacturing units and a diversity of product categories in cold rolling production line, is established in this paper.
• A class of correlative genetic algorithm is used to obtain a better solution of this function.
• The practical production data from a cold mill of Shanghai Baosteel Co., Ltd are adopted to verify the proposed method.

Scheduling optimization of refinery operations based on production continuity

Ming Li and Qiqiang Li
School of Control Science and Engineering, Shandong University
Jinan, China

• Production continuity is an important process characteristic which receives significant attentions in actual refinery process.
• The core of this paper is to deal with the scheduling optimization problem of refinery operations based on production continuity.
• A generalized disjunctive programming model is proposed to tackle such scheduling problem.
• Case study shows that the optimal schedule obtained from the proposed model is more feasible and practical.

Minimizing Total Weighted Completion Time on a Batch-processing Machine with Re-entrance

Rui Zheng, Hongyu Li
School of Management, Fudan University
Shanghai, China

• The single batch-processing machine scheduling problem with re-entrance to minimize total weighted completion time is considered, where the capacity of the machine is infinite and there are different processing types in the same machine.
• This problem can be transformed into a model with parallel chains precedence constraint.
• A polynomial time heuristic algorithm for the problem is given. Experimentation results show that the algorithm is efficient.

Study on the Relationship between Port Cluster and Regional Economic Development with SD

Li Zhaoliang, Zhao Xu, Xu ye-er, Zhu Banyi
Transportation Management College, Dalian Maritime University
Dalian, China

• This paper first studies this interactive relationship qualitatively, then chooses system dynamics model, analyzing the characteristics of their coordinated development quantitatively in Zhejiang Province.
• By changing three system parameters-the investment ratio in port, the collaboration coefficient and ROR in port cluster, we do the simulation between the economic development and port cluster in Zhejiang Province, in order to make port cluster develop more rapidly. Finally, we put forward the corresponding proposals and countermeasures.
• It improves the whole operation affiance of port cluster t, and better serve the regional economic development, and finally it realizes the harmonious development.

Model Constrains based on Polychromatic Sets Theory with Genetic Algorithm for Sequencing Machining Step on a Machining Center

Yanrong Li, Zongbin Li, and Enhu Lu
State Key Laboratory for Manufacturing System Engineering, Xi'an Jiaotong University
Xi'an, China

• The approach of sequencing machining step on a machining center was proposed.
• Constraints model was established based on polychromatic sets theory.
• Genetic Algorithm was used to sequence the machining step.
• A box part example demonstrated the approach.
Coordination Contracts for a Kind of Reverse Supply Chain Based on Retailer’s Delivery Time Guarantee

Chenglin Shen 1, Xinxin Zhang 2, Ke ma1
School of Business, Tianjin Polytechnic University , 2. Tianjin Institute of Pharmaceutical Research

- In this paper, we consider a two-echelon reverse supply chain system with one manufacturer, one retailer and a group of consumers, which offers consumers with perishable products, and consumers are allowed to return products to the retailer after purchasing. Joint decision models of delivery time and ordering quantity as well as refund was established separately in decentralized decision mode and centralized decision mode under the random market demand and delivery time. Further, we also analyze the optimal decisions under the two modes. Results show that centralized decisions not only shorten the delivery time and increase the total profit of the supply chain but increase the ordering quantity.

The Relationship between Location of New Central Business District and Traffic Flow

Shiyan Xu1, Yuyao He 2, Xue Li 3
1, 3 School of Electronic and Control Engineering, Chang’an University, Xi’an, China
2. College of Marine Engineering , Northwestern Polytechnical University, Xian, China

- A traffic equilibrium model is proposed to research the relationship between central business district (CBD) location and traffic flow in the city.
- To make the model more realistic, travelers can either travel directly to the CBD on the continuum (surface streets), or they can travel on the continuum and then exchange at an interchange (ramp) before moving to the CBD on the discrete network.
- Finite element method is used to solve the model.

Risk Identification, Evaluation and Mitigation in Spare Parts Purchasing

NING Zhong, XU Xun
School of Management, Fudan University
Shanghai, China

- Introduction and Literature Review
- Identification of Spare Parts Purchasing Risk of the Purchasing Department of Bao Maintenance Co. LTD
- Evaluation and Further Evaluation of Spare Parts Purchasing Risk
- Control of Spare Parts Purchasing Risk
- Conclusion and Outlook
FEP: Process optimization

Session Chair: Yibin Li and Chengjin Zhang

HQHT 16:40-17:40 Friday, August 7th

HQHT Hallway (27) 16:40-17:40

Edge Grinding Process and Edge Checking Control for Screw Cutter
Guang-yao Meng, Jiwen Tan & Yucheng Ding
Department of Mechanical Engineering, Qingdao Technological University, Qingdao (266033) China

- I. Introduction
- II. Calculation of theory edge curve and tool-path
- III. Grinding force model and fuzzy control
- VI. Edge checking and envelop error of edge curve
- V. Processes of edge curve grinding and cutter re-sharpening
- IV. Conclusion

HQHT Hallway (28) 16:40-17:40

Roller Bearings Fault Diagnosis Based on LS-SVM
Wentao Sui, Dan Zhang, Wilson Wang
School of Mechanical Engineering, Shandong University of Technology, Zibo, China

- A fault diagnosis method of roller bearings in rotating machinery based on LS-SVM is presented.
- LS-SVM is used as a fault classifier.
- A feature selection method based on simulated annealing (SA) is presented.

HQHT Hallway (29) 16:40-17:40

Valve Control Command Based Fouling Detection of Heat Exchanger in an Aircraft Engine Bleed Air Temperature Control System
Lan Shang and Guangjun Liu
Department of Aerospace Engineering, Ryerson University, Toronto, Canada

- Fouling of heat exchanger reduces the heat transfer efficiency and introduces additional resistance to flow.
- A fouling detection method is proposed based on the valve control command of the normal bleed air temperature regulation system in operation.
- No additional sensor measurement is required for the heat exchanger fouling detection.

HQHT Hallway (30) 16:40-17:40

Differential Evolution Algorithm for Hot Rolling Process Optimization
Li Chen, Lixin Tang and Rui Luo
Liaoning Key Laboratory of Manufacturing System and Logistics, The Logistics Institute, Northeastern University, Shenyang, China

- A nonlinear model for hot rolling process optimization is designed.
- An improved differential evolution algorithm by adjusting the mutation factor and crossover rate is proposed.
- The proposed differential evolution algorithm is used to solve the hot rolling process optimization problem.

HQHT Hallway (31) 16:40-17:40

Design and Distributed Control of Discrete Event Robotic Manufacturing Systems using Petri Nets
Gen’ichi Yasuda
Nagasaki Institute of Applied Science, Nagasaki, Japan

- A methodology of decomposition and coordination is presented for hierarchical and distributed control of robotic manufacturing systems.
- The overall Petri net is decomposed and the constituent subnets are assigned to local Petri net based controllers.
- The cooperation of each controller is implemented so that the behavior of the overall system is the same as the centralized control system.
Detecting Abnormal State of Elderly for Service Robot with H-FCM

Haitao Li, Lingfu Kong and Peiliang Wu
College of Information Science and Engineering, Yanshan University, Qinhuangdao, China

- The abnormal state of elder is dangerous.
- We can find some relation between the state and the location information of elder.
- Home map is necessary.
- H-FCM algorithm can be the effective method in detection.

Brain-Computer Interface Based Camera Carrier in Aerospace

Genghuang Yang, Li Zhao, Shiqiang Cui, Yuliang Liu, Longteng Xiao, Xuelian Xu
School of Automation & Electrical Engineering, Tianjin University of Technology & Education, Tianjin, China

- An on-line BCI system based on event-related potentials P300 is designed to control self-designed robot for photo-taking in simulated aerospace environment.
- The BCI system is The robot can move forward and backward, go up and down, turn to left and right. Also the robot can grasp and release a shuttle of a camera.
- The EEG is sampled by a DSP based device and the robot is controlled to move or operate by the subject’s EEG with wire or wireless communication.

Location for Audio signals Based on Empirical Mode decomposition

1. Signals is separated into several intrinsic mode functions (IMFs) using empirical mode decomposition (EMD).
2. We compute normal energy of each IMF and denoise IMFs according to normal energy.
3. The signals is restructured only using main IMFs.
4. Time delay is estimated and location is completed by solving the geometry equation.

Research on Motion Control System of Mine Rescue Robot

MA Hongwei, Tian Hao, Li Xiaopeng
School of Mechanical Engineering, Xi’an University of Science and Technology, Xi’an, China

- Real-time of robot running is improved by hardware architecture basing on upper and lower processor of multi-cpu.
- Reliability and maintainability of motion control system are improved by modularization of hardware and software’s design.
- Accuracy of motion control system is improved by Closed-loop system.
An automated method to Robot calibration using line-structure-light vision sensor

Wenbiao Wang, Aiqiu Li, Zhi Ma, Huipu Xu, Yuan Tian
Automation Research Center, Dalian Maritime University
Dalian, China

- An industrial robot calibration algorithm is presented, which uses a line-structure-light sensor.
- The kinematic parameters of the robot are estimated due to the coordinates of the feature point is invariable in robot base frame.
- The proposed method uses a line-structure-light vision sensor on the robot's end-effector to measure a fixed point and the whole calibration process is separated into two stages: hand-eye point and the whole calibration process is estimated due to the coordinates of the light sensor.

The Piecewise Monte Carlo Localization System for a Humanoid Soccer Robot

Wei Hong and Yanzao Tian
College of Communication Engineering, Jilin University, China
Changjiu Zhou
Advanced Robotics and Intelligent Control Centre, School of Electrical and Electronic Engineering, Singapore Polytechnic, Singapore

- Piecewise MCL method can change the size of sample set and resampling rules dynamically.
- Two feature variables are defined to divide the state of filter into two phases: global localization and local tracking.
- Physical walking toward target experiments and simultaneous kidnapped problem experiments were performed on the humanoid soccer robot.

Application of Fuzzy Reasoning on an Autonomous Robot

Qingmei Yang1 Jiammin Sun2
1. College of Automation, Beijing Union University, Beijing, China
2. Beijing University of Civil Engineering and Architecture, Beijing, China

- Move-in-mud robot is a new kind of underwater robot, which is used in wreck salvage. Kinematic model of move-in-mud robot is set up based on the mechanical structure.
- To control the filter exhale, Fuzzy Kalman filter is designed. The simulation results show that the precision of Fuzzy Kalman filter is better than the precision of Kalman filter.

Global Path Planning for Mobile Robot Based on Improved Artificial Potential Function

Pu Shi, Yiyen Zhao
Department of Automation Engineering, North-eastern University at Qinhuangdao
Qinhuangdao, China

- The formation of local minima is a major problem with traditional artificial potential field method.
- An improved potential field approach ensures the target is the global minimum of the artificial potential function.
- Experimental results show that the improved approach has much higher capacity of global optimization than traditional method.

A Robotic Surgery Navigation System for Hepatic Microwave Coagulation Therapy

Jing Xu1, Zhangjun Song2 and Zhicheng Jia3
1. Michigan State University, East Lansing, Michigan, USA
2. Shenzhen Institute of Advanced Integration Technology, Shenzhen, China
3. Department of Mechanical Engineering, University of Michigan, Michigan, USA

- The system includes a needle insertion robot, a surgical planning subsystem, a magnetic tracking device and a stereo vision system.
- First, a patient body fixation technique was used to reduce unintentional patient movement. Then, stereo vision technique was used to track the markers on the patient’s body surface.
- By combining the fixation and stereo vision, we can trace the exact motion of the organ, minimizing influence of respiratory and cardiac motion.
- Accuracy experiment on 3D ultrasound phantom was carried out to evaluate the navigation system.
Self-Adaptive Monte Carlo for Single-Robot and Multi-Robot Localization
Lei Zhang, René Zapata and Pascal Lépinay
LIRMM, Université Montpellier II, France

• Propose the Self-Adaptive Monte Carlo Localization (SAMCL) algorithm.
• SAMCL solves efficiently position tracking, global localization and the kidnapped robot problem, together.
• SAMCL is extended to handle multi-robot cooperative localization through a Position Mapping (PM) algorithm.
• Experiments are implemented on the robot Pioneer 3-DX in a real laboratory environment.

Constrained Motion Planning for Robot Manipulators
G. Antonelli, S. Chiaverini
DAEIM, University of Cassino, Italy

• An off-line and non-iterative planning algorithm for robot manipulators
• Joint velocity, acceleration, jerk, and torque limits are taken into account
• Point-to-Point and fly motions in joint and cartesian space
• Clotoid geometric blend in cartesian space
• Extensive simulations and experiments

Swarm of Robots Flocking via the Null-Space-based Behavioral Control
Gianluca Antonelli, Filippo Amichelli, Stefano Chiaverini
DAEIM, University of Cassino, Italy

• Flocking problem for a swarm of robots
• Solved via a behavior based approach, namely the Null-Space based Behavioral control
• Tested in presence/absence of a common rendez-vous point
• Validated by numerical simulations and experimental results with a team of grounded mobile robots

Face Detection and Recognition with SURF for Human-Robot Interaction
Shan An, Xin Ma, Rui Song, and Yibin Li
School of Control Science and Engineering, Shandong University, Jinan, China

• We have described a feature-based approach for face detection and recognition for human-robot interaction (HRI), which is capable of processing images rapidly and achieving high detection and recognition rates.
• The face region is located by employing some morphological steps after skin region detected.
• SURF descriptors are used to extract the features of elliptical face region.
• The query images are matched with the database images and the geometrical consistency is checked.

Adaptive Behavior Design Based on FNN for the Mobile Robot
Caihong Li, Yibin Li, Ping Chen
Computer Science and Technology, Shandong University of Technology, Zibo, China

• A fuzzy neural network (FNN) has been trained off-line to memory the fuzzy control rules of the adaptive behaviors for the local optimal path planning of mobile robot.
• The simulation results show that because all training samples are from the trained fuzzy rules, the output is almost the same as the result of the training rules.

Research and Design of Control System for a Tracked SAR Robot Under Coal Mine
Yibin Li, Caihong Li, Ping Chen
Research Laboratory of Robotics, Shandong University, Jinan, China

• A search and rescue (SAR) robot, named LUKER-I, is introduced to replace people to access to the accident scene when the underground gas and dust explosion happen under coal mine.
• The control system uses two layers architecture, namely the bottom control network and IPC.
• A modular method is used to carry out a detailed design.
Virtual Pheromones to Control Mobile Robots
Ioan Susnea, Grigore Vasiliu, Adrian Filipescu, Adriana Serbencu, Adrian Radaschin
Department of Automation and Industrial Informatics of the “Dunarea de Jos” University Galati, Romania

• Agents send queries containing their current position.
• The pheromone server locates the agent on the internal map, computes the corresponding pheromone intensity, and sends the result back to the agent.
• The agent adjusts its position to get closer to the existing pheromone trail, embedded in the map.
• The map is dynamically modified.

How Virtual Pheromones Operate

Design of Linear Quadratic Optimal Controller for Bicycle Robot
Lei Guo, Qizheng Liao, Shimin Wei, and Yufeng Zhuang
School of Automation, Beijing University of Posts and Telecommunications
Beijing, China

• Aiming at the goal of balancing bicycle robot with high speed, a kind of linear dynamic model of bicycle robot was presented.
• The district time model of the bicycle robot was presented.
• A linear quadratic optimal controller was designed for the linear dynamic model of bicycle robot.
• The computer simulation results show the efficiency of the control algorithm.

Comparative Graph

Cooperative Q-learning Based on Learning Automata
Mao Yang, Yantao Tian and Xinyue Qi
School of Communication Engineering, Jilin University
Changchun, Jilin, China

• Object: accelerate the speed of reinforcement learning.
• Communication architecture: blackboard
• Methods: Learning automata.
• Results of learning automata is used for sharing experiences among robots.

Symbolic-based Motion Control Method for Wheeled Mobile Robots
Jannin Hua1, Hangyi Li2, Yuechao Wang and Ning Xi3
1Northeastern University
2Shenyang Institute of Automation, Chinese Academy of Sciences

• Great challenge can be incurred by the richness of the set of mappings from sensor to actuator signals in designing a suitable control law to steer mobile robots.
• Control procedures in the symbolic-based control method have a linguistic flavor.
• Symbolic-based motion control method can be used to design control laws at the level of strings and primitives.

Framework for Symbolic-based Motion Control

Path-planning of Underwater Microrobot in 3-D Space Using Spiral Particle Pathway Searching Approach
Shuxiang Guo1, 2, Baofeng Gao3 and Nan Xiao1
1Kagawa University, Takamatsu, Japan 2Harbin Engineering University, Harbin, China

• We have introduced research on a multi-robot system including the structure and control system, task allocation, Motion Planning Approaches.
• A new approach called the Primary Spiral Particle Pathway Searching Approach was proposed to search for particles in the pathway in the plane of parallel subspace.
• MATLAB was used to calculate the particles in order to search the best path to the target points in 3-D space.
• Finally, we determined the shortest pathway for a single robot, optimized by DPSO.
FEP: Robotics and Control VI
Session Chair: Yibin Li and Chengjin Zhang
HQHT 16:40-17:40 Friday, August 7th

**Electric Control and Design for Automatic Precision Forging Production Line**

GAO Junyao, DUAN Xingguang, YANG Yigang, HE Ming, WEI Boyu
Intelligent Robotics Institute, School of Mecha-Electronic Engineering, Beijing Institute of Technology, Beijing, China

- This paper presents a precision forging line of plate spares production. The line include press, robot, heating furnace, convey. Main computer control each device work in coordination with each other. Robots are used to carry spares automatically. The line is automatic control and high efficient, high quality.

**Study on the Calculation method of the Light Mobile Robot Motor Power**

GAO Junyao, GAO Xueshan, ZHU Jianguo, ZHU Wei, WEI Boyu, WANG Shilin
Intelligent Robotics Institute, School of Mecha-Electronic Engineering, Beijing Institute of Technology, Beijing, China

- Light mobile robot’s motor powers calculate and design is an important problem. It includes weight, velocity, motor power, slope angle, reduce gearbox, battery, etc. These factors influence each other. It is difficult to calculate precise each parameter. But it decides function and ability of mobile robot. In this paper, motor powers calculate method is advanced. There are many factors to consider. There are several aspects of calculate method are analyzed.

**Path Following Problem for PatrolBot Solved with Fuzzy Control**

Adriana Serbencu, Daniela Cristina Cernega, Adrian Emanuel Serbencu, and Ioan Susana
Department of Automation and Industrial Informatics, ”Dunarea de Jos” University Galați, Romania

- The paper has been focused on implementing a fuzzy command on low-cost embedded devices, built around simple microcontroller structures.
- The design and implementation of the fuzzy controller is described and analyzed.
- Tests on circular trajectory and generalized two-dimensional curve are presented.

**Research on Seam Tracking Controller of Mobile Welding Robot**

Ting Zhang, Kai Li, Shijie Dai, Shumei Xiao and He Huang
Research Institute of Robotics and Automation, Hebei University of Technology, Tianjin, China

- Dynamics model of the mobile welding robot was designed.
- Self-turning fuzzy controller was designed to complete coordinately controlling of cross-slider and wheels.
- The controller utilized self-learning and self-adaptive ability of the neural network to deal with the partial uncertainty and the disturbances of the parameters of the robot model.
- It is proved that the selected control input torques make the system globally asymptotically stable based on the Lyapunov function selected out.

**Navigation and Positioning Research of Service Robot Based on Intelligent space**

Shouyin Lu Wei Qi
School of Information and Electrical Eng. Shandong Jianzhu University Jinan, China

- The overall structure of the service robots system based on the intelligent space
- The navigation and positioning research based on the intelligent space
- Experimental results

**An Optimized Gait Generator Based on Fourier Series Towards Fast and Robust Biped Locomotion Involving Arms Swing**

Nima Shafii, Ali Khorsandian, Abbas Abdolmaleki, Bahram Jozi
Young Researchers Club, Islamic Azad University Qazvin Branch, Iran

- A model free approach with emphasis on making robot’s walking more stable and faster is presented. Particle Swarm Optimization (PSO) has been used to optimize the signals produced by Truncated Fourier Series (TFS) which control joints’ angels. The role of hands is also considered to smooth walking and to increase its robustness.
**Design of Mobile Robot Teleoperation System Based on Virtual Reality**

Ding Chengjun, Duan Ping, Zhang Minglu
School of Mechanical Engineering, Hebei University of Technology, Tianjin China

- Sets up the model of .
- Creates virtual hierarchical control environment, designing video supervising system and brings technology of virtual reality in robot teleoperation system

The Interface of Virtual Environment

---

**Real Time Algorithm for Magnet's Localization in Capsule Endoscope**

Shuang Song, Chao Hu, Mao Li, Wanan Yang and Max Q.-H. Meng
Shenzhen Institute of Advanced Technology (SIAT), Shenzhen China
Chinese University of Hong Kong, Shatin, N.T. Hong Kong

- Track the movement of the wireless capsule.
- Magnetic localization and orientation system, in a space of 0.5m*0.5m*0.5m.
- Good accuracy, high speed and high robustness.
- Nonlinear Minimization.
- Localization error is 1.8mm, and orientation error is 1.54°.

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**Simulation Research of Location System for Fire Detecting Robot**

Qingmei Yang, Jiamin Sun
1. College of Automation, Beijing Union University, Beijing, China
2. Beijing University of Civil Engineering and Architecture, Beijing, China

- General methods of multi-sensor information fusion are analysed.
- The GPS and INS integrated measure system of the robot is designed to improving precise and reliable measurement information of the robot.
- The simulation results show that the fusion location can improve the precision of measurement system efficiently.

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**Modular Robot System Configuration Design Based on Axiomatic Design**

Liu Xuan, Zhang Minglu, Liu Wei, and Fan Lina
School of Mechanical Engineering, Hebei University of Technology, Tianjin, China

- AD is applied to the modular special robot configuration system.
- For a specific design mission, refine design objective and design restraints, and then complete decomposing of FRs and DPs between the functional and physical domains.
- By adjusting design matrix, configuration design order can be overall planned. By using the design parameters, the corresponding module can be found from the module set easily.

Design process as a mapping

---

**Study on the Mobile Robot Reconfiguration Control Methods**

Jingli Lu, Chunguang Bu
State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, China

- proposes a new reconfiguration control method for rough terrain and an auto-control method to get over channels, ridges etc.
- control method are validated experimentally on a six-leg-wheel hybrid robot of SIA.

Leg-wheel hybrid robot
FEP: Strategy on Logistics

Session Chair: Yibin Li and Chengjin Zhang

HQHT 16:40-17:40 Friday, August 7th

**Optimal pricing decisions for a product with two selling chances**

Jing Zhao, Author2, …, and AuthorN
School of Science, Tianjin Polytechnic University
Tianjin, China

This paper investigates the seasonal product's optimal pricing problem in one period with two selling chances under price-dependent demand. A retailer who has a chance to order a certain initial level of inventory of a product from a supplier before the beginning of stage 1, which can be used to sell by the retailer at stage 1 and stage 2. Another new product will be introduced to the market by this supplier, which will influence the customers' demand for the existing product. The retailer's problem is to determine the initial ordering quantity and the optimal retail price at stage 1 and at stage 2, considering that the product's retail price charged both at stage 1 and stage 2 will influence the product's demand at stage 2.

**Logistics Cost Optimized Election in the Manufacturing Process Based on ELECTURE-II Algorithm**

—take XinFeiLin artificial wood-based board company as an example
Gin Long, Li-Qing Meng, Lin-Fang Liu and Wei Chen
Faculty of Management and Economics, Southwest Forestry College, China

- The logistics cost optimization of manufacturing enterprises is a significant link for reducing the total cost. This paper analyzes several major logistics cost attributes of the production flow in each kind enterprise, checks all the alternative operating programs in harmoniousness test and non-harmoniousness test, and identifies their level in superior relation. And it figures out the average sequence by means of forward sequencing and reverse sequencing, and eventually comes out the final sequant results ranking from superiority to inferiority that stem from each alternative program for logistics cost control. The purpose of this research lies in helping decision-makers select the optimal program scientifically and make decisions rationally.

**Benchmarking Model for Reverse Logistics Entry by Third-party Providers**

Shuyun Wang, Shuai Zhang
School of Economics & Management, Yantai University
Yantai, China

- Benchmarking model is theoretically useful for a third-party logistics provider to make decisions.
- It can help the third-party logistics company in making the decision to more aggressively enter the reverse logistics business or to decline.
- Chinese logistics providers should utilize the benchmarking model to make great improvements.

**Realizing Risk: A Shift from Classic Optimization in Production Processes**

Lei Chen, Allen Fang
Fuzhou University, Fujian, China

- Most logistics studies concentrate on optimizing costs.
- However, when considering production processes, manufacturers may become prude and maximize their own utility function.
- That utility function may include factors such as costs, revenues, market share, and also risk.
- We present an efficient way to calculate the trade-off between costs and risk.

**Optimal Location Planning of Logistics Park with Variable Capacity**

Jianxun Tang, Lixin Tang
Liaoning Key Laboratory of Manufacturing System and Logistics, The Logistics Institute, Northeastern University, Shenyang, China

- A mix integer programming model for location planning of logistics park is designed.
- Size mode is introduced to reformulate model. Then the set partitioning model is given and the column generation is used to solve the model to get a good low bound.
- Based on the lower bound, we obtain the best solution by tabu search.
• The proposed system can give many advantages.
• Finally, we proposed an improved transportation system with buffer. The basic idea of new type is based on LMTT (Linear Motor Transfer Technology).
• The paper applies ICSA to solving vehicle routing problems and verifies the validity and stability.

A Rolling Horizon Procedure for Dynamic Pickup and Delivery Problem with Time Windows
Yong Ji Jia1, ChangJun Wang1 and LiMing Wang2
1Glorious Sun School of Business and Management, Donghua University, Shanghai, China
2Procurement Fulfillment Dept., Huawei Technologies Co. Ltd., Shenzhen, China

• Periodic and event-driven RHP method for solving dynamic FDPDPTW is discussed.
• RHP is a heuristic mechanism with which the global scheduling is replaced by a procedure of solving a series of local sub-problems.
• Simulation results show that RHP method is fast and effective and its performance is satisfactory.

An Improved Immune Clonal Selection Algorithm and its Applications for VRP
Ma Ji Shao, Gang Gao, Liping Liu
Shenyang Aeronautical Engineering Institute, Shenyang china

• This paper is put forward an improved immune clonal selection algorithm (ICSA) through the introduction of cloning operator.
• clonal proliferation operators, super mutation operators and clonal selection operators.
• The paper applies ICSA to solving the vehicle routing problems and verifies the validity and stability.

Dynamic Model and Scheduling System for a Real-Time Pickup and Delivery Problem with Time Windows
Yong Ji Jia, ChangJun Wang, Yong Lu and XiaoFeng Wang
Glorious Sun School of Business and Management, Donghua University, Shanghai, China

• Real-Time Pickup and Delivery Problem with Time Windows is studied.
• Framework of scheduling system based on A*-opt algorithm is proposed.
• Simulation result shows that the scheduling system is well suitable to deal with RTPDPTW in real life conditions.

Study of Toll-by-load policy effects on vehicle type constitution of parallel network
Chen Liang1, Li Qiaoru1, Li Xiaoxiao1 and Zhi Xuejun2
1Department of Traffic Engineering, Hebei University of Technology, Tianjin, China; 2Road and bridge engineering company, Tianjin Dagang oil field, Tianjin, China

• The influences of toll-by-load policy on vehicle type constitution are discussed.
• The variations of toll collecting volume of toll gates after adopting toll-by-load policy are analyzed.
• This paper presents the generalized cost route choice model with considering the time value.
• Take Jin-ji and the parallel road Jinwei as an example, the minimum generalized costs on Freeway and the parallel road under current toll rate are Compared.
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Zhao, Li compiler                                               F E P . 3 4  Zhu, Yi-an                                  F P . 2 . 3
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Zhao, Zhanwei                                      F P P . 9
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Zhou, Lei                                         F M - 1 . 4
Zhou, Luanjie                                     W P P . 2 7
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Zhou, Xing-guo                                    T P P . 3 1
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<td>14:00 – 20:00</td>
<td>Registration</td>
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<td>08:30 – 09:00</td>
<td>Opening Ceremony</td>
<td>HQHT Auditorium</td>
<td>Chair: Tzyh-Jong Tarn</td>
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<td>09:00 – 10:00</td>
<td>Plenary Talk I</td>
<td>HQHT Auditorium</td>
<td>Chair: Toshio Fukuda</td>
<td>David D. Yao, Columbia University, USA</td>
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<td>10:00 – 10:20</td>
<td>Tea and Coffee Break</td>
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<td>10:20 – 12:00</td>
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<td>14:00 – 15:40</td>
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<td>15:40 – 16:00</td>
<td>Poster Session WPP (HQHT): Automatic Control</td>
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<td>16:40 – 17:40</td>
<td>Plenary Talk II (HQHT Auditorium)</td>
<td>Chair: Max Q.-H. Meng</td>
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<td>ICART: Intelligent Cooperative Autonomous Robot Transporters</td>
<td>Katsuhiro Kosuge, Tohoku University, Japan</td>
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<td>18:00 – 20:30</td>
<td>Welcome Dinner at Xin Hong Ji Restaurant (新洪记饺子馆)</td>
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<td>Plenary Talk III (HQHT Auditorium)</td>
<td>Chair: Tianyou Chai</td>
<td>Zhongtuo Wang, Dalian University of Science and Technology, China</td>
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<td>10:20 – 12:00</td>
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<td>14:00 – 15:00</td>
<td>Plenary Talk IV (HQHT Auditorium)</td>
<td>Chair: Derong Liu</td>
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<td>Approximate Dynamic Programming for High-Dimensional Resource Allocation Problems</td>
<td>Warren B. Powell, Princeton University, USA</td>
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<td>15:00 – 16:00</td>
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<td>16:00 – 17:00</td>
<td>NEU 111 Project Panel Automation and Logistics Forum</td>
<td>Chairs: Tianyou Chai and Tzyh-Jong Tarn</td>
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<td>17:00 – 18:00</td>
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<td>Chair: Huaguang Zhang</td>
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<td>Automatic Fabrication of Ultraprecision Microparts with Complicated Shape</td>
<td>Yoshihi Takeuchi, Osaka University, Japan</td>
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<td>18:00 – 21:00</td>
<td>Award Banquet with Local Performance in Banquet Hall of Liaoning Tower (辽宁大厦宴会厅)</td>
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<td>09:00 – 10:00</td>
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<td>Chair: Jason J. Gu</td>
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<td>Modeling, Scheduling and Control of Cluster Tools in Semiconductor Manufacturing Automation</td>
<td>Mengchu Zhou, New Jersey Institute of Technology, USA</td>
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<td>Farewell Party at Sheraton Hotel Shenyang (沈阳丽都喜来登大酒店)</td>
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<td>09:00 – 17:00</td>
<td>Local tour of Shenyang attractions</td>
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