2008 IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

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Conference Program Digest

July 2 - 5, 2008, Xi'an, China

2008 IEEE/ASME International Conference on

Advanced Intelligent Mechatronics

AIM 2008

Xi'an, China

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WELCOME

On behalf of the IEEE/AIM 2008 Conference Organizing Committee, we are very pleased to welcome you to Xi'an, China for the 2008 IEEE/ASME International Conference on Advanced Intelligent Mechatronics, the 2008 event of the annual AIM conference series co-sponsored by the IEEE and the ASME. The conference theme, "*Intelligent mechatronics for the advancement of humanity*," reflects the ever growing interests in the research, development and applications in advanced intelligent mechatronics. Of the 439 initial paper submissions, 245 papers are accepted for inclusion in the conference program and for presentation at the conference, after a rigorous full-paper review process, achieving an acceptance rate of 55%. These papers reflect the dynamism of research and development activities in the broad areas of advanced intelligent mechatronics, as well as the emergence of related new research topics in addressing the ever increasing challenges from the related industrial and societal needs.

Located at the geographic center of China, Xi'an is one of the greatest ancient capitals in the world, being the Chinese national capital of 12 dynasties from Western Zhou (1046 – 771 BC) to Tang (618 – 907). Featuring its historical sites, rich cultural relics, and beautiful scenery sites, Xi'an is the home to the terracotta warriors and horses unearthed in 1974 and is also the starting point of the famous Silk Road to the West. Hosted in such a great historical city, AIM 2008 promises to be a great experience for researchers and scholars in the general research areas of advanced intelligent mechatronics from all over the world, with excellent technical and attractive social programs.

We wish to express our gratitude 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 submissions, 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 participants from some 27 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 Xi'an area and the rest of China. We wish you a great conference and enjoyable visit in Xi'an.

Max Q.-H. Meng
General Chair

Michael Y. Wang
Program Chair

IEEE/ASME AIM 2008 Conference
Plenary Talk 1

System Cell Engineering
- Micro and Nano Mechatronics Applications -

Prof. Dr. Toshio FUKUDA

Department of Micro-Nano Systems Engineering
Nagoya University, Japan
http://www.mein.nagoya-u.ac.jp

Abstract:

There are a lot of projects on Bio-Medical applications these days but few for the Cell Engineering in the systematic way using the micro and nano mechatronics technology. In this study, a new methodology in the domain of the micro and nanomechatronics will be shown to the multiscale bio and medical manipulations from the nano to millimeter scale object handling in the systematic way, such as molecular manipulation, cell manipulation and tissue system manipulations, which is called "System Cell

Engineering" and will create a systematic approach from the robotic and mechatronics viewpoints. Thus, the new mechatronics application domain will be expected in near future for the bio and medical fields.

Short Bio: Toshio Fukuda graduated from Waseda University in 1971 and received the Master of Engineering degree and Dr. Eng. from the University of Tokyo in 1973 and 1977, respectively. Meanwhile, he studied at the graduate school of Yale University from 1973 to 1975. In 1977, he joined the National Mechanical Engineering Laboratory and became Visiting Research Fellow at the University of Stuttgart from 1979 to 1980. He joined the Science University of Tokyo in 1982, and then joined Nagoya University in 1989.

Currently, he is Professor of Department of Micro-Nano System Engineering and Department of Mechanical Science and Engineering, Nagoya University, Japan, mainly engaging in the research fields of intelligent robotic system, cellular robotic system, mechatronics and micro-nano robotics.

He has published over 1,000 technical papers in micro system, robotics, mechatronics and automation areas. He was awarded, IEEE Eugene Mittlemann Award (1997), IEEE Millennium Medal (2000), Alexander von Humboldt Foundation Research Award (2002), Fanuc FA and Robot Foundation Best Paper Award (2004), Pioneer in Robotics and Automation Award (2004), Best paper award from RSJ (2004), Distinguished Service Award in Robotics and Automation Society (2005) and Research Award from Ministry of Education, Science and Technology (2005). Achievement award from SICE-SI (2005), ROBOMEC Best Paper Award from JSME Robotics and Mechatronics Division (2006), Good Design Special Award from Ministry of Economic, Trade and Industry (2006)., 2007 IEEE Nanotechnology Council Distinguished Service Award (2007), IEEE Transactions on Automation Science and Engineering 2006 Googol Best New Application Paper Award (2007), SPIE Nano Engineering Award (2008), JSME Funai Award (2008)

He was the Vice President of IEEE IES (1990-1999), IEEE Neural Network Council Secretary (1992 -1993), IFSA Vice President (1997 -2001), IEEE Robotics and Automation Society President (1998-1999), Editor-in-Chief, IEEE / ASME Transactions on Mechatronics (2000-2002), IEEE Division X Director (2001-2002), IEEE Nanotechnology Council President (2002-2005), and President of SOFT (Japan Society for Fuzzy Theory and Intelligent Informatics)(2003-2005). IEEE Fellow (1995), SICE Fellow (1995), JSME Fellow (2001), RSJ Fellow (2004).

IEEE/ASME AIM 2008 Conference
Plenary Talk 2

Nature Inspired Solutions to Mechatronics and Beyond

Prof. Dr. Kok-Meng Lee

George W. Woodruff School of Mechanical Engineering
Georgia Institute of Technology, USA
http:// www.me.gatech.edu/aimrl/

Abstract:

Nature has been a fertile source for bases of engineering principles and inspiration for creative design; Newton's laws of motion, energy-based bond graph for building mathematical models of dynamic systems, and bionic car design from the idea of boxfish, to name a few. Over the last two decades, the rapid advancement of computing, communication, control and information technologies at reducing cost has resulted new approaches that take advantages of many similarities to those exist in natural processes;

notably the biomimetic design. This talk will discuss a variety of nature inspired principles and inspiration for design, analysis and creation of devices/processes in the context of mechatronics. Emphases will be on new directions that explore nature inspired solutions beyond an outcome of individual interest or accidental exposure. Several examples will be given to help illustrate these impacts, and yet to cover a wide variety of practical and emerging applications; among these are electromagnetic models for analyzing and designing multi degrees-of-freedom actuators and sensors, machine color vision emulating the human visual system, and compliant systems for handling natural objects.

Short Bio: Kok-Meng Lee received his B. S. degree in mechanical engineering from State University of New York at Buffalo in 1980 and the M.S. and Ph.D. degrees in mechanical engineering from the Massachusetts Institute of Technology in 1982 and 1985, respectively. He has been with the Georgia Institute of Technology since 1985. As a Professor of mechanical engineering, his research interests include system dynamics and control, robotics, automation and optomechatronics. He holds eight U.S. patents. Dr. Lee is a Fellow of ASME and IEEE. He is currently the Editor-in-Chief of the IEEE/ASME Transactions of Mechatronics for which he served as an Editor from 1995 to 1999. He has held representative positions within the IEEE Robotics and Automation Society: he founded and chaired the Technical Committees on Manufacturing Automation, and on Prototyping for Robotics and Automation; and served as Chair or Co-Chair for numerous international conferences and on the AIM Conference Advisory Committee since 2000. His awards include Presidential Young Investigator (PYI) Award, Sigma Xi Junior Faculty Award, International Hall of Fame New Technology Award, and the Woodruff Faculty Fellow. He was also recognized as an advisor for seven Best Student Paper Awards and a Best Thesis Award.

IEEE/ASME AIM 2008 Conference
Plenary Talk 3

Force and Visual Control for Physical Human-Robot Interaction

Prof. Dr. Bruno Siciliano

Department of Computer and Systems Engineering
University of Naples, Italy
http://www.prisma.unina.it

Abstract:

Unlike the industrial robotics domain where the workspace of machines and humans can be segmented, applications of intelligent machines that work in contact with humans are increasing, which involve e.g. haptic interfaces and teleoperators, cooperative material-handling, power extenders and such high-volume markets as rehabilitation, physical training, entertainment. In this context, it is customary to distinguish between Cognitive Human-Robot Interaction (cHRI) and Physical Human-Robot Interaction (pHRI). This talk is aimed at presenting a unified framework

for development of pHRI control schemes using vision and force; vision provides global information on the surrounding environment to be used for motion planning and obstacle avoidance, while force allows adjusting the robot motion so that the local constraints imposed by the environment are satisfied. The proposed solution is to adopt position-based visual servoing when the robot is far from the object, where the relative pose of the robot with respect to the object is estimated recursively using only vision. On the other hand, when the robot is in contact with the object, any kind of force control strategy can be adopted (hybrid force/position control, parallel force/position control, impedance control), and the relative pose of the robot with respect to the object is estimated recursively using vision, force and joint position measurements. Remarkably, all control schemes are experimentally tested on a setup consisting of a dual robot system with open control architecture, force/torque sensor and hybrid camera system. The presentation will be accompanied by videos.

Short Bio: Bruno SICILIANO was born in Naples, Italy, on October 27, 1959. He received the Laurea degree and the Research Doctorate degree in Electronic Engineering from the University of Naples in 1982 and 1987, respectively. He is Professor of Control and Robotics, and Director of the PRISMA Lab in the Department of Computer and Systems Engineering at University of Naples. His research interests include: identification and adaptive control, impedance and force control, visual tracking and servoing, redundant and cooperative manipulators, lightweight flexible arms, space robots, human-centered and service robotics. He has co-authored 7 books, 70 journal papers, 160 conference papers and book chapters; his book "Modelling and Control of Robot Manipulators" is one of the most widely adopted textbooks world-wide. He has delivered 80 invited lectures and seminars at institutions worldwide. He is a Fellow of both IEEE and ASME. He is Co-Editor of the Springer Handbook of Robotics, the Springer Tracts in Advanced Robotics series, and has served on the Editorial Boards of several journals as well as Chair or Co-Chair for numerous international conferences. He is the coordinator of the large-scale integrating project DEXMART on dexterous and autonomous dual-arm/hand manipulation, funded by the European Commission in the 7th Framework Programme. He has served the IEEE Robotics and Automation Society as Vice-President for Technical Activities and Vice-President for Publications, as a member of the AdCom, and as a Distinguished Lecturer. Currently he is the Society President.

IEEE/ASME AIM 2008 Conference
Plenary Talk 3

Human-Centered Robotics

Prof. Dr. Oussama Khatib

Department of Computer Science
Stanford University, USA
http:// robotics.stanford.edu/~ok/

Abstract:

Robotics is rapidly expanding into human environments and vigorously engaged in its new emerging challenges. Interacting, exploring, and working with humans, the new generation of robots will increasingly touch people and their lives. The successful introduction of robots in human environments will rely on the development of competent and practical systems that are dependable, safe, and easy to use. This presentation focuses on the effort to develop human-friendly robotic systems that combine the essential characteristics of safety, human-compatibility, and performance. In the area of human-friendly robot design, we present new design concepts for the

development of intrinsically safe robotic systems that possess the requisite capabilities and performance to interact and work with humans. In human-motion synthesis, our exploration has employed models of human musculoskeletal dynamics and used extensive experimental studies of human subjects with motion capture techniques. This investigation has revealed the dominant role physiological characteristics play in shaping human motion. Using these characteristics we develop generic motion behaviors that efficiently and effectively encode some basic human motion behaviors. To implement these behaviors on robots with complex human-like structures, we developed a whole-body task-oriented control structure that addresses dynamics in the context of multiple tasks, multi-point contacts, and multiple constraints. The performance and effectiveness of this approach are demonstrated through extensive robot dynamic simulations and implementations on physical robots for experimental validation.

Tipsu!Cjp;!Oussama Khatib is Professor of Computer Science at Stanford University. He received his Ph.D. in 1980 from Sup'Aero, Toulouse, France. His current research is in human-centered robotics, haptic interactions, and human-friendly robot design. Professor Khatib was the Program Chair of ICRA2000 (San Francisco) and Co-Editor of ``The Robotics Review" (MIT Press). He served as the Director of the Stanford Computer Forum, an industry affiliate program. Professor Khatib is the President of the International Foundation of Robotics Research, IFRR, Co-Editor of STAR, Springer Tracts in Advanced Robotics, and Co-Editor of Springer Handbook of Robotics. He is an IEEE Fellow who served as a Distinguished Lecturer of IEEE, and is a recipient of the JARA Award.

Wednesday, 2 July 2008

WM-1	Modular Robots
WM-2	Actuators I
WM-3	Diagnosis
WM-4	Manipulators
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WP-2	Design & Prototyping
WP-3	Teleoperation
WP-4	Dual Arm/Cooperative
WP-5	Mobile Robots III
WE-1	Electromagnetic Devices I
WE-2	Actuators II
WE-3	Medical Robotics
WE-4	Parallel Manipulators
WE-5	Special Robots

WM-1: Modular Robots

Session Chairs: Shugen Ma, Ritsumeikan Univeristy
Qiang Huang, Beijing Institute of Technology

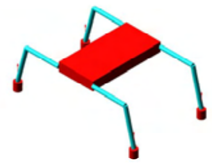
Room 1, 8:30-10:10, Wednesday, 2 July 2008

WM−1(1) 8:30−8:50

Comparison of Gait Generation methods in Quadruped Walking

Osman Darıcı, Mehmet Kürşat Yalçın and Hakan Temeltaş
Robotics Lab., Istanbul Technical University, Istanbul, Türkiye

- 3 types of quadruped gait techniques are analyzed and compared.
- Co-simulations made with MATLAB/Simulink and ADAMS.
- Straight going path tracking and stability of these gait types are demonstrated



WM−1(2) 8:50−9:10

Connection Methodology for Two Ubiquitous Robot Spaces - Connection of RT-Middleware and CAMUS

Hyun Min Do, Yong-Shik Kim, Bong Keun Kim, Tamio Tanikawa, Kohtaro Ohba
AIST, JAPAN
Janarbek Matai, Young-Ho Suh, Hyoung Sun Kim, Jae-Yeong Lee, Wonpil Yu
ETRI, KOREA

- Connection of u-RT space of AIST and URS of ETRI.
- Development of connection scheme for RT-Middleware and CAMUS.
- The service provided by RT-Middleware side can be available to CAMUS side and vice versa
- Implementation of connection scheme in u-RT space.

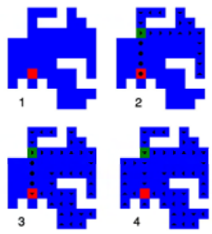
Connection Diagram

WM−1(3) 9:10−9:30

Goal Recognition and Configuration Recognition Algorithms for Modular Robots

Mehran Balaei
Mechatronics Division, K. N. Toosi University of Technology, Tehran, Iran

- An error is detected in a goal recognition algorithm using simulation
- The error has been corrected and the corrected algorithm has been simulated
- A configuration recognition algorithm is presented which has resolved the former algorithm's problems
- The presented algorithm has been completed and tested by simulating different configurations

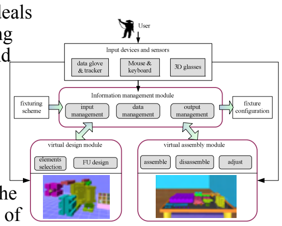


WM−1(4) 9:30−9:50

A pragmatic system to support interactive modular fixture configuration design in desktop virtual environment

Peng Gaoliang Wang Gongdong, Chen Yanhai
School of Mechatronics Engineering, Harbin Institute of Technology
Harbin, China

- *Information management module* deals with the loading, storing and printing all data and drawing information and serves an open interface
- *Virtual design module* provides a natural design environment for convenient and fast operations of fixture configuration design.
- *Virtual assembly module* provides the means of intuitive 3D manipulation of virtual models, users can interactively perform fixture assembly operations.



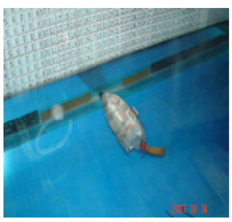
Architecture of IV-MFADS

WM−1(5) 9:50−10:10

Design and Realization of a Remote Control Centimeter-Scale Robotic Fish

Xiufen Ye, Yudong Su, Shuxiang Guo, Liquan Wang
Automation College, Harbin Engineering University
Harbin, Heilongjiang, China

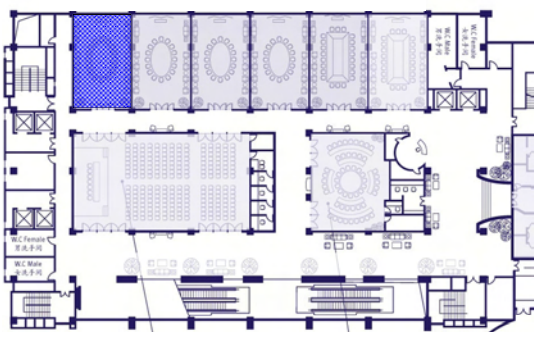
- The robotic fish mimics a type of small crucian. .
- IPMC actuator and two pieces of PVC film construct a caudal fin to mimic the swing of the small crucian in structure.
- The remote control function is realized at the base of an infrared sensor.
- The cruise-straight, cruise-in-turning, burst and coast swimming pattern can be realized on the robotic fish.



The robotic fish

Room 1
Toulouse

2nd Floor
Sofitel Convention Centre



WM-2: Actuators I

Session Chairs: I-Ming Chen, Nanyang Technological University
Koichi Suzumori, Okayama University

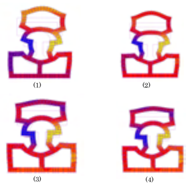
Room 2, 8:30-10:10, Wednesday, 2 July 2008

WM-2(1) 8:30-8:50

Optimum Design of Pneumatic Multi-chamber Rubber Tube Actuator Generating Traveling Deformation Waves for Colonoscope Insertion

Hisakazu Onoe, Koichi Suzumori and Shuichi Wakimoto
Department of Systems Engineering, Okayama University, Japan

- A pneumatic multi-chamber rubber tube actuator has been designed, fabricated, and tested.
- The evaluation and designs are made based on non-linear FEM analysis.
- An optimized actuator design generates the motion 15.5 times larger than that of the actuator reported in previous report.
- A functional model works very well to generate traveling waves.



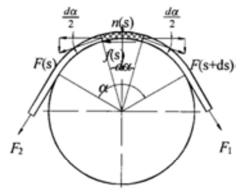
The motion of I-TCA analyzed by FEM

WM-2(2) 8:50-9:10

Study of the Inertial Effect on Interaction between Flat Belt and Pulley

Da-yu Zheng, Qing-xin Meng, Li-quan Wang, and Han-lin Yang
Mecho-electrical Engineering College, Harbin Engineering University
Harbin, China

- the tangential and radial inertia leads to the calculations to have bigger slip angle.
- flexible belt with small stiffness makes the slip angle to be smaller and the friction to be bigger .
- analyze the non-linear characteristics in further study.
- this paper is suitable for the high speed belt drive and the belt.



Belt Unit Forces Analysis

WM-2(3) 9:10-9:30

An Active Micro Reactor System with Integrated Fluid Control Devices for Chemical Synthetic Process

Hironari TANIGUCHI, Koichi SUZUMORI, and Shintaro NAKATANI
Graduate School of National Science and Technology, Okayama University
Tsushima-naka, Okayama, Okayama, JAPAN

- This system consists of several kinds of fluid control devices such as micro pumps and micro mixers.
- It has the possibility for various chemical synthetic processes.
- Small enough for portability.
- The characteristics of the developed pumps and mixers were evaluated.

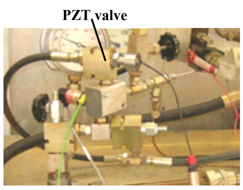
The Active Micro Reactor

WM-2(4) 9:30-9:50

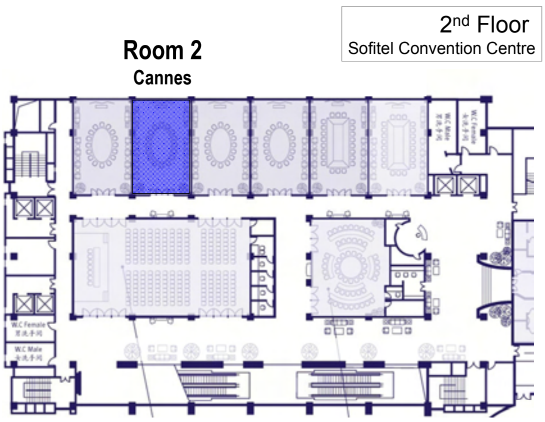
Piezoelectric Actuators for Screw-in Cartridge Valves

Xiaoping Ouyang[1], Derek Tilley[2], Patrick Keogh[2], Huayong Yang[1], and Peter Hopkins[3]
1 The State Key Lab of Fluid Power Transmission and Control, Hangzhou, China
2 Department of Mechanical Engineering, University of Bath, Bath, UK
3 Parker Hannifin Ltd, Sterling Hydraulics Division, Somerset, UK

- Introduction
- PZT actuator concept
- Simulation
- Experimental study
- Improvement in response
- Conclusions



Test Rig



WM-3: Diagnosis

Session Chairs: Ruxu Du, Chinese University of Hong Kong
Peter Tavner, Durham University

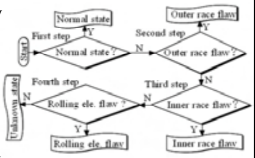
Room 3, 8:30-10:10, Wednesday, 2 July 2008

WM-3(1) 8:30-8:50

Sequential Diagnosis for Rolling Bearing Using Fuzzy Neural Network

Huaqing Wang and Peng Chen
Graduate School of Bioresources, Mie University, Mie-Ken, Japan

- The sequential diagnose algorithm for condition monitoring of a rolling bearing is proposed by using a fuzzy neural network.
- The partially-linearized neural network (PNN) is also proposed.
- The non-dimensional symptom parameters (NSP) which can reflect the features of a signal are described in the time domain.
- The PNN can precisely distinguish the fault types on the basis of the possibility distributions of NSPs.



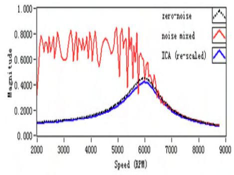
Sequential Diagnosis Algorithm

WM-3(2) 8:50-9:10

Noise Reduction in Computed Order Tracking Based on FastICA

Yu Guo, Yilin Chi, and Huawen Zheng
Faculty of Mechanical and Electrical Engineering, Kunming University of Science and Technology, Kunming, China

- ONLY Crossing noise removal scheme in COT.
- The ambiguities of ICA are solved with the proposed approach.
- ICA separation is performed in the angular domain.



The comparison of amplitude plots

WM-3(3) 9:10-9:30

Multifractal spectrum Theory Used to Medical Image from CT Testing

Dawei Qi and Lei Yu
College of Science, Northeast Forestry University
Harbin, China

- If the multifractal spectrum of some points is 1, that is f=1, the points are on the contour line;
- If f=1, edge points can be filtered; If f=1.5, irregular contour line can be gained; If spectrum approaches to 2, information in smoothing domain and in coarse domain can be can be gained.

WM-3(4) 9:30-9:50

The Application and Research of the Intelligent Fault Diagnosis for Marine Diesel Engine

LI Peng, Liu Lei
Automation College , Harbin Engineering University
Heilongjiang, China

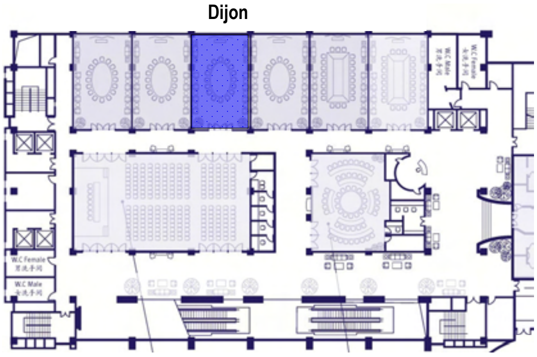
- The marine diesel engine is a complex system.
- A novel approach of optimizing and training fuzzy neural network based on the ant colony algorithm is proposed for the intelligent fault diagnosis of this kind of diesel engine.
- The structure and the parameter of fuzzy neural network for fault diagnosis system are introduced .
- The comparison of simulation results shows good performance and validity of the proposed method.

Input		Output(Fault confidence level)					
T_r	P_z	F_1	F_2	F_3	F_4	F_5	F_6
356	137.0	0.6260	0.0583	0.0485	0.0474	0.0682	0.5899
358	123.2	0.0533	0.0513	0.0743	0.0483	0.9283	0.0579
341	138.0	0.0601	0.0397	0.6742	0.2361	0.0005	0.9137
343	124.4	0.0390	0.2033	0.0711	0.0396	0.0492	0.0578
323	137.0	0.9422	0.0508	0.9299	0.9122	0.0447	0.0422
322	131.4	0.1051	0.0270	0.0926	0.6327	0.0487	0.0215

The simulation result of FNN based on ant colony algorithm optimizing and training

2nd Floor
Sofitel Convention Centre

Room 3
Dijon



WM-4: Manipulators

Session Chairs: Wei Wang, Beihang University
Kazuhiro Kosuge, Tohoku University

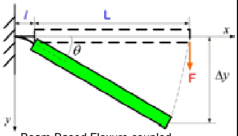
Room 4, 8:30-10:10, Wednesday, 2 July 2008

WM-4(1) 8:30–8:50

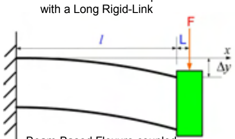
A Semi-Analytic Model for Large Deflection Beam-Based Flexure Joints

Tat Joo Teo[1,2], I-Ming Chen[1], Guilin Yang[2], and Wei Lin[2]
[1]School of Mechanical & Aerospace Engineering, Nanyang Technology University, Singapore
[2]Singapore Institute of Manufacturing Technology, Singapore

- Beam-based flexure joint has been a popular choice to achieve millimeters of travel with nanometric resolutions.
- Unfortunately, it exhibits a non-linear deflection due to the shifting of pivot point and beam elongation.
- A semi-analytic model is presented as a simple, quick and complete solution for approximating the large deflection of a beam-based flexure coupled with a rigid-link of any length.



Beam-Based Flexure coupled with a Long Rigid-Link



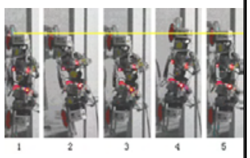
Beam-Based Flexure coupled with a Much Shorter Rigid-Link

WM-4(2) 8:50–9:10

Analysis of the Kinematics of Module Climbing Caterpillar Robots

Wang Wei, Houxiang Zhang, Yingying Wang, Kun Wang and Jianwei Zhang
Robotics Institute, Beihang University, Beijing, China
TMAS, Information Department, University of Hamburg, Hamburg, Germany

- Two climbing caterpillar robot model are presented in paper.
- The mechanism model and valuable gaits of the two robots are analyzed in detailed.
- Experiments are discussed to explain why the inchworm robot can walk on the wall easily.
- A idea based on passive joints are proposed to overcome the redundant driving problem existed in caterpillar robot.



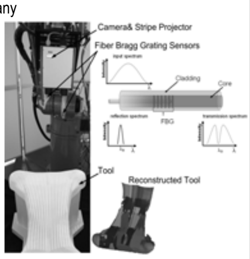
The Inchworm Robot

WM-4(3) 9:10–9:30

Observation of Link Deformations of a Robotic Manipulator with Fiber Bragg Grating Sensors

Rene Franke, Frank Hoffmann, Torsten Bertram
Chair for Control Systems Engineering,
Faculty of Electrical Engineering and Information Technology, TU Dortmund
Dortmund, Germany

- Measure the elastic deformations of robot links in order to improve its pose accuracy.
- Model of the fiber Bragg sensors that locally measure strain.
- Systematic analysis and optimization of the signal processing and sensor configuration.
- Experimental validation on an industrial robot.



Industrial robot with additional sensors

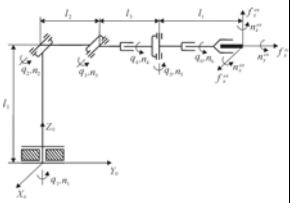
WM-4(4) 9:30–9:50

Adaptive Force/Position Control of Robot Manipulators

Vladimir Filaretov, Alexandr Zuev
Robotics Laboratory, Institute for Automation and Control Processes
Vladivostok, Russia

A new synthesis method of adaptive force/position control systems of robot manipulators is proposed. The control systems synthesized on the basis of this method without using force/moment sensors and other additional devices provide simultaneous accurate control of both the position of robot's end-effector and the force exerted by end-effector on some object (or environment).

The results of simulation confirm efficiency of the proposed method.

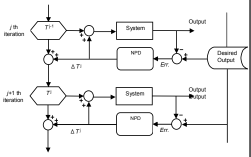

Kinematical scheme of manipulator

WM-4(5) 9:50–10:10

Application of Nonlinear PD Learning Control to a Closed Loop Manipulator

P. R. Ouyang[1)] and W. J. Zhang[2)]
[1)]Department of Aerospace Engineering, Ryerson University, Toronto, ON, Canada
[2)]Department of Mechanical Engineering, University of Saskatchewan, Saskatoon, SK, Canada

- Control method: Feedback vs. feedforward (learning control).
- Stability of control system: Lyapunov function.
- Experiments: Verification of NPD learning control.
- Comparisons: Effectiveness of the algorithm.



NPD Learning Control

2nd Floor
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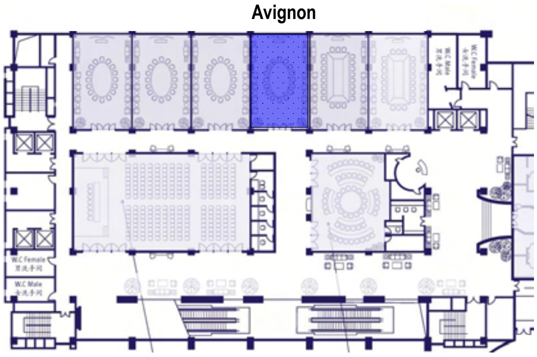
Room 4
Avignon



WM-5: Mobile Robots I

Session Chairs: Wen J. Li, Chinese University of Hong Kong
Jason Gu, Dalhousie University

Room 5, 8:30-10:10, Wednesday, 2 July 2008

WM-5(1) 8:30-8:50

Towards an Electric-Powered Air-Gliding Skateboard

Qing Shan[1], Jason L. Yang[1], C.S. Chan[2], Guanglie Zhang[2], Wen J. Li[1]
[1]the Centre for Micro and Nano Systems, The Chinese University of Hong Kong, Hong Kong SAR
[2]Virtus Asia Ltd., Hong Kong Science Park, Hong Kong SAR

- A novel air-gliding skateboard, called the *Hoverboard*, which works based on a new hovering principle.
- Demonstrated the possibility of having an all-electric powered air-gliding board transporting an adult of ~60Kg.
- Integrated MEMS sensors on the *Hoverboard* to detect aerodynamic fluttering during operation.

The Hoverboard

WM-5(2) 8:50-9:10

A Study on Development of Home Mess-Cleanup Robot McBot

Youngkak Ma, Seungwoo Kim, Dongik Oh and Youngwan Cho*
Soonchunhyang University, *Seokyeong University**
Asan, Chungnam, Korea

- Mess-Cleanup robot can clean-up and arrange object which other cleaning robot can't do.
- McBot has agile navigation and novel manipulation system for Clean-up and arrange object.
- RFID system is used for self-localization and object recognition.
- Good performance was confirmed through the result of experiments.

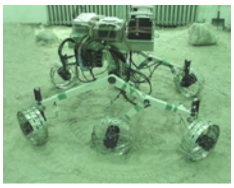
Mess-Cleanup Robot (McBot)

WM-5(3) 9:10-9:30

Mobility Performance Analysis of Lunar Rover Based on Terramechanics

Peng Zhang , Zongquan Deng, Ming Hu, Haibo Gao
State Key Laboratory of Robotics and System, Harbin Institute of Technology
Harbin, China

- Analysis of wheel-soil interaction
- Relationships between configuration parameters and performance parameters
- Performance analysis and metrics
- Performance comparison
- Conclusions



LER-1 Locomotion System

WM-5(4) 9:30-9:50

Track-Terrain Interaction Analysis for Tracked Mobile Robot

Weidong Wang, Lei Zhou, Zhijiang Du, Lining Sun
Robotics Institute, Harbin Institute of Technology
Harbin, China

- A tracked robot is introduced from machinery, hardware system to software system.
- The features of mechanical system are modular design, suspension system and radiation protection and waterproof and onboard manipulator
- With the analysis of the track-terrain interaction, a simplified track-ground model is developed.

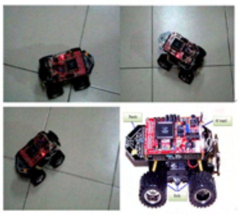
Tracked Mobile Robot

WM-5(5) 9:50-10:10

Embedded Vehicle Control System Based on Voice Processing Technologies

X. L. Zhou, Z.Y. Sun, Z. Y. Liu, Y. Q. Chen, D. Y. Peng, F. M. Guo*, Z. Q. Zhu
School of Information Science & Technology. East China Normal University, Shanghai, China

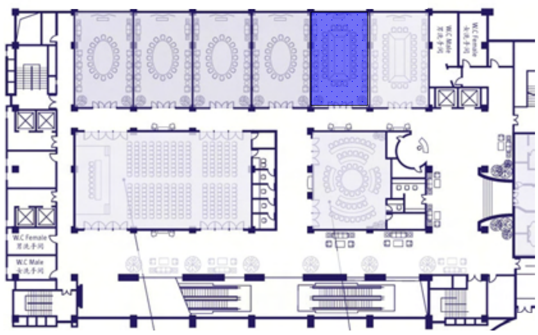
- One microcontroller car which processes speech-LINGYANG SPCE061A microchip forms the Speech Recognition System.
- The Speech Recognition system not only has high recognizable veracity, small volume, economy-power consumption, lower cost, high operation speed and real-time speech recognition.
- The function of speech cue offers a favourable interface for human-computer interaction in the system.



The acoustic control robotic vehicle

2nd Floor
Sofitel Convention Centre

Room 5
Marseilles



WA-1: Machine Vision I

Session Chairs: Hong Zhang, University of Alberta
Dongbing Gu, University of Essex

Room 1, 10:30-12:10, Wednesday, 2 July 2008

WA−1(1) 10:30−10:50

A Virtual Simulation System of TDI Line Scan Camera

Xiaoli Chen[1], Chengliang Yin[1], Yong Feng [2]
(1 School of Mechanical Engineering, Shanghai Jiao Tong University, Shanghai 200240
2 Department of Electrical Engineering, Harbin Institute of Technology, Harbin, 150001)

The paper established a TDI line scan camera virtual simulation system which consists three parts:

- Optical pipeline model,
- TDI CCD model
- Camera electronics model.

The virtual simulation system can realize the recover of a scenic image just as a real camera do.

It is useful to design and evaluate electronics of the camera and to study the image improvement methods.


Original Image

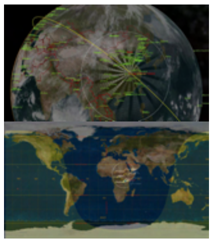

Recovered Image

WA−1(2) 10:50−11:10

Selection for Visualization: Voronoi Tessellation of Large Scale and Sparsely Distributed Data

Zhengxu Zhao and Jinsheng Fan
School of Computing, University of Derby, Derby, UK
School of Computing and Informatics, Shjiazhuang Tiedao Institute, Sijiazhuang, China

- Instantaneously visualize data selected among a large scale and sparsely distributed database in low complexity of computation.
- Use Voronoi tessellation in data processing.
- Is implemented in large scale and complex virtual environments.
- Is tested with applications in satellite tracking and controls.


The FOV of ISS

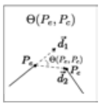
WA−1(3) 11:10−11:30

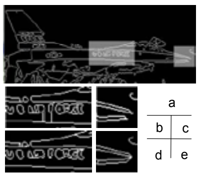
Edge Linking Using Geodesic Distance and Neighborhood Information

Zhijie Wang, Hong Zhang
Computer Science, University of Alberta, Edmonton, Canada

- Problem: Edge Linking.
- Contributions:
  - Use neighborhood information.
  - Use geodesic distance.
- Likelihood function:

$$H(P_e, P_c) = \frac{1}{D_g(P_e, P_c) \cdot \Theta(P_e, P_c)}$$





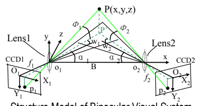
Comparison between results of CAEL(b,c) and our algorithm(d,e)

WA−1(4) 11:30−11:50

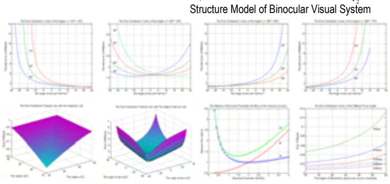
Structural Parameters Optimal Design and Accuracy Analysis for Binocular Vision Measure System

Qiong Liu, Xiansheng Qin, Shenshun Yin, and Feng He
Department of Mechatronics, Northwestern Polytechnical University
Xi'an, China

- In order to improve the measurement precision for visual measure system, research on the influence of stereovision structure is presented based on binocular vision.
- A structure model of binocular visual measure system.
- Multi-factors error distribution features of affecting measure accuracy in visual measure system



Structure Model of Binocular Visual System


the error distribution features

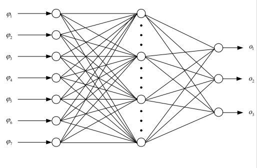
WA−1(5) 11:50−12:10

Method of Vehicle Classification Based on Video

Zhong Qin
College of Traffic and Communications
South China Univ. of Tech.
Guangzhou, China

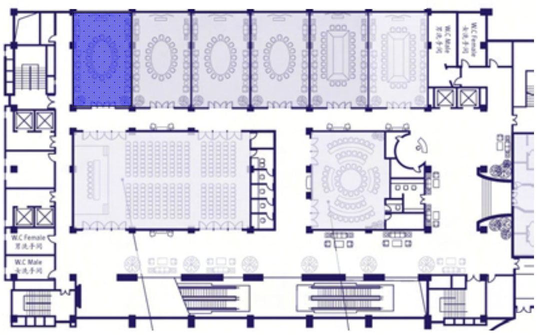
- Image moment invariant.
- BP Neural Network Model of Vehicle Classification.

According to the vehicles classification number, 3 neurones are set. So the output vector is $O = \{o_1, o_2, o_3\}$, the expectation output of network is $\{1,0,0\}$, $\{0,1,0\}$, $\{0,0,1\}$, corresponds the small vehicle, the standard size car and the large-scale vehicle separately.


BP Neural Network Model of Vehicle Classification

Room 1
Toulouse

2nd Floor
Sofitel Convention Centre



WA-2: Human-Machine Interaction I

Session Chairs: Shigeki Sugano, Waseda University
Lisheng Xu, Chinese University of Hong Kong

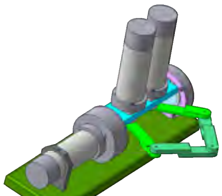
Room 2, 10:30-12:10, Wednesday, 2 July 2008

WA-2(1) 10:30-10:50

Telerobotic System for Cell Manipulation

Igor Gaponov[*], Jee-Hwan Ryu[*], Hyun-Chan Cho[**], Seong-Joo Choi[*], and Yury Poduraev[***]
[*] Department of Mechanical Engineering, KUT, Cheonan, Korea
[**] School of Information Technology, KUT, Cheonan, Korea
[***] Department of Robotics and Mechatronics, MSTU "STANKIN", Moscow, Russia

- Flexible telecontrollable manipulator with original kinematic structure and resolution of 0.25 um was designed.
- Implementation of original force estimation algorithm based on visual information has been developed to provide force feedback to the operator.
- Applying wavelet filtering algorithms to filter oscillations of operator's hand makes the motion of manipulator smooth and accurate.



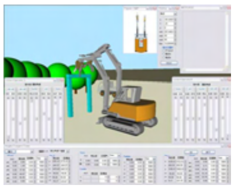
Designed Telerobotic Slave Manipulator

WA-2(2) 10:50-11:10

Development of an Operation Skill-Training Simulator for Double-Front Construction Machinery

Mitsuhiro Kamezaki, Hiroyasu Iwata and Shigeki Sugano
Department of Modern Mechanical Engineering, Waseda University
Tokyo, Japan

- We newly developed the simulator for operation skill training in Double Front Construction Machinery.
- This simulator allows novices to virtually experience tough operations repeatedly under a variety of conditions.
- Evaluation experiments indicated repeated trainings using the simulator successfully decrease operation time to complete a task and enhance positioning accuracy.
- We confirmed the effectiveness of the developed simulator.



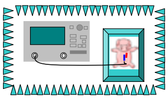
Graphical display of the developed simulator

WA-2(3) 11:10-11:30

Influence of Animal Body on Ingested Wireless Device before and after Death

Lisheng XU, Max Q.-H. Meng, Yawen Chan, Chao Hu and Haibin Wang
School of Control Science and Engineering , Shandong University, Jinan, China

- Three monopole antennas were designed and put in two positions of the intestine of an adult female pig.
- The results demonstrate that the frequencies drift greatly from 2.78, 2.17, 4.29 GHz at the free space into 1.42, 1.0, 2.2 GHz when the antennas are put in the top position of the intestine of the anesthetic pig and the frequency will increase to 1.62, 1.15, 2.85 GHz after the pig's euthanasia.
- The frequencies increase from 1.5, 1.03, 2.3 GHz to 1.67, 1.13, 2.8 GHz when the antennas are put in the bottom position of the intestine of the pig after its euthanasia within one hour. The dead body of the pig absorbed less radiation energy than the living body.



WA-2(4) 11:30-11:50

Haptic human-machine interaction by active, holonomic moving devices

Markus Koch
Cooperative Computing & Communication Laboratory (C-LAB)
University of Paderborn and Siemens, Fuerstenallee 11, 33102 Paderborn, Germany

- Holonomic moving devices
- Human-machine interaction
- Cooperative haptic working over wide area networks
- Haptic education
- Medical applications
- Hardware prototype
- Experiments
- Evaluation
- Video clips

ID 231

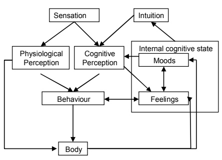
Holonomic moving device

WA-2(5) 11:50-12:10

A generic architecture for emotion and personality

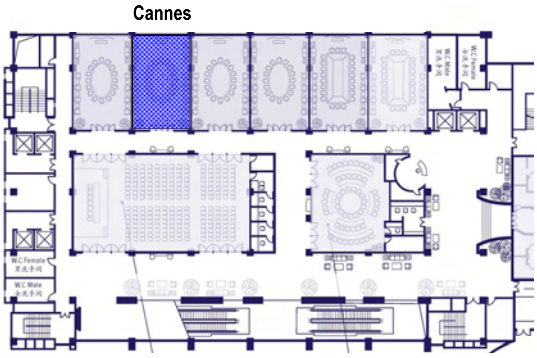
Dominique Duhaut
ValoriaUniversité de Bretagne Sud France
dominique.duhaut@univ-ubs.fr

We propose a generic computational model to include emotion and personality in the behaviour of a robot. This model is based on classical hybrid architecture for robot computation and merged with psychological works on emotion and personality.



Room 2
Cannes

2nd Floor
Sofitel Convention Centre



WA-3: Sensing I

Session Chairs: Satoshi Tadokoro, Tohoku University
Zhang Xianmin, South China Uiniversity Of Technology

Room 3, 10:30-12:10, Wednesday, 2 July 2008

WA−3(1) 10:30−10:50

Contact Points Detection for Tracked Mobile Robots Using Inclination of Track Chains

Daisuke Inoue, Masashi Konyo, Kazunori Ohno and Satoshi Tadokoro
Tohoku University, Sendai, Japan

- The authors developed a distributed touch sensor for the tracked vehicle.
- The sensor detects contact points between the crawler track and the steps by measuring inclination of the track chains optically.
- A special reflector was designed and evaluated for the optical sensing of the inclination.
- The sensing performance for detecting contact points during the step climbing motion was examined.

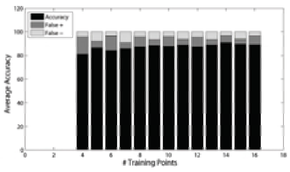
A tracked rescue robot having 4 flippers: “Ali-Baba”

WA−3(2) 10:50−11:10

Subject Independent Agitation Detection

George E. Sakr[1], Imad H. Elhajj[1], Huda Abu-Saad Huijer[2], Cheryl Riley-Doucet[3], Debatosh Debnath[4]
[1]Eletrical and Computer Engineering Dept., American University of Beirut, Beirut, Lebanon
[2]School of Nursing, American University of Beirut, Beirut, Lebanon
[3]School of Nursing, Oakland University, Rochester, MI, USA
[4]Computer Science and Engineering Dept., Oakland University, Rochester, MI, USA

- Three vital signs are monitored for agitation detection: Heart Rate, Galvanic Skin Response and Skin Temperature
- These measures are fed into an SVM based learning machine
- Accurate detection of agitation and subject independent learning

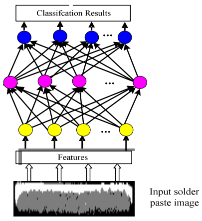


WA−3(3) 11:10−11:30

A Real-time Machine Vision System for Solder Paste Inspection

Huihui Wu Xianmin Zhang Yongcong Kuang Shenglin Lu
School of Mechanical Engineering South China University of Technology
Guangzhou, China

- To inspection the quality of the solder paste depositing in the process of Surface Mounting:
  - ➢ A new fast image matching method was applied to align the PCB and determinate the region of solder pastes.
  - ➢ The 2D features and a pseudo-3D feature were obtained.
  - ➢ The neuron network was established for classification the solder pastes.



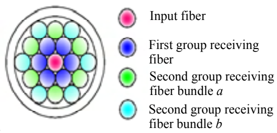
Structure of NN clustering module

WA−3(4) 11:30−11:50

Research on Displacement Sensor of Two-Circle Reflective Coaxial Fiber Bundle

Xiaodong Zhang and Liang Yang
School of Mechanical Engineering, Xi’an Jiaotong University
Xi’an, China

- Displacement sensor of two-circle reflective coaxial fiber bundle for measuring slide bearing of rotating machinery is designed.
- A mathematical model of modulation function for the fiber bundle sensor is established.
- The factors influencing the sensor’s characters are simulated and analyzed.
- At last, optimization design parameters of the system are presented.



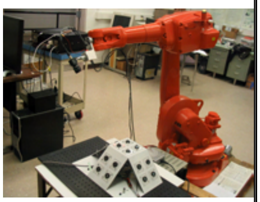
Arrangement of the Fiber Bundle

WA−3(5) 11:50−12:10

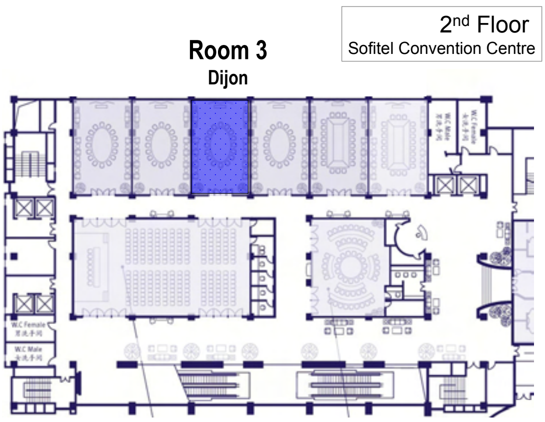
High-Accuracy Visual/PSD Hybrid Servoing of Robotic Manipulator

Yong Liu, Ning Xi, Yantao Shen, Sheng Bi, Bingtuan Gao, Quan Shi, Xiongzi Li, George Zhang, and Thomas A. Fuhlbrigge

- Present a new and effective multi-sensor based control strategy for high-precision automatic robot localization and calibration.
- Design a hybrid camera and position-sensitive detector (PSD) based servo controller.
- Develop a new multi-sensor based motion control system for robotic manipulator
- The accuracy (about 30µm) of robot localization is greatly improved.



multi-sensor based motion control system



WA-4: Flexible Manipulators

Session Chairs: ZhiWu Li, Xidian University
Jianwei Zhang, University of Hamburg

Room 4, 10:30-12:10, Wednesday, 2 July 2008

WA-4(1) 10:30–10:50

Development of a Low-cost Flexible Modular Robot GZ-I

H. X. Zhang[1], J. Gonzalez-Gomez[2], Z. Z. Xie[3], S. Cheng[3], J. W. Zhang[1,3]
[1]TAMS, University of Hamburg, Germany
[2] Universidad Autonoma de Madrid, Madrid, Spain; [3] Siat, Shenzhen, China

- Low-cost mechanical design with only six parts in aluminum;
- Simple robust modules assembling manually and quick-to-build, easy-to-handle design;
- Four faces for interconnecting modules to implement 2 DOFs
- Onboard controller and sensors completing the system and making sensor-servo-based active perception of the environment possible.

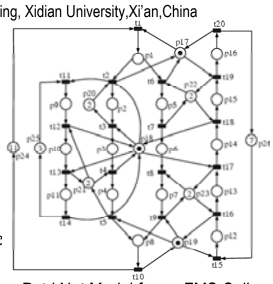
GZ-I modular robot

WA-4(2) 10:50–11:10

Deadlock Prevention Policy based on Elementary Siphons for Flexible Manufacturing systems

Mingming Yan, Hesuan Hu, and Zhiwu Li
School of Electro-Mechanical Engineering, Xidian University,Xi'an,China

- Propose a deadlock prevention policy for a special class of Petri nets,S^3PR.
- Apply the deadlock avoidance policy (DAP) of Conjunctive/Disjunctive Resources Upstream Neighborhood (C/D RUN) to the deadlock revention policy(DPP).
- Allocate the sequential resource reasonably to guarantee the absence of deadlock states and processes.



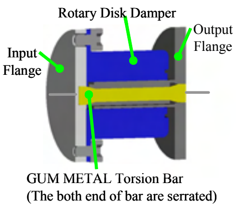
Petri Net Model for an FMS Cell

WA-4(3) 11:10–11:30

New Visco-Elastic Mechanism Design for the Flexible Joint Manipulator

Taisuke SUGAIWA, Hiroyasu IWATA, Shigeki SUGANO
Waseda University
Tokyo, Japan

- Space-efficient visco-elastic mechanism using torsion bar and rotary disk damper.
- GUMMETAL torsion bar which has enormous elastic deformation make flexible joint more small-sized and lightweight.
- Shear elastic modulus of GUMMETAL has linearity and small hysteresis loop, and so proposed mechanism has large advantage for the robot servo control.



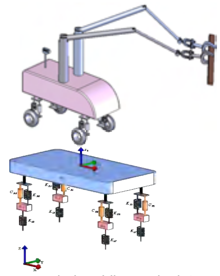
Space-Efficient Visco-Elastic Mechanism

WA-4(4) 11:30–11:50

Postural Stability Evaluation of Spatial Wheeled Mobile Robots with Flexible Suspension over Rough Terrains

Khalil Alipour **S. Ali A. Moosavian** **Yousef Bahramzadeh**
Department of Mechanical Engineering, K. N. Toosi Univ. of Technology, Iran

- Dynamics of a 16 DOF spatial wheeled mobile robot is derived;
- A new reliable and efficient metric named as Moment-Height Stability (MHS) measure is introduced;
- The MHS measure is utilized for postural stability evaluation of a 3D SWMR during motion along straight and curved paths over rough trains.



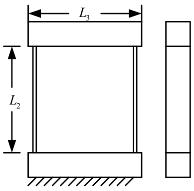
A suspended mobile manipulator which can move on a rough terrain.

WA-4(5) 11:50–12:10

Dynamic Analysis of Compliant Mechanisms Using the Finite Element Method

Wenjing Wang, Yueqing Yu
College of Mechanical Engineering and Applied Electronics, Beijing University of Technology
Beijing, China

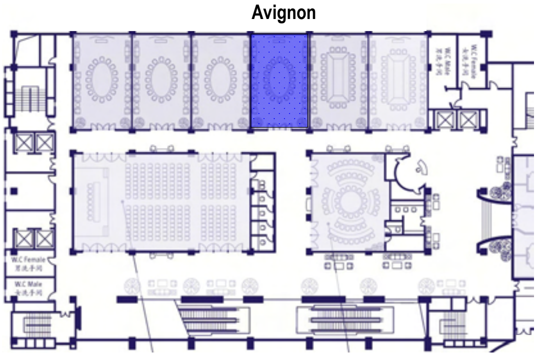
- Using the finite element method, the model for dynamic analysis of compliant mechanisms is developed.
- A systematic analysis for performing dynamic characteristics of compliant mechanisms is presented including natural frequencies and modes, elastic motion response, strain response, and sensitivity.



Compliant Mechanism

2nd Floor
Sofitel Convention Centre

Room 4
Avignon



WA-5: Mobile Robots II

Session Chairs: Tianmiao Wang, Beihang University
Zhenwei Wu, SIA, Chinese Academy of Sciences

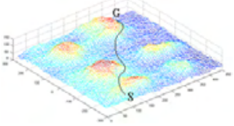
Room 5, 10:30-12:10, Wednesday, 2 July 2008

WA−5(1) 10:30−10:50

Mobile Robot Path Planning in Three-Dimensional Environment Based on ACO-PSO Hybrid Algorithm

Chunxue Shi, Yingyong Bu and Jianghui Liu
Department of Mechanical and Electronical Engineering , Center South University
Changsha, Hunan Province, China

- Introduction.
- Environment Modeling.
- Planning Algorithm.
- Simulation Experiments.



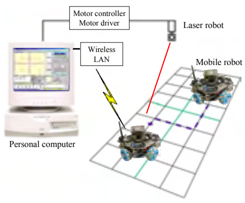
The simulation result

WA−5(2) 10:50−11:10

Navigation Using One Laser Source for Mobile Robot with Optical Sensor Array Installed in Pan and Tilt Mechanism

Keigo Hara, Masahiro Inoue, Shoichi Maeyama, and Akio Gofuku
Department of Intelligent Mechanical Systems, Okayama University
Okayama, Japan

- The laser robot scans the navigation path on the moving area.
- The mobile robot obtains the irradiated laser spots by the optical sensor array.
- The optical sensor array we developed is composed of the phototransistors arranged in a matrix.
- We added a pan and tilt mechanism to the optical sensor array and expanded the operating range.



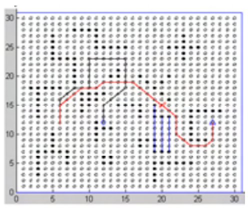
Laser navigation system

WA−5(3) 11:10−11:30

Dynamic Path Planning for Mobile Robots Using Chaotic Prediction

Qian Jia, Xingsong Wang
School of Mechanical Engineering, Southeast University
Nanjing, China

- THIS proposed algorithm improves distance-propagating system.
- It can solve the problem of path selection at critical position by using chaotic control.
- Short-term prediction is added and the speeds of robot and target are considered.



Planned paths using this algorithm

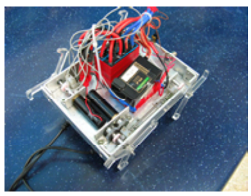
WA−5(4) 11:30−11:50

Structural Design and Simulation of Crossing Obstacle of a Robot with Wheel-legs

Diansheng Chen Yu Huang
Robotic Institute, Beihang University
Beijing, P.R.China

Tianshan Lv
School of Business Administration, Changchun University of Technology
Changchun, P.R.China

- The design of wheel-legs system of the robot
- Analysis of crossing obstacle and simulation of a robot with wheel-legs
- analysis and simulation of the drive motor's performance
- Physical prototype and test results



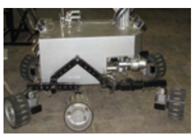
Robot with Wheel-legs

WA−5(5) 11:50−12:10

Kinematical Model-Based Yaw Calculation for an All-Terrain Mobile Robot

Xiaokang Song, Yuechao Wang and Zhenwei Wu
State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, China

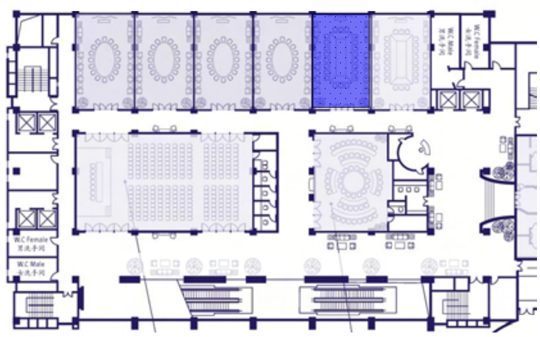
- A Kinematical model-based method for yaw calculation of an all-terrain mobile robot is proposed.
- The kinematics model of the robot is built considering wheel slips and the physical contact relationship between the wheel and the terrain.
- The yaw information is obtained based on solving the robot's kinematics model and the dead-reckoning operation.



An All-Terrain Mobile Robot

2nd Floor
Sofitel Convention Centre

Room 5
Marseilles



WP-1: Machine Vision II

Session Chairs: Yasuharu Kunii, Chuo University
Kejie Li, Beijing Institute of Technology

Room 1, 14:00-15:40, Wednesday, 2 July 2008

WP−1(1) 14:00−14:20

Novel Application of a Laser Range Finder with Vision System for Wheeled Mobile Robot

Ya-Chun Chang, Hidemasa Kuwabara, Yoshio Yamamoto
Department of Precision Engineering, Tokai University
Hiratsuka, Japan

- The Potential Field method is utilized to create force fields around obstacles and a goal.
- Look-ahead control is adopted to steer the mobile robot in which a reference point located in front of the robot is dynamically changed.
- The scanning laser is reflected by a small reflection mirror which is placed in front of the mobile robot, so that the reflected ray scans the nearby ground surface.

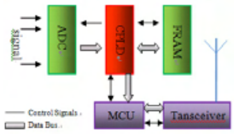

Mobile Robot with Reflected Mirror Unit and Camera

WP−1(2) 14:20−14:40

Predictive Sampling and Reconfigurable Technology Based Intelligent Memory-measurement System

Guangping Qi, Ping Song and Kejie Li
School of Aerospace Science and Engineering
Beijing Institute of Technology
Beijing, China

- Design ideas for the intelligent memory and measure system were presented
- CPLD, the core controller in the data acquisition system, controls ADC, the state machine, the memory and reading of data, the communication with a MCU and transceiver
- The predictive sampling technology is proposed and applied
- Reconfigurable technology makes the system can adjust sampling rate from 0 to 40Msps

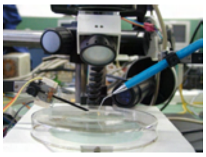


WP−1(3) 14:40−15:00

Visual Servoing Based on Fuzzy Adaptive PID with Modified Smith Predictor for Micromanipulation

Xiangjin Zeng, Xinhan Huang and Min Wang
Department of Control Science & Engineering, HUST
Wuhan, China

- A control scheme based on fuzzy adaptive PID with a modified smith predicator for the control of micromanipulation .
- For the vision delay, a timing modelling of visual servoing system is built .
- The new-added controller M improves the system performance of disturbance rejection .

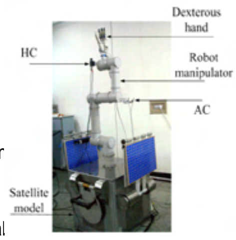

The experimental system of micromanipulation

WP−1(4) 15:00−15:20

Vision-Based System for Satellite On-Orbit Self-Servicing

Guoliang Zhang, Hong Liu, Jie Wang, Zainan Jiang
State Key Laboratory of Robotics and System,Harbin Institute of Technology
Harbin, China

- Puts forward a new concept of the Satellite On-Orbit Self-Servicing using vision .
- A prototype vision system has been built.
- Cooperative object recognition has beer designed and implemented based on polygonal approximation
- A simple redundant feature based visual servoing method is presented.



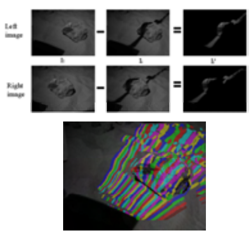
Vision Based SOOS System

WP−1(5) 15:20−15:40

Shadow casting Stereo Imaging for High Accurate and Robust Stereo Processing of Natural Environment

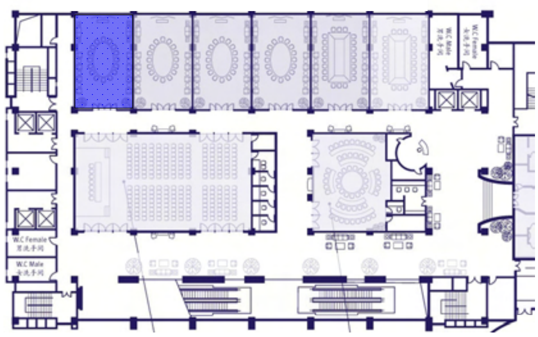
Yasuharu KUNII and Takahiro Ushioda
Dept. of Electrical, Electronic and Communication Eng., Chuo University
Tokyo, Japan

- Shadow is projected on a target, and the projection is useful for the compensation of uncertainty caused by the matching problem.
- The result of our experiment clearly shows that the disadvantages of stereo method were improved without expanding its system scale, and an accurate and robust measurement was achieved. The robustness for natural objects and the improvement of the calculation speed were obtained.


Shadow casting stereo processing

Room 1
Toulouse

2nd Floor
Sofitel Convention Centre



WP-2: Design & Prototyping

Session Chairs: Jing-Sin Liu, IIS, Academia Sinica
Lixin Dong, ETHZ

Room 2, 14:00-15:40, Wednesday, 2 July 2008

WP−2(1) 14:00−14:20

Test of Base Vibration Influence on Dynamics of A Magnetic Suspended Disk

Guoping Ding, Zude Zhou ,Yefa Hu
School of Electromechanical Engineering, Wuhan University of Technology
Wuhan, China

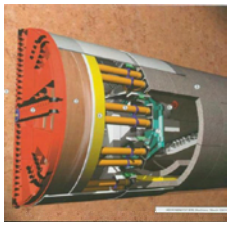
- A novel and concise magnetic suspended disk test device as a simplified FWB model is fabricated
- A vibrating-base magnetic suspend disk test system is sets up.
- A series of sine and random vibration signal with different frequencies are applied to the base and the dynamic response of the suspended disk are measured through several accelerometers mounted on the disk.
- The disk dynamic response are analyzed for controller improvement.

WP−2(2) 14:20−14:40

Pressure and Speed Control of Electro-hydraulic Drive for Shield Tunnelling Machine

Hu Shi, Guofang Gong and Huayong Yang
State Key Lab of Fluid Power Transmission and Control, Zhejiang University
Hangzhou, China

- This paper presents an electro-hydraulic control system for shield thrust drive.
- The control model of thrust system is developed .
- A pressure and flow compound control approach is applied using the pressure and flow rate feedback to design an outer loop controller and an inner loop controller.
- Simulation and field application results are presented to verify the effectiveness and rationality of the proposed drive system and its control.



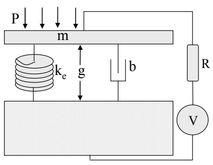
The Shield Tunneling Machine

WP−2(3) 14:40−15:00

A 1-D Lumped Theoretical Model for CMUT

Wenchao Zhou [1, 2], Ting Yu[1], and Fengqi Yu[1]
1 Department of Integrated Electronics, Shenzhen Institute of Advanced Technology, CAS, Shenzhen, China 2 Institute of Precision Engineering, Xi'an Jiao Tong University Xi'an, China

- A transfer function between output sound pressure and input AC voltage has been deduced.
- This model makes it easier to optimize the parameters of a CMUT with respect to output sound pressure and bandwidth and to understand the influence of each parameter.
- The dynamical behavior of CMUT can be studied by this model.



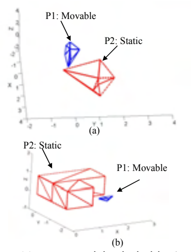
Schematic of 1-D lumped model for CMUT

WP−2(4) 15:00−15:20

On Tolerance Problem of Contacting Polyhedral Objects

Wen-Hua Pan, Jing-Sin Liu
Institute of Information Science Academia Sinica
Taiwan, R.O.C

- Consider scaled convex and non-convex polyhedra moving and contacting problem.
- Define the conditions of relation motion(type, direction, amount) that the contact maintenance/transition between the scaling pairs .
- Families of decision curves can be solved the tolerance problems of manufacture



(a)convex polyhedral objects
(b)non-convex polyhedral object

WP−2(5) 15:20−15:40

Design, Analysis and Experiment of the Feed Cable-Suspended Structure

Baoyan Duan, Yuanying Qiu, Fushun Zhang, and Bin Zi
Xidian University

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2nd Floor
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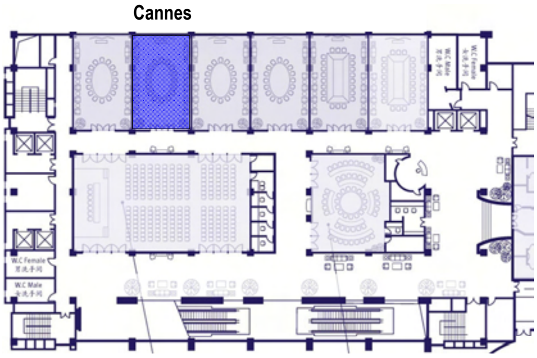


WP-3: Teleoperation

Session Chairs: Ning Xi, MSU
Simon X. Yang, University of Guelph

Room 3, 14:00-15:40, Wednesday, 2 July 2008

WP-3(1) 14:00-14:20

Stable Bilateral Teleoperation using the Energy-Bounding Algorithm: Basic Idea and Feasibility Tests

Changhoon Seo[1], Jaeha Kim[1], Jong-Phil Kim[1], Joo Hong Yoon[2] and Jeha Ryu[1]
[1]Gwangju Institute of Science and Technology(GIST), Gwangju, Republic of Korea
[2]Agency for Defense Development, Daejeon, Republic of Korea

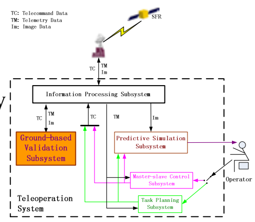
- This paper presents basic idea and feasibility test results of the energy-bounding algorithm (EBA) for bilateral teleoperation.
- Various test results for free, contact, and abrupt motions show that the EBA can ensure stable bilateral teleoperation for the fairy large constant/variable time delays (2.5 sec for free motion and 300 msec for contact motion).
- In addition, the EBA with holding previous data strategy can achieve stable teleoperation when some packet drop is occurred during the data transmission.

WP-3(2) 14:20-14:40

General Scheme of Teleoperation for Space Robot

Xueqian Wang, Wenfu Xu, Bin Liang and Cheng Li
Harbin Institute of Technology Shenzhen Graduate School
Shenzhen, China

- three level tele-programming modes are provided
- graphic predictive display can solve the problem of time delay
- bilateral control can improve the performance of operation
- dynamic emulation and kinematic equivalence is used



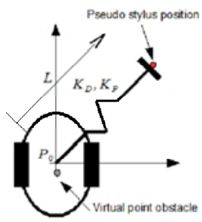
Teleoperation system

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

Stable Mobile Robots Teleoperation via Potential Field Method

Adha I. Cahyadi, Chang Ya-Chun, Yoshio Yamamoto
Department of Precision Engineering, Tokai University
Kanagawa, Japan

- The paper presents a remotely teleoperated mobile robot using haptic device.
- The teleoperation system is based on the Potential Field method especially for detecting the obstacle.
- Under some assumptions the teleoperation is guarranted to be stable.
- Simulation studies are shown to verify the effectiveness of the method.



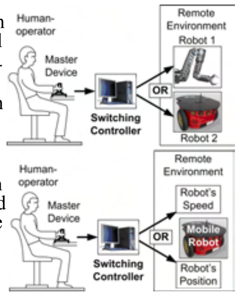
Pseudo distant strategy

WP-3(4) 15:00-15:20

Switching of Control Signals in Teleoperation Systems: Formalization and Application

Ildar Farkhatdinov and Jee-Hwan Ryu
BioRobotics Laboratory, Korea University of Technology and Education
Cheonan, Korea

- Multiple teleoperation systems when one human-operator controls several objects or properties were described.
- Strategy for control signal distribution in multiple teleoperation systems was proposed. Special switching controller and resetting algorithm were designed.
- Examples of switching teleoperation of mobile manipulator and combined speed and position control of mobile robot were given.
- Simulation and experimental study were performed.

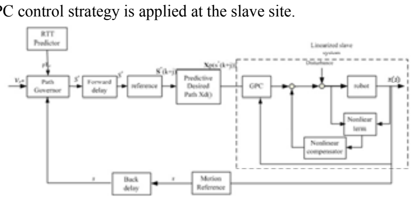


WP-3(5) 15:20-15:40

Event-based Predictive Control Strategy for Teleoperation via Internet

Dan Chen, Ning Xi, Yuechao Wang, Hongyi Li, Xusheng Tang
Robotics Laboratory of the Chinese Academy of Sciences, Shenyang Institute of Automation

- we present a event –based predictive strategy for teleoperating via communication channel with unknown and variable time delay
- a discrete-time device called path governor(PG) generates on line a suitable time-parameterization of the path to be tracked, by solving at fixed interval a look-ahead optimization problem
- GPC control strategy is applied at the slave site.



event-based predictive telecontrol teleoperation

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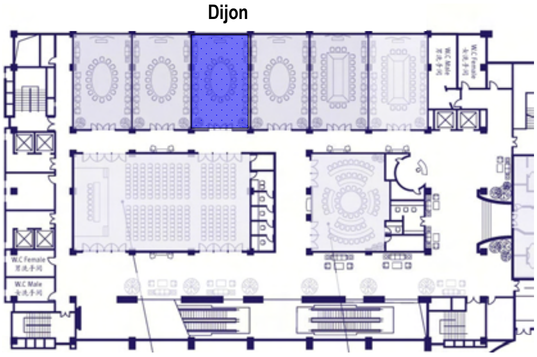


WP-4: Dual Arm/Cooperative

Session Chairs: Shugen Ma, Ritsumeikan Univeristy
Jindong Tan, Michigan Technological University

Room 4, 14:00-15:40, Wednesday, 2 July 2008

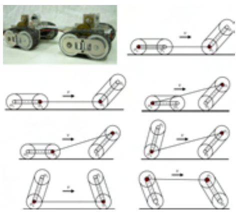
WP−4(1) 14:00−14:20

Posture Analysis of a Dual-crawler-driven Robot

Shugen Ma, Qiquan Quan
Department of Robotics
Ritsumeikan University, Kusatsu,Japan

Rongqiang Liu
School of Mechatronics Engineering
Harbin Institute of Technology, Harbin,China

- For one crawler, one motor generates two locomotion modes.
- According to terrain, two locomotion modes are switched autonomously.
- Dual-crawler-driven robot can not only switch its locomotion modes, but also generate many postures through controlling cooperatively two actuators.



The dual-crawler-driven robot and its different postures

WP−4(2) 14:20−14:40

A Web Based Collaborative Portal for Remote Monitoring and Analysis of Livestock Farm Odor

Rui Liu, Leilei Pan, Simon X. Yang and Max Q.-H. Meng
Advanced Robotics & Intelligent Systems Lab, Univ. of Guelph, Canada

- Remote monitoring and analysis of livestock farm environment require cooperation and collaboration of multiple partners.
- A dynamic and cooperative framework is developed based on a web-based portal application.
- It provides an efficient, robust, and user-friendly environment for distributed users to manage and process data records, share analysis results, and collaborate on distributed tasks.

Collaborative Portal Architecture

WP−4(3) 14:40−15:00

Mechanical Design and Impedance Compensation of SUBAR

Kyoungchul Kong and Masayoshi Tomizuka
Department of Mechanical Engineering, University of California, Berkeley, USA
Hyosang Moon, Beomsoo Hwang and Doyoung Jeon*
Department of Mechanical Engineering, Sogang University, Korea

- SUBAR is a wearable robot developed for assisting physically impaired people.
- The mechanical design of SUBAR including the flexible transmission and its associated control algorithm are presented.
- For the ideal force mode actuation, a flexible transmission is applied and controlled to reject friction.
- Since the actuation system of the SUBAR has a large model variation, a control algorithm for the flexible transmission is designed based on robust control theory.

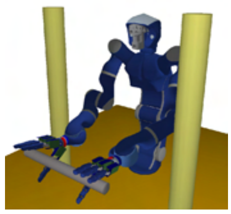
SUBAR (Sogang University's Biomedical Assistive Robot)

WP−4(4) 15:00−15:20

A sampling-based path planner for dual-arm manipulation

M. Gharbi, J. Cortés, T. Siméon
LAAS-CNRS, Université de Toulouse,
Toulouse, France

- Compute collision-free coordinated manipulation paths for multi-arm robot systems.
- Find solution paths requiring the robot reconfiguration through an explicit treatment of singular configurations.
- Approach demonstrated on a complex dual-arm manipulator with 17 DoF.



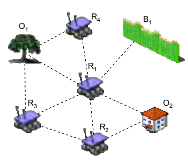
The DLR Light-Weight-Robot Justin

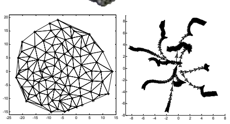
WP−4(5) 15:20−15:40

Deployment of Multi-robot Systems under the Nonholonomic Constraint

Yu Zhou* and Jindong Tan**
*Department of Mechanical Engineering, State University of New York at Stony Brook, USA
** Department of Electrical and Computer Engineering, Michigan Technological University, USA

- A distributed multi-robot deployment algorithm
- Derived from the Hamilton's principle
- Incorporating the nonholonomic constraint arising in wheeled robots.
- Adopting the Rayleigh's dissipation function to maintain the deployment stability of each robot.





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Room 4
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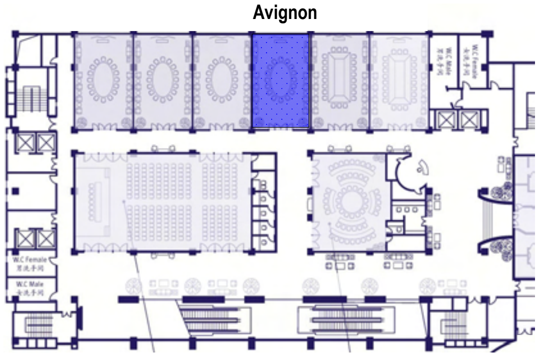


WP-5: Mobile Robots III

Session Chairs: Fumiaki Takemori, Tottori University
Jean-Francois Allan, Hydro-Quebec's Research Institute

Room 5, 14:00-15:40, Wednesday, 2 July 2008

WP−5(1) 14:00−14:20

Mobility of Legged Robot by Non-Contact Impedance Control

Fumiaki Takemori, Naoki Tomita, Daisuke Kushida and Akira Kitamura
Dept. of Information and Electronics, Graduate School of Eng., Tottori University, Japan

- A legged mobile robot carrying the human is developed.
- This robot has three legs. Each leg consists of three linear actuators.
- As a method for avoiding the obstacles, the virtual impedance control method is proposed.
- The mobility for avoiding unknown height step and soft-landing motion is confirmed through some experiments.

Human carrying robot

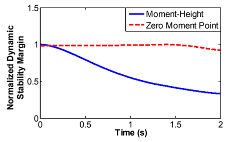
WP−5(2) 14:20−14:40

MHS Measure for Postural Stability Monitoring and Control of Biped Robots

Amir Takhmar, Mansoor Alghooneh, Khalil Alipour, and S. Ali. A. Moosavian

Department of Mechanical Engineering, K. N. Toosi Univ. of Technology, Iran

- ✓ The Moment-Height stability (MHS) measure which has been previously proposed for wheeled mobile robots is developed for biped robot control;
- ✓ The results of application of the MHS are compared with those of the ZMP;
- ✓ The MHS metric is able not only to monitor the state of postural stability of a biped robot during the entire gait cycle, but also it does reliably indicate the severity of instability of the gait.



Comparison between MHS measure and ZMP during standing

WP−5(3) 14:40−15:00

Development of a Mobile Robotic Platform for the Underground Distribution Lines

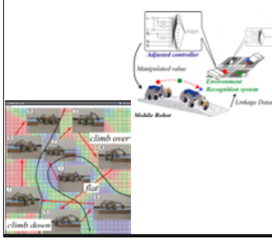
Jean-François Allan, Ghislain Lambert, Samuel Lavoie and Stéphane Reiher
Hydro-Québec's Research Institute
Varennes, Québec, Canada

- Presentation of the first mobile robotic platform dedicated to the underground distribution network.
- Design of a 5-DOF hydraulic arm mounted on a articulated vehicle.
- Specific tools made to perform tasks on an underground switch.
- Analysis and design of a 6-DOF electric manipulator with integrated electronics.
- Prototype built to perform tasks on automatic mode (no teleoperation)

WP−5(4) 15:00−15:20

Environment Recognition System based on Multiple Classification Analyses for Mobile Robots

Atushi Kanda, Masanori Sato and Kazuo Ishii
Department of Brain Science and EngineeringKyushu Institute of Technology
2-4 Hibikino, Wakamatsu, Kitakyushu, Fukuoka, Japan
kanda-atushi@edu.brain.kyutech.ac.jp, {m-sato, ishii}@brain.kyutech.ac.jp



•Wheel type mobile robot have difficulty in rough terrain movement.
•We propose the switching controller system according to various environment.
•The system consist of environment recognition system using Self-organizing Map (SOM) and PCA

WP−5(5) 15:20−15:40

Design and Experiments on a New Wheel-Based Cable Climbing Robot

Fengyu Xu, Xingsong Wang
School of Mechanical Engineering, Southeast University Nanjing, China

This paper proposes an ameliorated wheel-Based cable inspection robot is composed of two equally spaced modules, which are equally spaced modules, which are joined by connecting bars to form a closed hexagonal body to clasp on the cable. For safe landing, a gas damper and a new electric circuit is introduced. Several Climbing experiments show the robot can climb along a cable with diameters varying from 65mm to 205mm.

Cable Climbing Robot

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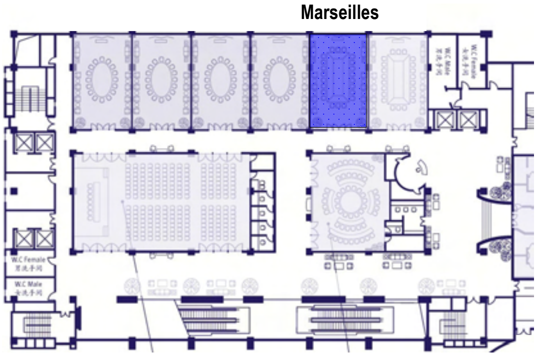
Room 5
Marseilles



WE-1: Electromagnetic Devices I

Session Chairs: I-Ming Chen, Nanyang Technological University
Wei Wang, Xidian University

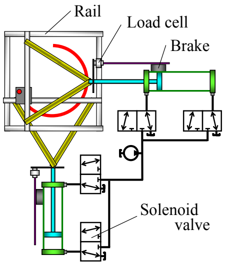
Room 1, 16:00-17:40, Wednesday, 2 July 2008

WE-1(1) 16:00-16:20

Follow-up Control of Pneumatic Cylinders by Passive Dynamic Control

Yasuhiro Minamiyama, Takanori Kiyota, Takumi Sasaki and Noboru Sugimoto
Graduate School of Environmental Engineering, The University of Kitakyushu
Fukuoka, Japan

- The passive dynamic control ("PDC") is a new mechanical system control method based on inherently safe design.
- The PDC pneumatic cylinder was made in order to apply PDC in pneumatic system.
- Two types of follow-up controls were described : one is trajectory follow-up control to follow up a circular trajectory, and the other is time follow-up control to follow up a sine curve.



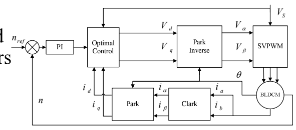
Experimental setup

WE-1(2) 16:20-16:40

Precise Speed Control of Brushless DC Motors Based on Optimal Control

Hao Wu, Xinya Sun, and Yindong Ji
Department of Automation, Tsinghua University
Beijing, China

- This paper proposes a new technique to take precise speed control of Brushless DC Motors with trapezoidal-shaped back-EMF.
- Starting from the motor model, the method firstly removes the speed disturbance to linearize the state equation, then applies optimal control on stator current to eliminate the torque ripple and speed fluctuation.
- Simulation results have shown the effectiveness and superiority over Kalman filter algorithm in a wide speed range .



The Control Scheme of BLDCM

WE-1(3) 16:40-17:00

On Coupled Structural-Electromagnetic Modeling and Analysis of Rectangle Active Phased Array Antennas

C. S. Wang, W. Wang, and H. Bao
Key Lab of Electronic Equipment Structure of Ministry of Education
Xidian University, Xi'an 710071, China

- The analysis of EM performances of active phased array antennas with distorted plane errors is important to the engineering development of high-performance antennas.
- An coupled model is developed, which describes the effect on the performances of the errors caused by the bent and bowl distortion. The application of the model to a plane array antenna demonstrates the degradation of the sidelobe level and gain of the antenna with different distortion grades.
- The satisfactory analysis results provide a theoretical guidance for the engineer to determine the structural tolerance.

WE-1(4) 17:00-17:20

Dynamic Characteristics Study of Single-Sided Linear Induction Motor Using FEM

Junfei Han, Yaohua Li, Yumei Du and Nengqiang Jin
Institute of Electrical Engineering, Chinese Academy of Sciences
Beijing, China

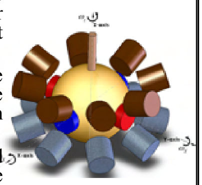
- The linear interpolation movement interface method to solve the transient electromagnetic field-circuit-torque coupling problem was proposed .
- Compute 2D transient electromagnetic field of SLIM with high speed by FEM.
- The electromagnetic force trend of changes with frequency and velocity and analysis of the eddy current in reaction plate was presented.
- Longitudinal end effect deteriorates the performance of SLIM.

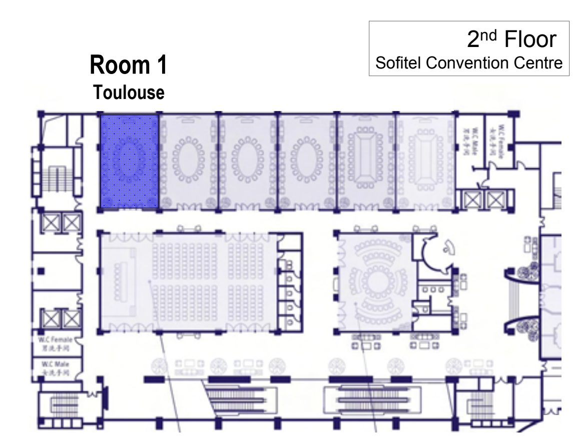
WE-1(5) 17:20-17:40

Torque Modeling of a Permanent Magnet Spherical Actuator based on Magnetic Dipole Moment Principle

Chee Kian Lim, I-Ming Chen, Liang Yan, Guilin Yang, Wei Lin, Kok-Meng Lee
School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

- In this paper, a new approach in torque formulation of PM spherical actuator employing the magnetic dipole moment principle is being discussed.
- Derivation from first principle and the extension of this novel method in the acquisition of the resultant torque induced on the rotor is presented.
- The proposed approach circumvents the need for electromagnetic energy analysis within the air-gap between the rotor and stator poles and henceforth providing a direct computation of the resultant torque.


PM Spherical Actuator



WE-2: Actuators II

Session Chairs: Yuen Kuan Yong, University of Newcastle
Yvan Michellod, EPFL-LA

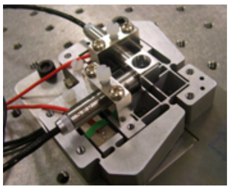
Room 2, 16:00-17:40, Wednesday, 2 July 2008

WE-2(1) 16:00-16:20

Design, Analysis and Control of a Fast Nanopositioning Stage

Yuen Kuan Yong, Sumeet Aphale and S. O. Reza Moheimani
School of Electrical Engineering and Computer Science, The University of Newcastle

- A fast flexure-based, piezoelectric stack-actuated XY nanopositioning stage is presented.
- The design has high first resonant mode at 2.7kHz, low cross-coupling of -35dB and relatively large traveling range of 25μm x 25μm.
- Hysteresis effect due to the piezoelectric stack actuators is minimized using charge actuation.
- Fast and accurate scanning performances, up to 400Hz, are achieved by applying the Integral Resonant Control method to damp the 1st resonant mode and by implementing the feedforward inversion technique for tracking.



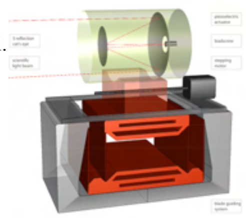
The XY Nanopositioning Stage

WE-2(2) 16:20-16:40

Dedicated controller design for a dual-stage opto-mechatronic system

M. Stalder, Y. Michellod, Ph. Mullhaupt, and D. Gillet
Laboratoire d'automatique, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

- PRIMA-Differential Delay Line (DDL) facility for VLTI, in Chili.
- Mechanical compensation of the atmospheric perturbation on the scientific light beam.
- Dynamic tracking of a stochastic reference with bandwidth up to 200Hz.
- Nanometer resolution above 70 mm.



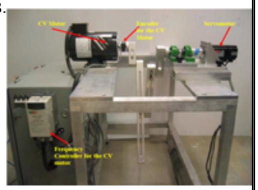
The DDL

WE-2(3) 16:40-17:00

Experimental Study on a Hybrid Actuation System

P. R. Ouyang[1], W. J. Zhang[2] and R. Moazed[2]
[1]Department of Aerospace Engineering, Ryerson University, Toronto, ON, Canada
[2]Department of Mechanical Engineering, University of Saskatchewan, Saskatoon, SK, Canada

- Hybrid system: Strength vs. Weakness.
- Hybrid actuation system: CV motor + Servomotor.
- Control strategy: Servomotor compensates CV motor.
- Experiments: Verification of hybrid system.
- Discussion: Improvement of experiment.



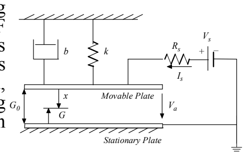
Hybrid actuation system

WE-2(4) 17:00-17:20

Robust Adaptive Tracking Control of Electrostatic Micro-actuators with Uncertainty

Wenlei Li[1], Peter X. Liu[2]
1. College of Information Science and Engineering , Ningbo University, Ningbo, China
2. Dept. of Systems and Computer Engineering , Carleton University , Ottawa, ON Canada

- A novel adaptive robust tracking control scheme for a class of 1DOF electrostatic micro-actuator systems with constant parameter uncertainties and external disturbances is addressed, which is based on backstepping control technique and Nussbaum gain function.
- The derived controller guarantees that the closed-loop system is globally and uniformly bounded, and the tracking error is convergent to a small neighbourhood of zero. Besides, the singular problem can be avoided.
- Simulation results demonstrate that the developed tracking controller can drive the electrostatic micro-actuator systems into prescribed orbits with good robustness and adaptability.



1 DOF Parallel-plate Electrostatic Actuator

WE-2(5) 17:20-17:40

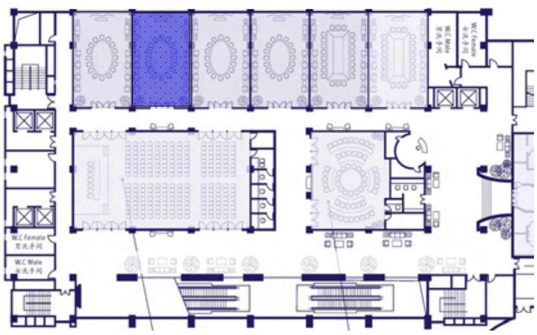
Development of Rate Independent Prandtl-Ishlinskii Model for Characterizing Asymmetric Hysteresis Nonlinearities of SMA Actuators

Mohammad Al Janaideh, Chun-Yi Su, and Subash Rakheja
Department of Mechanical and Industrial Engineering,
Concordia University, Canada

- A generalized Prandtl-Ishlinskii model is formulated to model hysteresis nonlinearities of SMA actuators. In this model, a generalized play hysteresis operator is proposed and integrated with a density function to construct generalized Prandtl-Ishlinskii model.
- The formulated generalized Prandtl-Ishlinskii model can also describe hysteresis loops with saturated output displacement.
- The results suggest that unlike the classical Prandtl-Ishlinskii model, the proposed Prandtl-Ishlinskii can effectively characterize hysteresis nonlinearities of the SMA actuators.

2nd Floor
Sofitel Convention Centre

Room 2
Cannes



WE-3: Medical Robotics

Session Chairs: Kiyoshi Nagai, Ritsumeikan University
Markus Koch, University of Paderborn, Germany

Room 3, 16:00-17:40, Wednesday, 2 July 2008

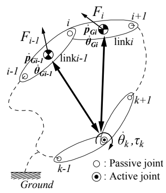
WE-3(1) 16:00-16:20

Dynamics Computation of Link Mechanisms Employing COG Jacobian

Takashi Sonoda and Kazuo Ishii
Department of Brain Science and Engineering
Kyushu Institute of Technology
Kitakyushu, Japan

Daigoro Isobe
Department of Engineering Mechanics and Energy
University of Tsukuba
Ibaraki, Japan

- This research is regarding to dynamics analysis employing center of gravity (COG) Jacobian for link mechanisms.
- COG Jacobian is a matrix that expresses differentiation relations about COG velocity and active joint's angle velocity in a motion.
- Using this method, we can obtain equation of motion concerning to open- and closed-link mechanisms.



Dynamics analysis using COG Jacobian

WE-3(2) 16:20-16:40

Novel Approach for Lower Limb Segment Orientation in Gait Analysis Using Triaxial Accelerometers

Kun Liu, Tao Liu, Kyoko Shibata, Yoshio Inoue, Rencheng Zheng
Department of Intelligent Mechanical Systems Engineering,
Kochi University of Technology Kochi Japan

- Novel approach only based on accelerometers for three-dimensional (3D) orientation of lower limb segments during real-time motion were present.
- The angle displacements for orientation of each segment were calculated based on low-pass filtered accelerometer signals without integration.
- A simple device was developed based on the approach and compared with the high-accuracy camera system.

Measuring Segment Orientation with the Developed Device

WE-3(3) 16:40-17:00

Optic-Tactile robotics and medical applications

Markus Koch, Juergen Schrage and Willi Richert
Cooperative Computing & Communication Laboratory (C-LAB)
University of Paderborn and Siemens, Fuerstenallee 11, 33102 Paderborn, Germany

- Optic-Tactile Sensors
- Robotics application
- Medical applications
- Hardware prototypes
- Sensory calibration
- Architectural overview
- Experiments
- Evaluation
- Video clips

ID 207

Example:
Optic-tactile robotics

WE-3(4) 17:00-17:20

In Situ Micro-Force Sensing and Quantitative Elasticity Evaluation of Living Drosophila Embryos At Different Stages

Uchechukwu C. Wejinya[1], Yantao Shen[2], and Ning Xi[3]
[1]University of Arkansas, [2]University of Nevada, Reno, [3]Michigan State University

- Designed, modeled and fabricated PVDF micro-force sensor
- PVDF micro-force sensor is integrated with networked human-robot system shown in Figure 1 for bio applications.
- Human-robot system used for injection of Drosophila embryos
- Force and deformation information are obtained from integrated system
- Elasticity results of the Drosophila embryo at different stages is evaluated, and results presented.

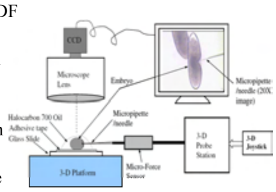


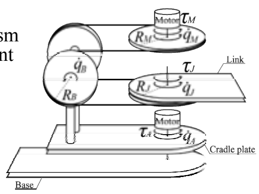
Figure 1: Experimental Setup for Micro-injection of Drosophila Embryo

WE-3(5) 17:20-17:40

Proposal of an Admittance Enhanced Redundant Joint Mechanism to Improve Backdrivability

Kiyoshi Nagai*, Yosuke Ikegami*, Rui C. V. Loureiro**, and William S. Harwin**
* Department of Robotics, Ritsumeikan University, Shiga, Japan
** School of Systems Engineering, University of Reading, Reading, UK

- A noble design of Admittance Enhanced Redundant Joint Mechanism (AERJM) is proposed to produce joint motions with adjustable admittance improving backdrivability.
- AERJM consists of a Redundancy Introducing Mechanism (RIM), the Adjustable Admittance Mechanism (AAM) and an ordinary actuator.
- The joint impedance of AERJM could be small even when an ordinary actuator adopts a high reduction ratio mechanism.



Basic Structure of Redundant Joint Mechanism

WE-4: Parallel Manipulators

Session Chairs: Yangmin Li, University of Macau
Cornel Brisan, Technical University of Cluj-napoca

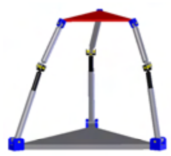
Room 4, 16:00-17:40, Wednesday, 2 July 2008

WE-4(1) 16:00-16:20

Position and Singularity Analysis of a Novel 3-RPUR Parallel Platform Mechanism

Shihua Li, Ning Ma and Changcheng Yu
Robotics Research Center , Yanshan University
Qinhuangdao, China

- The equation system of the mechanism structure constraint is established.
- The position analysis of the mechanism is done.
- The workspace of the structure constraint are analyzed.
- The singularity of the mechanism is researched.



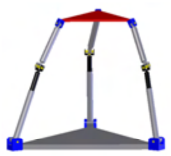
3-RPUR Parallel Mechanism

WE-4(2) 16:20-16:40

Kinematic Analysis of A Novel 3-DOF 3-RPUR Translational Parallel Mechanism

Shihua Li, Ning Ma and Wenhua Ding
Robotics Research Center , Yanshan University
Qinhuangdao, China

- The first and second-order influence coefficient matrices are deduced.
- The kinematic equations are established.
- The velocity and acceleration curves given inputs are drawn.
- The kinematic performance is successive and steady in workspace.



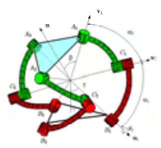
3-RPURParallel Mechanism

WE-4(3) 16:40-17:00

Forward Kinematics of Spherical Parallel Manipulators with Revolute Joints

Shaoping Bai and Michael R. Hansen
Department of Mechanical Engineering, Aalborg University
Aalborg, Denmark

- The forward kinematics of spherical parallel manipulators (SPM) is revisited.
- A novel approach utilizing the input-output equations of spherical four-bar linkages is presented.
- A polynomial equation for solutions of the forward kinematics problem is derived with concise coefficients
- Examples are included to demonstrate the application of the method



Kinematic Model of an SPM

WE-4(4) 17:00-17:20

Virtual models in the case of calibration of the robots with parallel topology

Cornel Brisan
Technical University of Cluj-Napoca
Cluj-Napoca, Romania

- open loop and wire loops can be used for calibration of robots with parallel topologies
- virtual models, useful for calibration may be developed using MOBILE software package
- wire loops are recommended for reconfigurable parallel robots calibration
-
- wire loops are recommended because of their accuracy

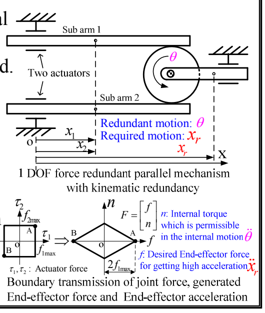
PARTNER robot with 6 dof

WE-4(5) 17:20-17:40

Introducing Kinematical Redundancy into Parallel Mechanism with Force Redundancy

Kiyoshi Nagai and Zhengyong Liu
Department of Robotics, Ritsumeikan University
Shiga, Japan

- A new concept that introducing internal kinematic redundancy into parallel force redundant mechanism is proposed.
- Higher acceleration can be gotten and small positional incoincidence among sub-arms can be allowed in the proposed mechanisms.
- The future work is to implement this theoretical method to improve the high speed mechanism NINJA, aiming at achieving an acceleration over 100[G] together with high precision.



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Room 4
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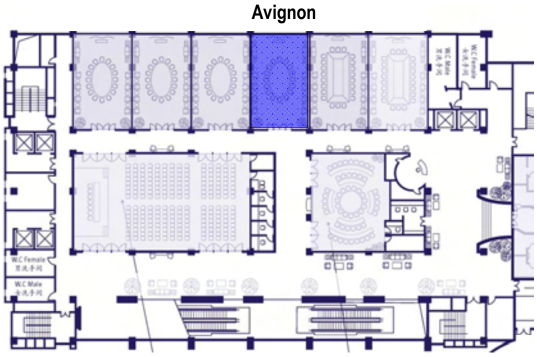


WE-5: Special Robots

Session Chairs: Yudai Adomi, Okayama University
Jeff Pieper, University of Calgary

Room 5, 16:00-17:40, Wednesday, 2 July 2008

WE-5(1) 16:00-16:20

An Autonomous Off-Road Robot Based on Integrative Technologies

Orlando J. Hernandez, Yunfeng Wang
Department of Mechanical Engineering, The College of New Jersey, New Jersey, USA

- Present an autonomous off-road robot designed by converging highly reliable integrative technologies.
- Provide a general robotics prototyping infrastructure for unmanned ground vehicle
- Demonstrated the robot's robust integration of several subsystems by successfully competing in the IGVC.

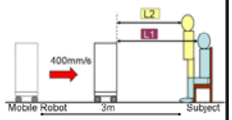
NJAV

WE-5(2) 16:20-16:40

Are Bigger Robots Scary?-The Relationship Between Robot Size and Psychological Threat-

Yutaka Hiroi* and Akinori Ito†
* Faculty of Software and Information Science, Iwate Prefectural University, Iwate, Japan
† Graduate School of Engineering, Tohoku University, Miyagi, Japan

- BACKGROUND: Few quantitative investigations have been made concerning the influence of the size of a robot on a user's impression.
- OBJECTIVE: To find out the best robot size for a service robot from the psychological threat point of view.
- METHODOLOGY: Investigate subjective acceptable distance and anxiety for robots of various sizes. (600mm, 1200mm and 1800mm)
- RESULT: 1.2 m-tall robot was better than that of the other two sizes.



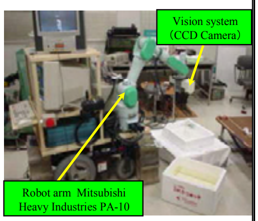
Definition of distances between robot and subject

WE-5(3) 16:40-17:00

Intelligence Comparison between Fish and Robot using Chaos and Random

Jun Hirao and Mamoru Minami
Faculty of Engineering, University of Fukui
Fukui, Japan

- In this paper we tackle a Fish-Catching task under a visual feedback hand-eye robotic system with a catching net.
- The purpose of this paper is to construct intelligence in order to track and catch the fish successfully.
- We embed chaotic and random motion into the net motion to realize a kind of robotic intelligence, and we show the chaotic and random net motion is effective to overcome the fish escaping strategies.



Fish Catching system PA10

WE-5(4) 17:00-17:20

Automatic Pipe Negotiation Control for snake-like robot

Akina Kuwada, Shuichi Wakimoto, Koichi Suzumori and Yudai Adomi
Graduate School of Natural Science and Technology, Okayama University
Tsushima-naka, Okayama, Okayama, Japan

- The purpose is to realize self-propelling ability of a snake-like robot which travels in pipes.
- The robot consists of thirteen intelligent actuators (each actuator has a DC motor, a micro processor including a motor driver and communication function).
- Three control algorithms are proposed and programmed in the processors (force control, adjusting controls to changing pipe diameter and to curved pipe).
- As the results, the robot can negotiate automatically in several kinds of pipes such as different diameter, elbow shape, T branch shape and vertical setting without overloaded.

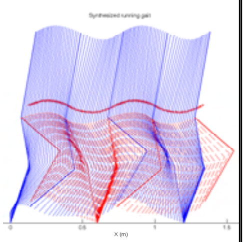
The robot's automatic movement

WE-5(5) 17:20-17:40

Bipedal Running with Nearly-Passive Flight Phases

Qinghong Guo, Chris Macnab, and Jeff Pieper
ECE, University of Calgary, Calgary, AB, Canada

- The flight phase is assumed nearly-passive
- The initial joint velocities of the flight phase can be solved by using a static optimization procedure
- The flight phase and the support phase are generated by dynamic optimization.
- The resultant running gaits are energy-efficient and elegant.



Bipedal Running

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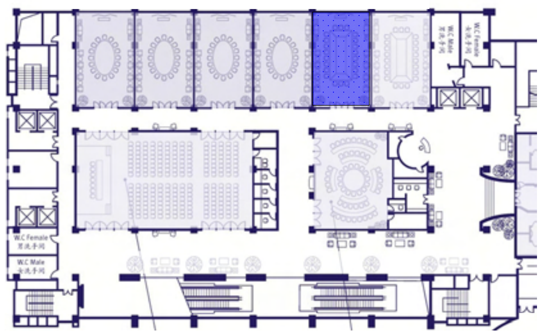
Room 5
Marseilles



Thursday, 3 July 2008

TA-1	Electromagnetic Devices II
TA-2	Localization I
TA-3	Measurement
TA-4	Microactuators
TA-5	Nonlinear & Adaptive Control I
TP-1	Piezoelectronic Devices
TP-2	Localization II
TP-3	Modeling and Simulation
TP-4	Micor/Nano Devices
TP-5	Nonlinear & Adaptive Control II
TE-1	Assembly
TE-2	Navigation
TE-3	Hybrid Systems/Control
TE-4	Micro/Nano Operations
TE-5	Nonlinear & Adaptive Control III

TA-1: Electromagnetic Devices II

Session Chairs: Kok-Meng Lee, Georgia Institute of Technology
Wataru Hijikata, Tokyo Institute of Technology

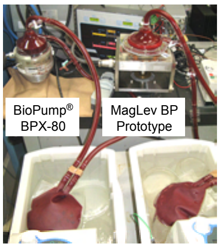
Room 1: Toulouse 10:30-12:10, Thursday, 3 July 2008

TA−1(1) 10:30−10:50

Disposable MagLev Centrifugal Blood Pump Utilizing Cone-Shaped Impeller

Wataru Hijikata[1], Tadahiko Shinshi[1], Hideo Sobajima[2], Setsuo Takatani[2], and Akira Shimokohbe[1]
1) Precision and Intelligence Laboratory, Tokyo Institute of Technology, Yokohama, Japan
2) Institute of Biomaterials and Bioengineering, Tokyo Medical and Dental University, Tokyo, Japan

- Higher durability and lower blood damage due to MagLev suspension of an impeller
- Cone-shaped impeller providing smooth blood flow
- Simply-structured MagLev mechanism for a low-cost disposable pump head
- CFD analysis for estimation of blood damage inside a pump head



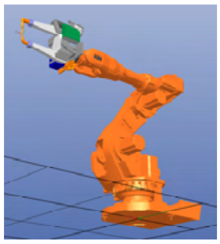
Comparison of blood damage

TA−1(2) 10:50−11:10

Clamping Force Regulation of Servo Gun Mounted on Resistance Spot Welding Robot

Bin Niu, Yonglin Chi and Hui Zhang
ABB Corporate Research China
Shanghai, China

- Force tolerance is one of the most critical parameters of a spot welding gun.
- Influence factors on the force output accuracy of servo gun are investigated.
- Force regulation methods based on both conventional open loop control and novel closed loop control are discussed.
- Closed loop force regulation will become the future trend.



Servo Gun on Robot

TA−1(3) 11:10−11:30

Lyapunnov Stable Control of Tubular Linear Permanent-Magnet Motor

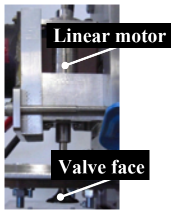
Wenyong Li,ITI GmbH;
BinCheng Li, Jiangsu University of Science and Technologgy

TA−1(4) 11:30−11:50

Sliding Mode Servo Control with Feedforward Compensator for Electromagnetic Engine Valve

Masaki Uchida*, Hideyuki Hasegawa, Ryohei Murata, Yoshifumi Morita and Takao Yabumi
*Department of Mechanical Engineering, Fukui University of Technology
Fukui, Japan

- ElectroMagnetic engine Valve (EMV) has received a great deal of attention from the view point of fuel economy.
- We proposed a new positioning controller using a sliding mode servo control with a feedforward control for the EMV in order to accomplish high speed positioning.
- We confirmed the effectiveness of the proposed controller through experiments using the prototype linear motor for the EMV.



Electromagnetic Engine Valve

Room 1
Toulouse

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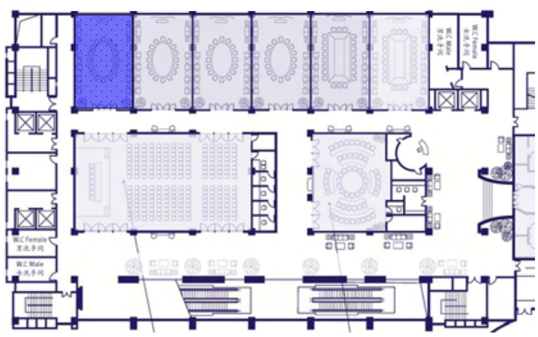


TA-2: Localization I

Session Chairs: Dongbing Gu, University of Essex
Peter X. Liu, Carleton University

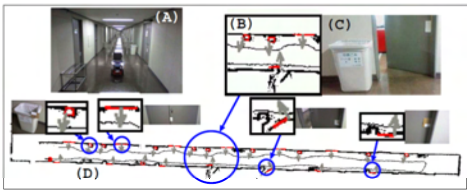
Room 2: Cannes 10:30-12:10, Thursday, 3 July 2008

TA-2(1) 10:30-10:50

Localizing Objects During Robot SLAM in Semi-Dynamic Environments

Hongjun Zhou and Shigeyuki Sakane
Tokyo Metropolitan Industrial Technology Research Institute, Japan and Chuo University, Japan

- We conducted experiments using a mobile robot mounted a laser range-finder and an RFID tag antenna



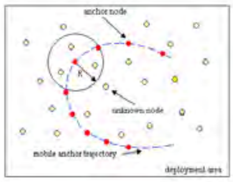
An experiment to detect semi-dynamic objects, dust boxes and doors, in a long corridor

TA-2(2) 10:50-11:10

Localization in Wireless Sensor Networks Using a Mobile Anchor Node

Zhen Hu [1], Dongbing Gu[2], Zhengxun Song [1], and Hongzuo Li [1]
[1]Changchun University of Science and Technology , Jilln, China
[2]University of Essex, UK.

- This paper describes a mobile anchor centroid localization method.
- It uses a single mobile anchor node to move in the sensing field.
- The single mobile anchor node broadcasts its current position periodically.
- We use simulations and tests from an indoor deployment to investigate the performance.

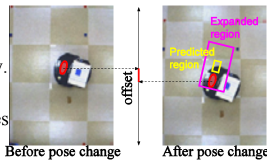


TA-2(3) 11:10-11:30

A Large Planar Camera Array for Multiple Automated Guided Vehicles Localization

Xuefeng Liang, Yasushi Sumi, Bong Keun Kim, Hyun Min Do, Yong-Shik Kim, Tetsuo Tomizawa, Kenichi Ohara, Tamio Tanikawa and Kohtaro Ohba
National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan

- An intelligent camera switch algorithm significantly reduces the redundant video data.
- The proposed system provides more precisely tracking, recognition and localization ability.
- The system can be automatically recalibrated if camera pose changes under an accident .



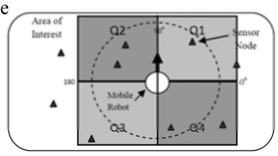
Localization & recalibration

TA-2(4) 11:30-11:50

Discrete Probabilistic Localization of Wireless Sensor Networks

Amena Amro[1], Anis Tabboush[1], Aleksandra Krsteva[2], Imad H. Elhajj[1]
[1]Electrical and Computer Engineering Dept., American University of Beirut, Beirut, Lebanon
[2]Computer Science and Engineering Dept., Oakland University, Rochester, MI, USA

- For certain applications, low overhead discrete localization achieves comparable results to costly fine localization
- A discrete and probabilistic localization method that requires no transmission overhead from the sensor nodes is presented
- Simulations show that the method converges to the true position in a relatively short time

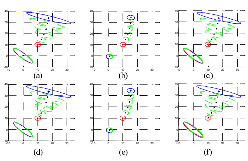


TA-2(5) 11:50-12:10

Improving Consistency of EKF-based SLAM Algorithms by Using Accurate Linear Approximation

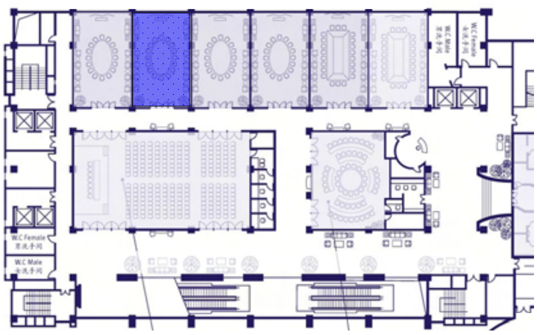
Rongchuan Sun[1,3], Shugen Ma[1,2], Bin Li[1], and Yuechao Wang[1]
[1]Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, China
[2]Department of Robotics, Ritsumeikan University, Nojihigashi, Kusatsu-Shi, Japan
[3]Graduate School of the Chinese Academy of Sciences, Beijing, China

- Accurate linear approximations of the measurements
- Linearizing the measurements at one point from the point view of objective function
- The improved EKF-based SLAM algorithm



Room 2
Cannes

2nd Floor
Sofitel Convention Centre



TA-3: Measurement

Session Chairs: Imad Elhajj, American University of Beirut
Kazuhiko Takahashi, Doshisha University

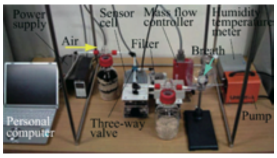
Room 3: Dijon 10:30-12:10, Thursday, 3 July 2008

TA-3(1) 10:30-10:50

Feasibility of Emotion Recognition from Breath Gas Information

Kazuhiko Takahashi[1] and Iwao Sugimoto[2]
[1] Doshisha University, Kyoto, Japan
[2] Tokyo University of Technology, Tokyo, Japan

- The breath gas sensing system is designed by using a quartz crystal resonator with a plasma-polymer film.
- Two emotions of comfortableness and no emotion are considered and the obtained average emotion recognition rates are 47.5% using the ANN and 67.5% using the SVM, respectively.



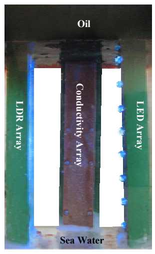
Breath gas sensing system

TA-3(2) 10:50-11:10

Wireless Sensor Node for Real-Time Thickness Measurement and Localization of Oil Spills

Agop Koulakezian, Rostom Ohannessian, Hovig Denkilkian,
Milad Chalfoun, Mohamad Khaled Joujou, Ali Chehab, Imad H. Elhajj
ECE Department, American University of Beirut, Beirut, Lebanon

- Low-cost floating oil thickness and location sensor
- Facilitates a fast and efficient oil spill cleanup
- Real-time thickness measurement based on conductivity and light absorption
- Features: insensitive to temperature, lighting conditions, waves, and water salinity



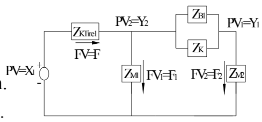
Oil Spill Sensor

TA-3(3) 11:10-11:30

Model of Airport Runway Frictional Coefficient Measure Vehicle Based on Impedance Diagrams

Xudong Shi ,Pengfei Yang,Liwen Wang and Yanhong Shi
Aeronautical Automation College,Civil Aviation University of China
Tianjin, China

- Airport runway frictional coefficient measure vehicle .
- Modeling of Impedance Diagram.
- Modelling of the hanging system.
- Modelling of the measuring system.



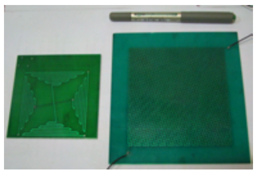
Impedance block diagram of the hanging system

TA-3(4) 11:30-11:50

TWO DIMENSIONAL INDUCTIVE ENCODER FOR MEASURING 2D DISPLACEMENT

Yosef Hojjat , Mohammad Reza Karafi , Mahmud Ghanbari
Department of mechanical engineering, tarbiat modares university
Tehran, iran

•A new method which can directly measure the displacements in X and Y direction simultaneously.



2D Inductive encoder

TA-3(5) 11:50-12:10

In Vivo Estimation of Dynamic Muscle-tendons Moment Arm Lengths Using a Wearable Sensor System

Rencheng Zheng
Kochi Univesity of Technology

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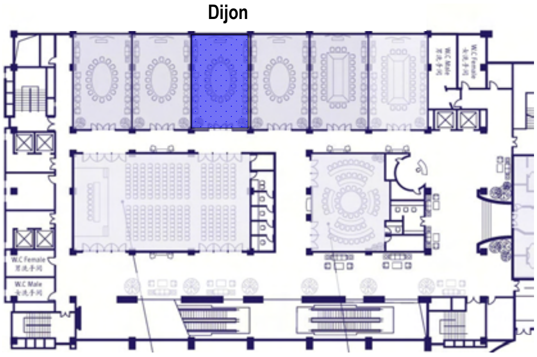


TA-4: Microactuators

Session Chairs: Chao Hu, Shenzhen Institute of Advanced Technology
Wei-Hsin Liao, Chinese University of Hong Kong

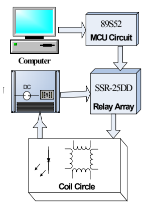
Room 4: Avignon 10:30-12:10, Thursday, 3 July 2008

TA-4(1) 10:30-10:50

A Wireless Actuation System for Micro-robot Moving Inside Pipeline

Chao Hu, Dongmei Chen, Max Q.-H. Meng, Lei Wang
Shenzhen Institute of Advanced Integration Technology, Chinese Academy of Science/Chinese University of Hong Kong Shenzhen, China

- The magnetic system and the actuation method.
- The approach how to compute the force and torque of the magnet enclosed in micro-robot
- The real time actuation system and experiment results



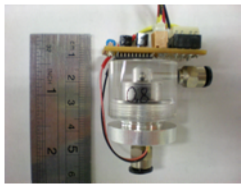
The schematic view of actuation system

TA-4(2) 10:50-11:10

Performance Evaluation of a Miniaturized Unconstrained Digital On-Off Switching Valve

Sumadi Jien, Yoichiro Ogawa, Shinichi Hirai, and Kenshin Honda
Department of Robotics, Ritsumeikan University
Shiga, Japan

- Miniaturized pneumatic digital switching valve for wearable robot.
- Simple construction, lightweight, small size and high flow rate.
- Piezoelectrically actuated valve.
- PWM-controlled valve with an embedded microcontroller and PZT driver reduces the overall size.
- Valve characteristics are described in detail by experimentation.



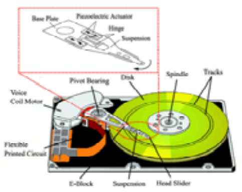
Miniaturized Unconstrained Pneumatic PWM Control Valve

TA-4(3) 11:10-11:30

Self-Sensing Actuators for Adaptive Vibration Control of Hard Disk Drives

Kwong Wah Chan and Wei-Hsin Liao
The Chinese University of Hong Kong
Shatin, N. T., Hong Kong, China

- Self-sensing piezoelectric actuators (SSAs) incorporating an adaptive mechanism for vibration control of suspensions in dual-stage hard disk drives are investigated
- Combining self-tuning adaptive compensation with the SSA technique to extract the true sensing signal
- An assembled suspension with micro piezoelectric actuators is tested
- Experimental results show the target vibration modes have been suppressed effectively using the adaptive positive position feedback controller



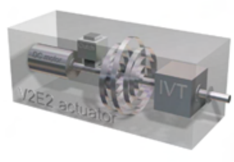
Dual-stage servo system

TA-4(4) 11:30-11:50

A Concept for a New Energy Efficient Actuator

Stefano Stramigioli, Gijs van Oort, Edwin Dertien
IMPACT institute, Control Engineering Group, University of Twente
Enschede, the Netherlands

- An ideal actuator would be able to
  - store and re-use negative work
  - deliver any static torque without consuming energy (no work= no energy)
- This can be achieved with a system consisting of
  - DC motor
  - clutching mechanism
  - elastic storage element
  - Infinite Variable Transmission



The V2E2 concept

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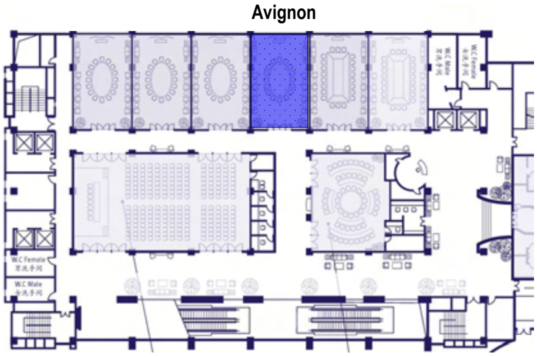


TA-5: Nonlinear & Adaptive Control I

Session Chairs: Moeed Mukhtar, Purdue University
Hideki Hashimoto, University of Tokyo

Room 5: Marseilles 10:30-12:10, Thursday, 3 July 2008

TA-5(1) 10:30–10:50

Trajectory Control for an Autonomous Bicycle with Balancer

Lychek Keo and Yamakita Masaki
Faculty of Mechanical and Control Engineering, Tokyo Institute of Technology
Tokyo, Japan

- The bicycle with the balancer dynamics is derived from Lagrangian and nonholonomic constraints.
- The trajectory tracking and balancing control systems can work very well, even when the forward velocity is zero.
- The proposed control is validated by numerical results for the bicycle stabilization and trajectory tracking

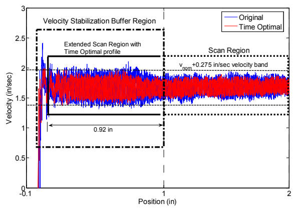

Bicycle with Balancer

TA-5(2) 10:50–11:10

Document Scanner Velocity Command Synthesis Using Time Optimal Command Shaping

Moeed Mukhtar, Peter H. Meckl, and George T.-C. Chiu
School of Mechanical Engineering, Purdue University
West Lafayette, Indiana, USA

- A buffer region exists between the velocity ramp-up and constant velocity scan to allow the transient vibrations to settle before starting a scan.
- This paper proposes using time optimal command shaping to reduce vibrations during velocity ramp-up for stepper motor belt drive systems.
- Experiment data confirms that with the proposed method, buffer region is shortened by 8% that resulted in 8% improvement in throughput. In addition the scanner footprint is also reduced by 0.9 in.



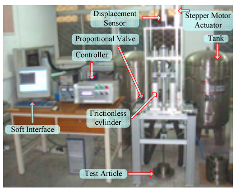
Scanhead Velocity Profile

TA-5(3) 11:10–11:30

Modeling and Control of the Pneumatic Constant Pressure System for Zero Gravity Simulation

Bo Lu, Guoliang Tao, Zhong Xiang, and Wei Zhong
State Key Laboratory of Fluid Power Transmission and Control, Zhejiang University
Hangzhou, China

- The complete dynamic mathematical model is developed.
- Valve dynamics, flow nonlinearities, pressure evolution and gas leakage in cylinders are considered.
- A hybrid piecewise control method combined with bang-bang, PD and fuzzy P+ID algorithm is proposed to minimize the pressure fluctuations.
- Steady state pressure fluctuation is less than 30Pa.



The Pneumatic Suspension Device for Zero Gravity simulation

TA-5(4) 11:30–11:50

Adaptive PID Controller Based on Online LSSVM Identification

Shang Wanfeng, Zhao Shengdun, Shen Yajing
Department of Mechatronics Engineering, Xi'an Jiaotong University
Xi'an, China

- A PID controller based on least squares support vector machines (LSSVM) identifier (PID_LSSVMI) is proposed.
- PID parameters are adjusted by gradient information of LSSVM for nonlinear time-varying system.
- Simulation is made to compare performance of three controllers, namely, PID_LSSVMI, classical PID controller, and PID_RBFNN.
- Results show the controller is effective and can achieve better control performance in control of nonlinear time-varying system.

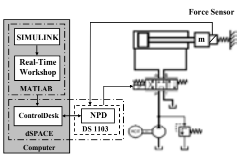
Estimation index	Input signal	Controllers		
		PID_LSSVMI	PID_RBFNN	Classical PID
RMSE	Rectangle	0.1256	0.1309	0.1203 Overshoot
	Sine	0.0073	0.0411	0.0394

TA-5(5) 11:50–12:10

New strategy of nonlinear PD controller for hydraulic force system under large variation of load stiffness

Huayong Yang, Yiming Xu, Wei Sun
State Key Laboratory of Fluid Power Transmission and Control , Zhejiang University
Hangzhou, China

- Large variation of stiffness and load.
- New approach to build the nonlinear gain functions.
- The performance of new functions is better than original .
- High performance can be guaranteed and the control algorithm is simple to realize in engineering.



The NPD controlled hydraulic force system

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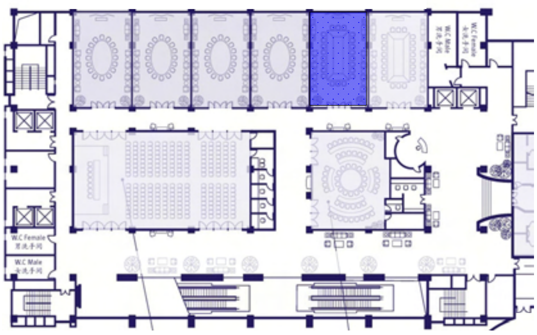
Marseilles



TP-1: Piezoelectronic Devices

Session Chairs: Wei Ren, Utah State University
Wei-Hsin Liao, Chinese University of Hong Kong

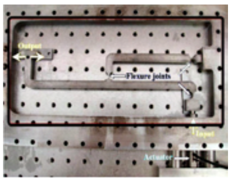
Room 1: Toulouse 14:00-15:40, Thursday, 3 July 2008

TP−1(1) 14:00−14:20

Closed-Form Equations for the Vibrations of a Flexure-Based Scott-Russell Mechanism

Y. Tian[1], B. Shirinzadeh[1], Y. Zhong[1], and D. Zhang[2]
[1]Robotics and Mechatronics Research Laboratory, Department of Mechanical and Aerospace Engineering, Monash University, Clayton, Australia
[2]School of Mechanical Engineering, Tianjin University, Tianjin, China

- Closed-form solutions for the vibration of a Scott-Russell mechanism is given.
- The dynamic model of the flexure-based mechanism is developed with consideration of the driving circuit.
- The slope control signal is utilized to improve the dynamic performance of the Scott-Russell mechanism.
- The influence of the rising time on the dynamic characteristics is investigated.



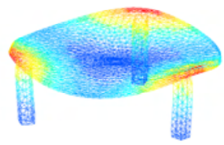
Scott-Russell Mechanism

TP−1(2) 14:20−14:40

A Multiphysics Coupled Model for Active Aerostatic Thrust Bearings

Gorka Aguirre, Farid Al-Bender, and Hendrik Van Brussel
Department of Mechanical Engineering, Katholieke Universiteit Leuven
Leuven, Belgium

- Active aerostatic bearings avoid problems related to friction and can achieve high dynamic stiffness and nanometer resolution.
- Structural flexibility, fluid dynamics, piezoelectricity and control must be considered simultaneously for an optimized design.
- A strongly coupled multiphysics finite element model is presented.



Active Air Bearing Model

TP−1(3) 14:40−15:00

Experiments with Coupled Harmonic Oscillators with Local Interaction

Larry Ballard and Wei Ren
Department of Electrical and Computer Engineering, Utah State University, Logan, UT, USA

- The purpose of this paper is to experimentally validate coupled harmonic oscillators using simulation and a team of mobile robots.
- The purpose of this control strategy is for distributed groups of mobile robots to move in a synchronized manner.
- Results of the control strategy are given for both continuous and discrete time implementations.

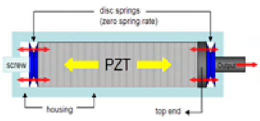
Mobile Robot Test-bed at Utah State University

TP−1(4) 15:00−15:20

Study on a PZT Actuator Based on Pre-stressed Mechanism

Yi-Cheng Huang, Jen-Ai Chao and Lin Hsiang-Jung
Department of Mechatronics Engineering
National Changhua University of Education

In this paper, a redesign of the prestress mechanism of the stack-type piezoelectric ceramic actuator is provided. Belleville (disc) springs which have a specific height-to-thickness ratio are constructed to generate a constant pre-stress force to the PZT and operated in a special condition. The zero-spring-rate preload mechanism is not only used to handle the tensile stress but also used in both the constant force actuation mode and elastic suspension mode.



TP−1(5) 15:20−15:40

Research on the Characteristic Gas Acquisition and Data Processing System for Power Transformer

Qian Suxiang, Hu Hongsheng, Cao Jian, and Yan Gongbiao
Mechanical and Electrical college, Jiaxing University
Jiaxing, China

- Introduction.
- The intelligent on-line monitoring instrument design.
- The characteristic gases acquisition signal selection.
- Sensor selection
- Information acquisition circuit
- Research on the data processing method and its realization
- Conclusions.

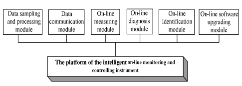


Fig.1 The intelligent on-line monitoring system

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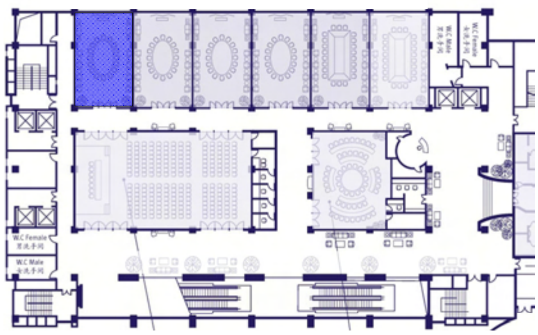


TP-2: Localization II

Session Chairs: Koichi Hashimoto, Tohoku University
Yasuharu Kunii, Chuo University

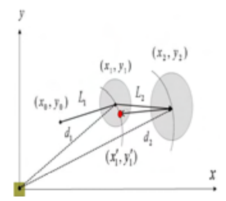
Room 2: Cannes 14:00-15:40, Thursday, 3 July 2008

TP-2(1) 14:00-14:20

A Dynamic Localization Algorithm for Mobile Robots using the iGS system

SeungKeun Cho, SukChan Shin, JangMyung Lee
Department of Electronic Engineering Pusan National University, Pusan, Korea

- Using the iGS system which is consist of three beacons and one localizer.
- Obtaining position of beacons using Auto calibration algorithm.
- Using the Dynamic Localization algorithm when the speed of the mobile robot is higher than permission error.
- Comparing position error of the normal algorithm with position error of the dynamic localization algorithm through experiment at high speed.



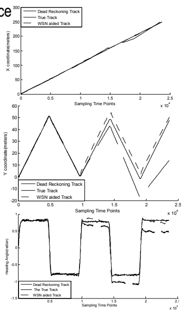
Dynamic localization algorithm

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

Particle Filtering for WSN Aided SLAM

Yangming Li1,2,3, Max Q.-H. Meng1, Huawei Liang1,3, Shuai Li1,2,3, Wanming Chen1,2,3
1.Institute of Intelligent Machine, Chinese Academy of Science
2.Department of Automation, University of Science and Technology of China
3. The Key Laboratory of Biomimetic Sensing and Advanced Robot Technology

- It does not impose any assumption to the system model and distributions of noises. So it can be applied in totally unknown environments and can be applied to dynamic system;
- It requires much small space of memories for it calculates posterior distribution recursively. That also decreases amount of calculations;
- It can be implemented as a distributed system. So the dimension can be decreased;
- It is suitable for non-linear systems and is more accurate than kalman filter based algorithms.



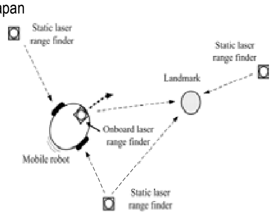
comparison of precision

TP-2(3) 14:40-15:00

Comparison of Robot Localization Methods Using Distributed and Onboard Laser Range Finders

Drazen Brscic and Hideki Hashimoto
Institute of Industrial Science, The University of Tokyo
Tokyo, Japan

- Tracking of robots by combining onboard sensors and distributed sensors.
- Two methods are considered: one based on approximation, the other using a model of the robot and environment.
- Comparison of tracking characteristics.



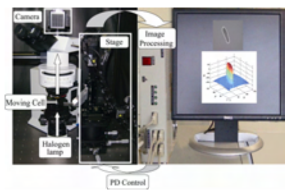
Combination of static and onboard sensors

TP-2(4) 15:00-15:20

2D tracking of single paramecium by using parallel level set method and visual servoing

Xianfeng Fei, Yasunobu Igarashi and Koichi Hashimoto
Graduate School of Information Sciences, Tohoku University
Sendai, Japan

- Our parallel LSM detects only one object for robust single cell tracking by limitation of detection area.
- By using our method, the single paramecium can be kept tracking even if another ones appear in the visual field and contact with the tracked one.



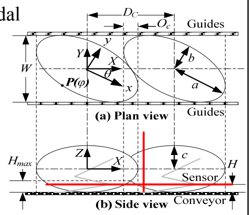
Experimental set-up

TP-2(5) 15:20-15:40

Effects of Overlapping Detection on Ellipsoidal Object Singulation with Live Broiler Handling Applications

Kok-Meng Lee, Shaohui Foong and John Jones
G.W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology
Georgia, USA

- Clustering characterization of ellipsoidal objects in narrow channel.
- Derivation of constraints imposed on sensor placement based on ellipsoidal size ranges.
- Experimental investigation using live broilers:
  - Effects of acceleration on broiler reaction.
  - Slip corrected overlapping broiler profiles.
  - Speed dependency of feature detection resolution of 2D profiles.



Design Tradeoffs of Overlapping Ellipsoidal Objects

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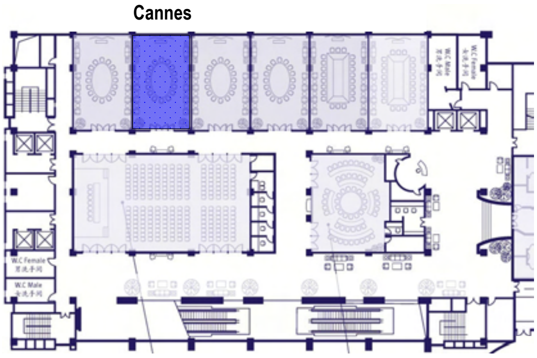


TP-3: Modeling and Simulation

Session Chairs: Lilong Cai, Hong Kong University of Science and Technology
Heinz Ulbrich, Technical University of Munich

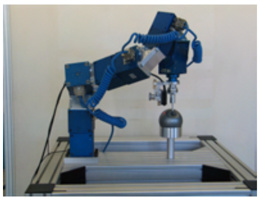
Room 3: Dijon 14:00-15:40, Thursday, 3 July 2008

TP-3(1) 14:00-14:20

Force Modeling with Parameter Estimation for Real Time Force Simulation

Chen Zhao, Gerhard Schillhuber, and Heinz Ulbrich
Institute of Applied Mechanics, Technische Universität München, Garching, Germany

- Real time force simulation and prediction based on Finite Element (FE) force models.
- Geometric modeling of the force models using measurements.
- Identification of Material parameter in the finite element force models.
- Online certification of the force models.
- Robotic contact operation system with laser and force-torque sensors.



The Contact Manipulation and Measurement System

TP-3(2) 14:20-14:40

A Calibration Method for Uncoupling Projector and Camera of a Structured Light System

Jiarui Liao and Lilong Cai
Department of Mechanical Engineering
The Hong Kong University of Science and Technology
Hong Kong, China

- Focus on the calibration of a 3D measurement system based on a structured light technique .
- Uncouple the complicated relationship between the projector and camera
- Fast, accurate and easy to implement

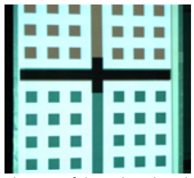


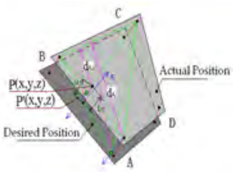
Image of the printed and projected grids simultaneously

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

Panel Adjustment Error of Large Reflector Antennas Considering Electromechanical Coupling

Wei Wang, Congsi Wang, Peng Li and Liwei Song
Research Institute on Mechatronics, Xidian University
Xi'an, Shaanxi Province, China

- The relationship between sample position vector and reflector panel displacement .
- An approximate expression for ETM (Error Transformation Matrix) between panel adjustment errors and aperture errors is derived.
- The power pattern of the antenna with panel adjustment error is calculated by Geometry Optics.
- Two types of panel adjustment errors are simulated in a three-ring segmented reflector antenna.



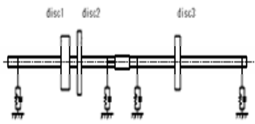
Geometric diagram for panel displacement

TP-3(4) 15:00-15:20

Analysis of Imbalance Response of the Rotor Test Bed

Honghong Fan and Xiaodong Zhang
School of Mechanical Engineering,Xi'an Jiaotong University
Xi'an, China

- This paper studies on the rotor test bed, and the supporting condition of the rotor-bearing is set in reason with the help of ANSYS .
- Critical speed of the rotor test bed is calculated .
- The response characteristic of the rotor-bearing system under various imbalances is analysed .
- The imbalance responses of different position of the rotor are shown .



Structure Scheme of the Rotor Test Bed

TP-3(5) 15:20-15:40

Research on Tooth Surface Integrality of Cold Rolling Spine

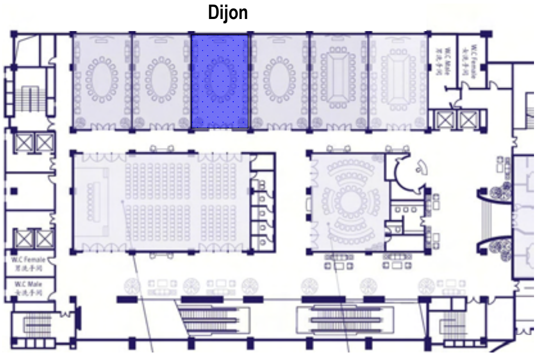
Fengkui Cui, Fengshou Zhang, Hongyu Xu ,Xiaoqiang Wang,and Yan LI
Henan University of Science & Technology ,Luoyang, China

- Based on the experimental research, metal microstructure evolvement, remnant stress distribution, hardness distribution and tooth surface quality, tooth surface integrity of cold rolling spline are studied in this paper.
- Some conclusions are obtained from the research results. Metal microstructure surface layer and remnant stress distribution are reformed. Strength of spline and tooth quality are improved. So tooth surface integrality is enhanced markedly.

Cold Rolling Spline Flank of Tooth

Room 3
Dijon

2nd Floor
Sofitel Convention Centre



TP-4: Micor/Nano Devices

Session Chairs: Shuxiang Guo, Kagawa University
Yangmin Li, University of Macau

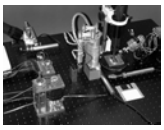
Room 4: Avignon 14:00-15:40, Thursday, 3 July 2008

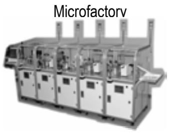
TP-4(1) 14:00-14:20

Concept proposal of a miniature on-demand factory and its efficiency evaluation

Nozomu Mishima, Shinsuke Kondoh, Shizuka Nakano, Kiwamu Ashida and Keijiro Masui
Advanced Manufacturing Research Institute, AIST
1-2 Namiki, Tsukuba, Ibaraki, Japan

- The authors proposed a conceptual miniature manufacturing system called microfactory.
- We also proposed an integrated and simple index of system efficiency.
- The analysis showed the system efficiency of the microfactory was still low.
- The second generation microfactory, on-demand factory was developed to show the miniature manufacturing system is suitable for diverse-types-and-small-quantity production.


Microfactory

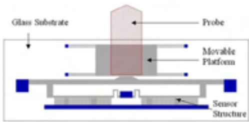

On-demand factory

TP-4(2) 14:20-14:40

MEMS Capacitive Force Sensor for Use in Microassembly

Henry K. Chu, James K. Mills, and William L. Cleghorn
Department of Mechanical and Industrial Engineering, University of Toronto, Toronto, Ontario, Canada

- This paper covers the design and modeling of a MEMS capacitive sensor for use in microassembly processes.
- The MEMS sensor has an dimension of 3600 µm x 840 µm x 10 µm and was fabricated using Micragem.
- The relationship between the input force and the resultant sensor displacement are modeled using strain energy equation.
- Experimental results showed that a capacitance change of 112.4 fF would result for a 20-µm input displacement.



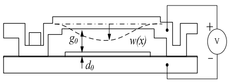
Schematic of the MEMS sensor

TP-4(3) 14:40-15:00

Analytical model of Electrostatic Fixed-Fixed Microbeam for Pull-in Voltage

Xiezhao Lin, Ji Ying
College of Mechanical and Energy Engineering, ZheJiang University
Hangzhou, Zhejiang, China

- An accurate model for predicting pull-in voltage necessitates the clear need for MEMS devices based on microbeam structures .
- Using Rayleigh–Ritz method for determining the pull-in voltage .
- The model can consider the effects of axial stress, residual stress, stretch stress gradient non-linear stiffening, and fringing fields.
- The model estimation results agree well with other published work and FEM simulation results in most common case.



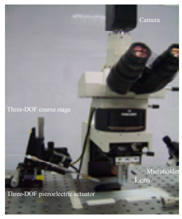
A schematic of a fixed-fixed microbeam.

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

Calibration of Piezoelectric Actuator-based Vision Guided Cell Microinjection System

Yanliang Zhang, Mingli Han, Yap Shee Cheng and Wei Tech Ang
School of Mechanical & Aerospace Engineering, Nanyang Technological University
Singapore

- Calibration of a vision guided cell microinjection system is tedious and expensive.
- Calibration sample is not required in the proposed method.
- Only one matrix is required to be calibrated.
- It is suitable for those systems that require calibration for every experiment .


Cell Microinjection System

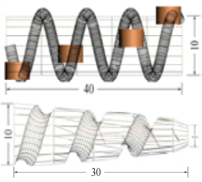
TP-4(5) 15:20-15:40

Development of a Spiral Type of Wireless Microrobot

Qinxue Pan
Dept. of Intelligent Mechanical Systems Eng'g
Kagawa University, Japan
s07d506@stmail.eng.kagawa-u.ac.jp

Shuxiang Guo
Dept. of Intelligent Mechanical Systems Eng'g
Kagawa University, Japan
Harbin Engineering University, China
guo@eng.kagawa-u.ac.jp

- Proposed a spiral type of microrobot that can move in human organs such like intestines, even blood vessels as an assumption has a great potential application for microsurgery.
- Based on the previous researches, the structure of the developed microrobot has been designed.
- Manipulated the motion of microrobot by applying the alternate magnetic field.
- Evaluated the characteristic of the microrobot.
- This microrobot will play an important role in both industrial and medical applications such as microsurgery.



The structure of the microrobot

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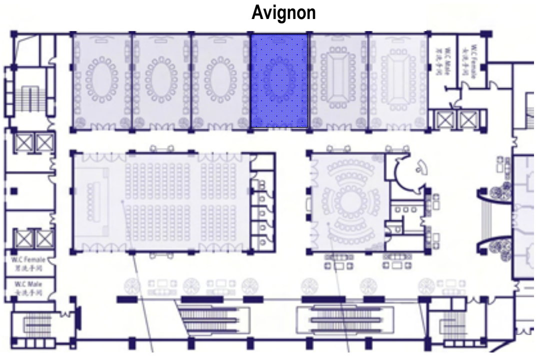
Sofitel Convention Centre

Room 4
Avignon



TP-5: Nonlinear & Adaptive Control II

Session Chairs: T.J. Tarn, Washington University
I-Ming Chen, Nanyang Technological University

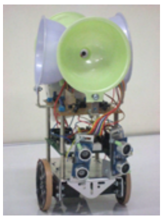
Room 5: Marseilles 14:00-15:40, Thursday, 3 July 2008

TP−5(1) 14:00−14:20

Could Chaotic Dynamics Knock at the Door of Intelligent Control?

Yongtao Li, Shuhei Kurata, Kosuke Shigematsu,
Yuta Takamura, Shogo Morita, Shigetoshi Nara
Graduate School of Natural Science and Technology, Okayama University, Okayama, Japan

- Observation of chaos in brain suggests that chaos could play an important role in their excellent (even intelligent) functioning.
- Neural network to generate chaos is constructed and implemented into a roving robot that is designed to solve ill-posed problems (2-dimensional mazes).
- In our idea, adaptability and using experience are the two important elements of intelligence, and both can be realized in our works.
- Chaotic dynamics has novel potential capability in complex control with simple rule.



Chaos traveler

TP−5(2) 14:20−14:40

An Improved Bayesian Optimization Algorithm for Fault Identification on Flight Control System

Xiaoxiong Liu, Jingping Shi, Weiguo Zhang, and Yan Wu
College of Automation Northwestern Polytechnical University, Xi'an, China

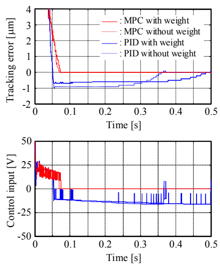
- A Mutation-based Bayesian Optimization Algorithm (BOA) is presented,
- The proposed algorithm combine the ability of guiding search of the global information and the ability of exploring search space of the local information.
- the clustering analysis algorithm for fault identification is achieved by using improved BOA.
- According to the fault analysis of aircraft actuation systems, the program of BOA for fault identification is introduced by simulation.

TP−5(3) 14:40−15:00

Model Predictive Control of Precision Stages with Nonlinear Friction

Seiji Hashimoto*, Shigeki Goka*, Toshifumi Kondo*, and Kenji Nakajima**
*Department of Electronic Engineering, Gunma University, Gunma, Japan
**Engine Development Department, Daihatsu Techner Co., Ltd., Shiga, Japan

- Model predictive control has been applied to the ultra-precision stage with frictional drive mechanism.
- Nonlinear friction compensation is performed to the stage.
- Identification and design of the MPC considering the frictional effect are investigated.
- Experiments with the linear actuator-driven stage prove the validity of the proposed design and control approach.



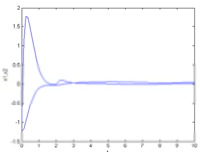
Experimental results

TP−5(4) 15:00−15:20

Controller Design for a Class of Nonlinear Fuzzy Time-varying Delay Systems

Wang Miaoxin1, Liu Jizhen1,2 and Liu Juncheng1
1.Department of Automation , North China Electric Power University,Beijing,102206,China
2.Key Laboratory of Condition Monitoring and Control for Power Plant Equipment (North China Electric Power University), Ministry of Education,Beijing 102206,China

- Fuzzy modeling for state and input time-varying Delay systems.
- Obtain a sufficient condition for the robustly asymptotic stability.
- Construct a feedback control law by solving LMI.

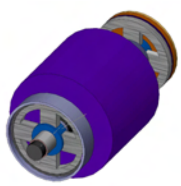


TP−5(5) 15:20−15:40

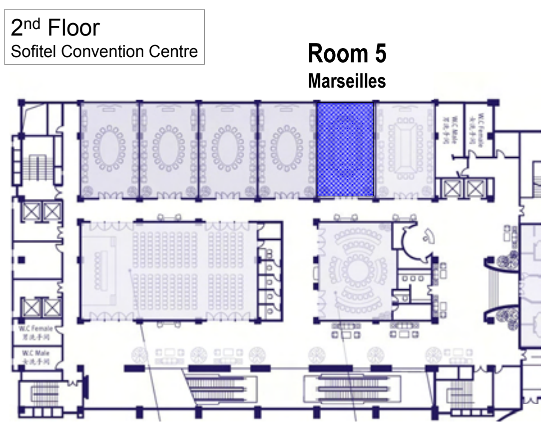
Robust Fuzzy Control of a Nonlinear Magnetic Bearing System with Computing Time Delay

Kai Zheng, Heng Liu, and Lie Yu
Institute of Mechatronics and Information Systems, Xi'an Jiaotong University
Xi'an, China

- This paper presents a robust fuzzy logic-base control scheme for a nonlinear magnetic bearing system with computing time delay. The well known Takagi-Sugeno fuzzy model is chosen to represent the nonlinear magnetic bearing. A fuzzy-model-based PDC controller is designed in terms of a proposed delay-dependent stabilization criterion which guarantees the asymptotic stability of the fuzzy model. Some simulation shows the effectiveness of the proposed method.



The magnetic bearing



TE-1: Assembly

Session Chairs: Kyong-mo Koo, Tohoku University
Kyoungchul Kong, University of California, Berkeley

Room 1: Toulouse 16:00-17:40, Thursday, 3 July 2008

TE-1(1) 16:00-16:20

Assembly Scheduling of Complex Devices with Work Force Optimization

Jianhua Yang
Tsinghua University

TE-1(2) 16:20-16:40

Effective Component Disassembly Approach for Aircraft Assembly Based on Fuzzy-Clustering Algorithm

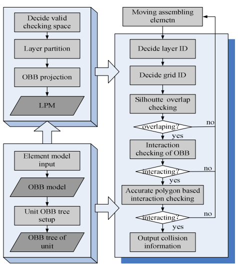
Kaifu Zhang, Lei Zhao,
Yuan Li, and Yi Shao
Northwestern Polytechnical University

TE-1(3) 16:40-17:00

Fast collision detection approach to facilitate interactive modular fixture assembly design in VE

Peng Gaoliang Wang Gongdong, Chen Yanhai
School of Mechatronics Engineering, Harbin Institute of Technology
Harbin, China

- *System memory*. the information of large numbers of bounding volumes was not need to store and the storage of thousands of polygons can be avoided. F-CD only needs less memory to store the information of LPM.
- *Cost time*. F-CD can exclude the collision possibility and avoid useless computation.
- *Practicability*. In the situation of environment models change frequently, F-CD is more suitable. Further more, F-CD can well integrate with VR developed toolkit thus more practical.



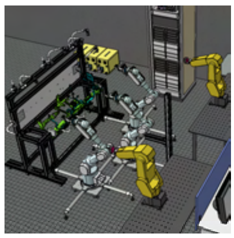
Overview of CD algorithm

TE-1(4) 17:00-17:20

Development of a Robot Car Wiring System

K. Koo, X. Jiang, K. Kikuchi, A. Konno, M. Uchiyama
Department of Aerospace Engineering, Tohoku University, Sendai, Japan

- A robot system for car wiring tasks is developed.
- The robot system is composed of three robot arms that are equipped with stereo cameras and force sensors at the wrists.
- A GUI-based teaching system is developed.
- The developed system demonstrates visual recognition, pinching a wire harness, and clamps it on a board.

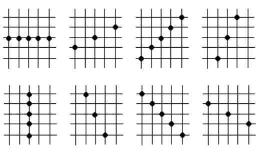


Overview of system

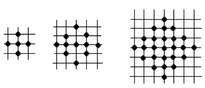
TE-1(5) 17:20-17:40

Omnidirectional Morphology Applied to Wood Defects Testing by using Computed Tomography

Dawei Qiand Lei Yu
College of Science, Northeast Forestry University
Harbin, China



Omni-directional Structure Element



Multi-scale Structure Element

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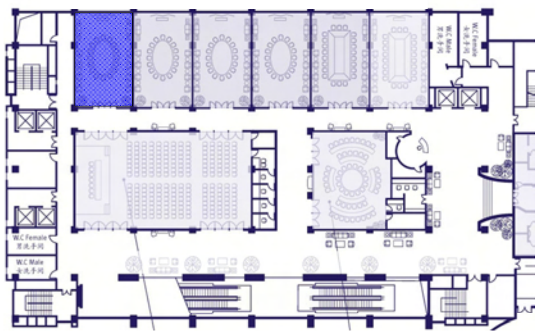
Room 1
Toulouse



TE-2: Navigation

Session Chairs: Huosheng Hu, University of Essex
Zhi-Dong Wang, Chiba University of Technology

Room 2: Cannes 16:00-17:40, Thursday, 3 July 2008

TE-2(1) 16:00-16:20

Learning Of Biologically Inspired Behaviors For Autonomous Robots By A Navigational Network

Paulo A. Jiménez, Bijan Shirinzadeh, and Yongmin Zhong
Robotics and Mechatronics Research Laboratory
(RMRL), Department of Mechanical and Aerospace Engineering, Monash University. Australia

- The navigational network is train to maintain a vector pointing to the home base based on the Path Integration (PI) system of ants.
- A search algorithm is proposed to located the home base once the navigational network has reach its reset position.

TE-2(2) 16:20-16:40

Mayfly: A Small Mapping Robot for Japanese Office Environments

Robert Ouellette
Open Thoughts Research, Waseda University, Kitakyushu, Japan
Kotaro Hirasawa
Information, Production and Systems Engineering Graduate School, Waseda University, Kitakyushu, Japan

- A robotic solution for mapping confined spaces.
- Can carry payloads greater in mass than itself.
- Mechatronic and software architecture extensible to many different kinds of robots.

The Mayfly Robot

TE-2(3) 16:40-17:00

VeE: Design and Implementation of a Generic Virtual Environment Engine

Lin Shi, Zhiliang Wang and Zhigang Li

Information and Engineering college, University of Science and Technology Beijing Beijing, China

- Architecture of the engine
- Model import, .max ->.x file, then all models loaded to the scene.
- Self defining script, it makes the scene edit easy to master, no need to program.
- Improved ray algorithm to do collision detection between objects and the land, which makes the virtual scene more realistic.
- An virtual indoor environment was constructed to test the engine, running results show it is effective and reasonable.

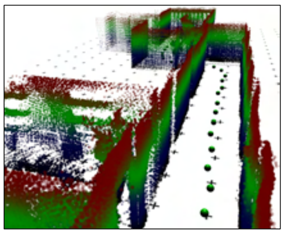
Virtual scenes builded by the engine

TE-2(4) 17:00-17:20

3D Laser Range Scanner with Hemispherical Field of View for Robot Navigation

Julian Ryde and Huosheng Hu
Department of Computing and Electronic Systems
University of Essex, Colchester, England

- A novel approach to 3D mapping based on an enhanced 3D laser scanner.
- Driven by a stepper motor to achieve omni-directional 3D scans in 3 seconds.
- Achieved by sampling Multi-Resolution Occupancy lists.
- Occupancy Lists, an efficient and compact representation.



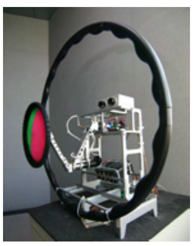
3D Mapping by using an enhanced 3D Laser scanner

TE-2(5) 17:20-17:40

The DSP Based Catcher Robot System with Stereo Vision

Chyi-Yeu Lin, Yi-Pin Chiu
Department of Mechanical Engineering
National Taiwan University of Science and Technology
Taipei, Taiwan

- The catcher robot includes a 2-DOF arm, 2-CCDs stereo vision source, and a DSP computation platform.
- The catcher robot can catch the ball thrown to it from four meters away.
- This ball fast recognition and catching techniques will be implemented to an adult-size humanoid robot soon.



The Catcher Robot

Room 2
Cannes

2nd Floor
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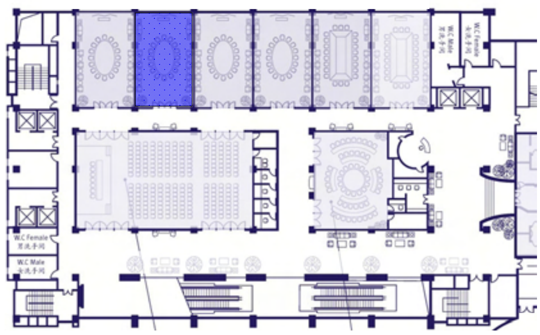


TE-3: Hybrid Systems/Control

Session Chairs: Shigeyuki Hosoe, RIKEN
Jianwei Zhang, University of Hamburg

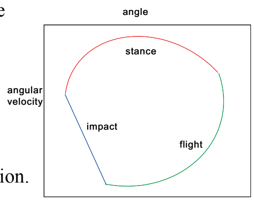
Room 3: Dijon 16:00-17:40, Thursday, 3 July 2008

TE-3(1) 16:00–16:20

A Hybrid External System for the Generation of Biped Locomotion

Y.J. Yinand S. Hosoe
Bio-mimetic Control Research Center, RIKEN, Japan

- We synthesize a hybrid system for the systematic generation of biped locomotion.
- The manifold of initial state and the parameters are specified.
- The system is robust to state perturbation.
- Simulation results illustrate and validate the method.



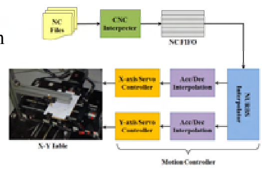
A periodic orbit of leg for biped running

TE-3(2) 16:20–16:40

On Acceleration/Deceleration Hybrid Interpolation for Multi-blocks of NURBS Curves

Hao-Wei Nien[a], Hong-Tzong Yau[a], Hsin-Chuan Su[b], Meng-Shiun Tsai[a] and Chin-Chu Sun[b]
[a]Department of Mechanical Engineering, National Chung Cheng Univ., Chia-Yi, Taiwan, R.O.C.
[b]Industrial Technology Research Institute, Hsin-Chu, Taiwan, R.O.C.

- The Acc/Dec hybrid interpolation integrates the Acc/Dec before interpolation and Acc/Dec after interpolation techniques to deal with multi-blocks of NURBS curves.
- The joint feedrates for multi-blocks of NURBS curves are computed by utilizing the derived corner error equation.
- The proposed Acc/Dec hybrid interpolation scheme improves tracking and contour accuracies.



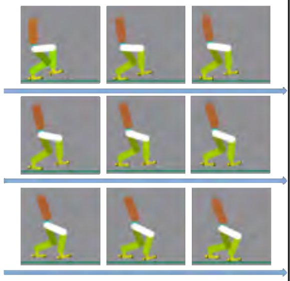
Block Diagram of Acc/Dec Hybrid Interpolation Scheme

TE-3(3) 16:40–17:00

ZMP-Based Biped Running Pattern Generation With Contact Transition of Foot

Hyeonsik Shin and Jong Hyeon Park
Mechatronics Lab, Hanyang University, Seoul, Korea

- Generates trajectory for biped robots based on the moving ZMP with SLIP model (COG or CoM).
- Results in an M-shaped ground reaction force at the support foot.
- Contact occurs at the heel first and the toe last.
- Momentum control is used.

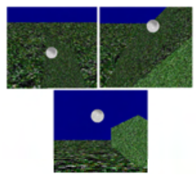


TE-3(4) 17:00–17:20

Impulse / Sliding Mode Hybrid System Modeling of Interacting Rigid Body Systems

Reza Pedrami, Brandon W. Gordon, and Ali Akgunduz
Department of Mechanical and Industrial Eng., Concordia University
Montreal, Quebec, Canada

- Hybrid modeling of rigid bodies in contact
- Impulse and collision model
- Modeling continuous contact with differential algebraic equations (DAE)
- Proposing hybrid automaton for analysis of rigid body systems

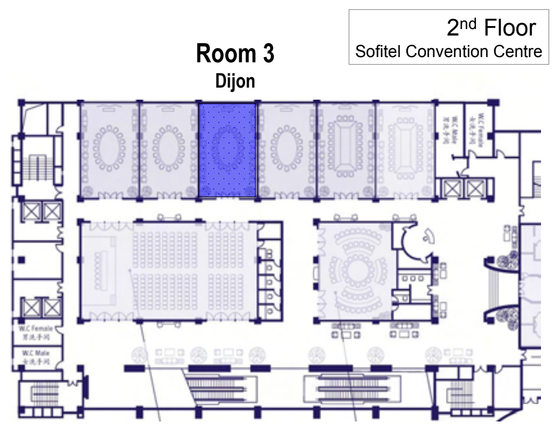


Rolling and Bouncing Ball

TE-3(5) 17:20–17:40

Research on Mode Tracking of Hybrid Systems

Changzheng Liu, Guiyun Ye
Heilongjiang Institute of Science and Technology, China



TE-4: Micro/Nano Operations

Session Chairs: Lixin Dong, ETHZ
Aiguo Ming, UEC

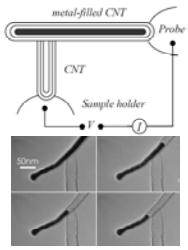
Room 4: Avignon 16:00-17:40, Thursday, 3 July 2008

TE-4(1) 16:00–16:20

Metal-filled Carbon Nanotubes for NanoMechatronics

Lixin Dong[1], Xinyong Tao[2,3], Li Zhang[1], Xiaobin Zhang[2], and Bradley J. Nelson[1]
[1]ETH Zurich, Switzerland, [2]Zhejiang Univ., China, [3]University of South Carolina, USA

- Controlled melting, evaporation and flowing of Cu and Sn intra-/inter-nanotube investigated experimentally.
- Attogram mass flow realized by electric current driven heating, diffusion, and electromigration.
- Metal atoms passed through nanotube walls. Mass loss for the cap-to-wall architecture is much smaller than that for the wall-to-cap junction.
- Kink nanotube fluidic junctions showed as potential nanoactuators.



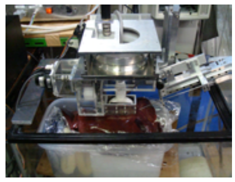
Inter-CNT ag Mass Transport

TE-4(2) 16:20–16:40

Development of the needle-insertion system for path-error correction using a CMTD(Curved Multi-Tubed Device)

Junji Furusho , Takehito Kikuchi , Hidekazu Tanaka , Hiroshi Kobayashi , Tatsuro Yamamoto , Motokazu Terayama , Morito Monden
Graduate school of Engineering, Osaka University, Osaka, Japan

- We are studying the mechanically-cotrollable insertion system for biopsy under ultrasound guidance so that we can reduce the time for the procedure and physical strain on the patient.
- In this study, we focus on needle path correction in pig liver environment after the occurrence of an error.

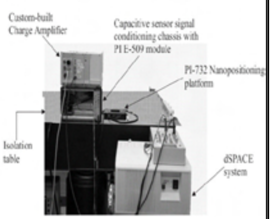

The experiment in the pig liver

TE-4(3) 16:40–17:00

Achieving High-Bandwidth Nanopositioning In Presence of Plant Uncertainties

Sumeet S. Aphale+, Santosh Devasia# and S. O. Reza Moheimani+
+University of Newcastle, Callaghan, NSW, Australia
#University of Washington, Seattle, WA, USA

- A technique to improve the tracking bandwidth of a nanopositioning platform using the inversion-based feedforward technique, by damping the system resonance is presented.
- This technique is robust and delivers accurate tracking performance in presence of changes in resonance frequency.
- It is shown that the tracking bandwidth increases from 310 Hz to 1320 Hz.
- Tracking results are presented for 15µm band-limited triangular waveforms at 10 Hz, 40 Hz and 100 Hz.



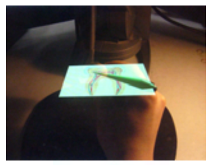
Experimental Setup

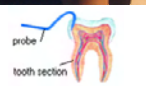
TE-4(4) 17:00–17:20

Haptic Rendering of Tissue Boundary for Surgical Training

Renge Zhou, Dangxiao Wang and Yuru Zhang
State Key Lab of Virtual Reality Technology and Systems, Beihang University
Beijing, China

- **Goal:** haptic rendering of the boundaries between tissues with different physical properties.
- **Performance metrics:** boundary perceptibility, boundary force stability and plane height stability.
- **Rendering Method:** gray area method, virtual interface method.
- **Experiments:** rendering of foggy boundary, sensing shape of boundary and tooth section simulation.





Tooth Section Simulation

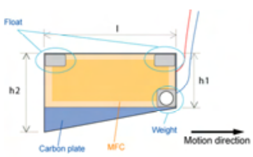
Email: rgzhou@me.buaa.edu.cn **Phone:** 8610-82338273

TE-4(5) 17:20–17:40

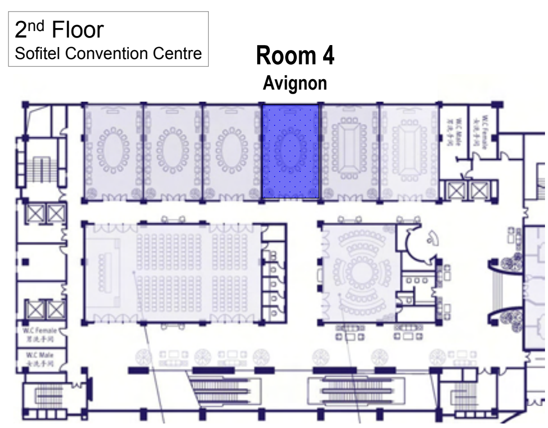
Development of Underwater Robot Using Macro Fiber Composite

Yoshinori Nagata, Seokyong Park, Aiguo Ming, and Makoto Shimojo
The University of Electro-Communications, Tokyo, Japan

- Using PZT fiber composites as actuator and sensor to develop intelligent underwater robots.
- Underwater robots can simulate the meandering movement of underwater creatures in compact and simple structure
- High speed motion at 0.32m/s has been realized.



A prototype of underwater robot



TE-5: Nonlinear & Adaptive Control III

Session Chairs: Bin Yao, Purdue University
Zhijie Wang, University of Alberta

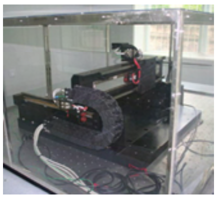
Room 5: Marseilles 16:00-17:40, Thursday, 3 July 2008

TE-5(1) 16:00–16:20

Adaptive Robust Control of Linear Motor Systems with Dynamic Friction Compensation Using Modified LuGre Model

Lu Lu [1], Bin Yao [1,2], Qingfeng Wang [1] and Zheng Chen [1]
1. The State Key Laboratory of Fluid Power Transmission and Control, Zhejiang University
2. School of Mechanical Engineering, Purdue University, West Lafayette, USA

- Details the digital implementation problems of the well-known LuGre model based dynamic friction compensation systems experiencing large range of motion speeds.
- A modified model is presented to overcome those shortcomings.
- An adaptive robust control (ARC) algorithm with friction compensation using the proposed dynamic friction model is developed and experimentally tested.
- Comparative experimental results reveal the substantially improved tracking performance at both low and high speed motions, while without the instability problem of the LuGre model based dynamic friction compensation at high speeds.



Experimental Testbed
- An Industrial Precision Gantry System

TE-5(2) 16:20–16:40

Slip Modelling, Detection and Control for Redundantly Actuated Wheeled Mobile Robots

Yuan Ping Li[1], Marcelo H. Ang Jr[2,] ..., and Wei Lin[1]
[1]Mechatronics Group, Singapore Institute of Manufacturing Technology, Singapore
[2]Department of Mechanical Engineering, National University of Singapore, Singapore

- Slip Formalization
- Kinematic Slip Model
- Slip Constrained Force Control
- Force-Controlled Guided Wheeled Mobile Robots

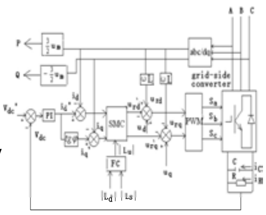
Omnidirectinoal wheeled mobile robot developed in SIMTech

TE-5(3) 16:40–17:00

The Grid-side PWM Converter of the Wind Power Generation System Based on Fuzzy Sliding Mode Control

Xingjia Yao, Chuanbao Yi, Deng ying
Shenyang University of Technology
Shenyang, China

- The equations of active power and reactive power controlled independently under the d-q frame of axes are given.
- The fuzzy sliding mode controller is designed suitably
- The simulation results show that the FSMC adopted can be held to disturbance and nonlinear variety of load.



FSMC of grid-side converter block diagram

TE-5(4) 17:00–17:20

Construction of Central Pattern Generator for Quadruped Locomotion Control

Huashan Feng and Runxiao Wang
School of Mechatronics, Northwestern Polytechnical University
Xi'an, China

- A perturbed dynamical system is driven by means of embedding arbitrary smooth target signal into a canonical oscillator with limit cycle properties.
- The shape of target signal can be adjusted on line by internal parameters.
- The coupling of the new oscillators is used to construct a CPG network.
- The outputs of system are used to control the walking of a quadruped robot with 12-DOF.

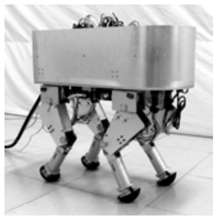


Photo of the Physical Robot

TE-5(5) 17:20–17:40

Robust Stability of Stochastic Genetic Regulatory Networks with Disturbance Attenuation

Wei Feng, Simon X. Yang, Wei Fu and Haixia Wu
College of Automation, Chongqing University
Chongqing, China

- We have dealt with the robust asymptotical stability of the stochastic GRNs with disturbance attenuation.
- By using the Lyapunov method approach, sufficient stability conditions are derived to guarantee robust asymptotical stability of the stochastic GRNs.
- One example has also been used to demonstrate the usefulness of the main results.

2nd Floor
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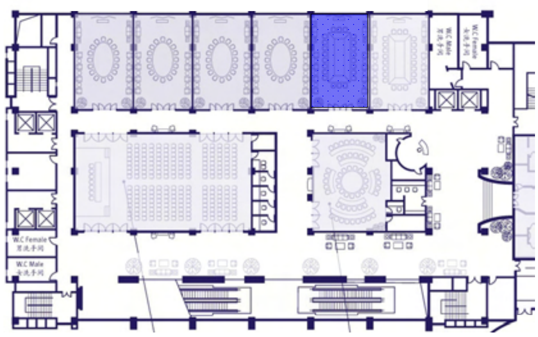
Room 5
Marseilles



Friday, 4 July 2008

FA-1	Mechatronic Applications
FA-2	Humanoid Robots I
FA-3	Hands/Fingers
FA-4	Fuzzy/Neural I
FA-5	Control Technology I
FP-1	Aerospace Applications
FP-2	Humanoid Robots II
FP-3	Multi-Agents/Robots
FP-4	Fuzzy/Neural II
FP-5	Control Technology II
FE-1	Advanced Control
FE-2	Precision Mechatronics
FE-3	Industrial Robots
FE-4	Fuzzy/Neural III
FE-5	Control Technology III

FA-1: Mechatronic Applications

Session Chairs: Jason Gu, Dalhousie University
Guangjun Liu, Ryerson University

Room 1: Toulouse 10:30-12:10, Friday, 4 July 2008

FA-1(1) 10:30-10:50

Design of a Compact 5-DOF Surgical Robot of a Spherical Mechanism: *CURES*

Sung-Kyun Kim, Won-Ho Shin, Seong-Young Ko, Jonathan Kim, and Dong-Soo Kwon
Telerobotics and Control Laboratory, KAIST
Daejeon, Korea

- **Compact surgical robot design procedure** based on **requirement specification** and **experimental evaluation**
- Workspace / force requirement for minimally invasive surgery
- 5-DOF spherical mechanism with workspace maximization
- Maximum torque simulation and Grasper operating force experiment
- Wire-driven mechanism minimization

CURES: **C**ompact **U**nit for **R**obotic **E**ndoscopic **S**urgery

FA-1(2) 10:50-11:10

Testbed for Testing an Active Body Support System for Locomotion Training

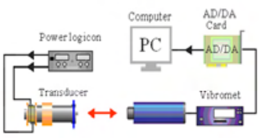
Ou Ma, Andres Hernandez,
Jianxun Liang, and Robert Paz
New Mexico State University

FA-1(3) 11:10-11:30

Experiment Study on Bonding Tool of Thermosonic Transducer for Flip-Chip Bonding

Yi-Cheng Huang, Kun-Yang Li and Chi-Hui Chen
Department of Mechatronics Engineering
National Changhua University of Education

The thermosonic bonding parameters on LEDs involve different bonding temperatures different bonding force, different bonding time and different ultrasonic power. Improving the efficiency of ultrasonic transducers plays an important role in the bonding process. However, the place of the tool on the transducer has affected transducer work efficiency.

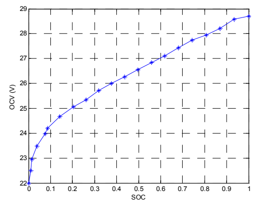


FA-1(4) 11:30-11:50

A Battery State of Charge Estimation Method using Extended Kalman Filter

Fei Zhang[1,3], Guangjun Liu[2], Lijin Fang[1]
[1] State Key Lab of Robotics, Shenyang Institute of Automation, CAS, China
[2] Department of Aerospace Engineering, Ryerson University, Canada
[3] Graduate School of the Chinese Academy of Sciences, China

- The relationship between battery OCV and SOC is assumed to be piecewisely linear and vary with the ambient temperature.
- The EKF is applied to estimate SOC directly for a lithium battery pack.
- Experimental results show that the proposed method is effective.

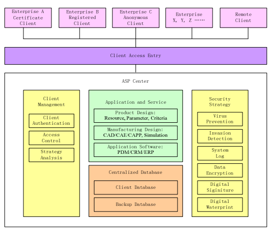


OCV vs SOC at the room temperature

FA-1(5) 11:50-12:10

Research on the Authentication Strategy of ASP Mode-based Networked Manufacturing System

Wenlan Ying, Aiping Li and Liyun Xu
Institute of Advanced Manufacturing Technology
Tongji University, Shanghai, China



Structure of ASP mode-based networked manufacturing system

- Logon Request: C-->S
- Challenge: S-->C: IDS||{(TS||RS||IDC)||ESS [Hash(TS||RS||IDC)]}
- Response: C-->S: IDC||{(TS||RS||IDS)||ESC [Hash(TS||RS||IDS)]}
- Result Feedback: S-->C

2nd Floor
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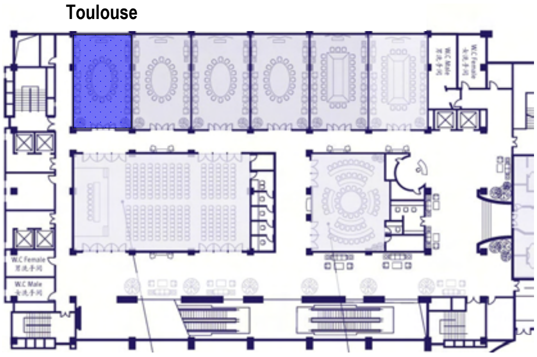
Room 1
Toulouse



FA-2: Humanoid Robots I

Session Chairs: Qiang Huang, Beijing Institute of Technology
Juan Cortes, LAAS-CNRS, Universite de Toulouse

Room 2: Cannes 10:30-12:10, Friday, 4 July 2008

FA-2(1) 10:30-10:50

Computer Control System and Walking Pattern Control for a Humanoid

Zhangguo YU[*1, *2], Qiang HUANG[*1], Jianxi LI[*1], Xuechao CHEN[*1], and Kejie LI[*1]
[*1]School of Aerospace Science and Technology, Beijing Institute of Technology, Beijing, China
[*2] School of Information Engineering, Southwest University of Science and Technology, China

- Present a distributed control system based on CAN bus and Ethernet to meet the requirement of large quantities of data and real-time motion control .
- Adopt two operating system with Windows and RT-Linux.
- Implement the hardware and software of coordinated motion control computer and joint controllers.
- Provide walking experiments.


A Humanoid Robot

FA-2(2) 10:50-11:10

Humanoid Robot Motion Generation for Nailing Task

T. Tsujita, A. Konno, S. Komizunai, Y. Nomura, T. Owa, T. Myojin, Y. Ayaz and M. Uchiyama
Department of Aerospace Engineering, Tohoku University
Sendai, Japan

- In order to exert a large force on the environment, it is effective to apply impulsive force.
- A nailing task is taken as an example of "impact motion" and experiments are carried out using a humanoid robot HRP-2.
- This paper proposes a way to generate impact motions for humanoid robots to exert a large force and a feedback control method for this application.

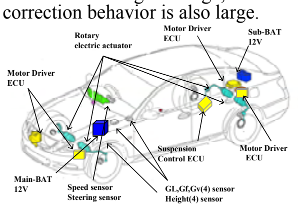
Nailing task by HRP-2

FA-2(3) 11:10-11:30

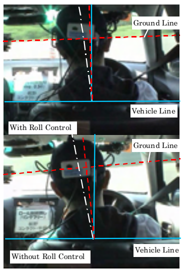
Consideration of a Human Dynamic Characteristic and Performance Evaluation of an Electric Active Suspension

Shuuichi Buma , Hidenori Kajino and Tsunenori Takahashi , Shun'ichi Doi
TOYOTA MOTOR CORPORATION and University of Kagawa , Japan

- The electric active suspension accomplishes two objectives; ride quality and inertial input control .
- When the roll angle is large, the head correction behavior is also large.



Arrangement of the system components



Driver's head movement in driving motion

FA-2(4) 11:30-11:50

The Architecture and Body of FUWA Developmental Humanoid

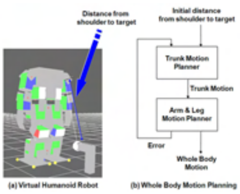
Wenqiang Zhang, Long Lu, JuyangWeng, Xiangyang Xue, and Rui Zhang
Fudan University

FA-2(5) 11:50-12:10

Motion Separating Based Whole Body Motion Planning For Humanoid Robots Using a Gradient Descent Method

Hwan-Joo Kwak and Gwi-Tae Park
Intelligent System Research Laboratory, Korea University
Seoul, Korea

- Whole body motion planner consists of several partial motion planners for trunk, arms, and legs.
- Each partial motion is controlled with low degrees of freedom using inverse-kinematics.
- A gradient descent method is used for the partial motion planner.



Whole Body Motion Planning

Room 2
Cannes

2nd Floor
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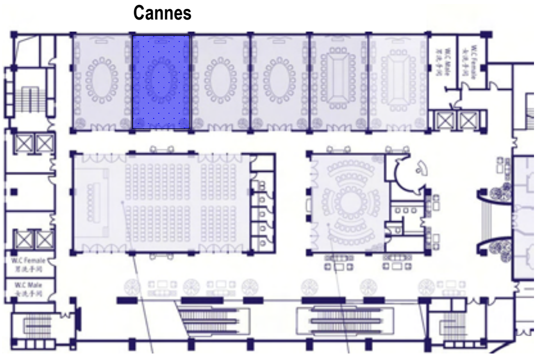


FA-3: Hands/Fingers

Session Chairs: Yisheng Guan, South China University of Technology
Yasuhisa Hirata, Tohoku University

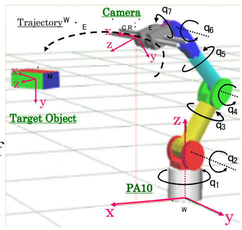
Room 3: Dijon 10:30-12:10, Friday, 4 July 2008

FA-3(1) 10:30–10:50

On-line Motion-Feedforward Pose Recognition Invariant for Dynamic Hand-eye motion

Wei Song and Mamoru Minami
Faculty of Engineering, University of Fukui
Fukui, Japan

- This paper presents a pose measurement method of a 3D object detected by hand-eye cameras.
- We propose a motion-feedforward (MFF) method to improve visual recognition dynamics, which become worse by disturbing hand-eye motion during visual servoing of the robot manipulator.
- The effectiveness of the proposed method is confirmed by experiments of object's 3D pose recognition being affected by dynamical oscillations of hand-eye cameras.



Hand-eye robot system

FA-3(2) 10:50–11:10

Automatic Optimal Grasp Planning Based On Found Contact Points

Zhixing Xue, J. Marius Zoellner and Ruediger Dillmann
Forschungszentrum Informatik
Karlsruhe, Germany

- Initial grasp is found by combining hand preshapes and approach directions.
- All the contact points between the fingers and the object are found efficiently.
- Based on the found contact points, the initial grasp with local optimal grasp quality and optimal forces for the grasp could be established.
- Experiment of building up a toy cup tower shows the feasibility of our method.

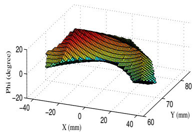
SAHand mounted on Kuka LBR Arm building up a tower with toy cups

FA-3(3) 11:10–11:30

Workspace Generation of 2-D Multifingered Manipulation under Consideration of All Constraints in the Grasp

Yisheng Guan,[1] Xianmin Zhang[1] and Hong Zhang[2,1]
[1]School of Mechanical Eng. South China Univ. of Tech.
[2]Dept. of Computing Science University of Alberta, Canada

- A numerical approach and algorithm are proposed for the workspace of multifingered hands grasping object
- Hand kinematics, object geometry, grasp types and froce constraints are taken into account

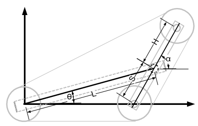


- By optimization technique and based on grasp feasibility analysis, optimization models are formulated
- An example is given and the workspace is visualized in a 3-D frame

FA-3(4) 11:30–11:50

Kinematics of transformable track

(Variable shapes single-tracked of a belt type wheel mechanism)



$$\theta = \tan^{-1}\left(\frac{s \cdot \sin\alpha}{\sqrt{l^2 - s^2 \cdot \sin^2\alpha}}\right)$$

$$\sin\theta = \frac{s}{l} \cdot \sin\alpha$$

$$\cos\theta = \frac{1}{l} \cdot \sqrt{l^2 - \frac{s^2}{l^2} \cdot \sin^2\alpha}$$

The location of P (rotation center point) is

$$(P_x, P_y) = (l \cdot \cos\theta, l \cdot \sin\theta)$$

The center point of short side wheel is

$$\begin{bmatrix} s_x \\ s_y \end{bmatrix} = \begin{bmatrix} s \cdot \sin(\frac{\pi}{2} - \alpha) + l\cos\theta \\ -s \cdot \cos(\frac{\pi}{2} - \alpha) + l \cdot \sin\theta) \end{bmatrix}$$

The center point of long side wheel is

$$\begin{bmatrix} h_x \\ h_y \end{bmatrix} = \begin{bmatrix} h \cdot \cos\alpha + l\cos\theta \\ h \cdot \sin\alpha + l \cdot \sin\theta \end{bmatrix}$$

iCrn Lab. Chonbuk Nat. Univ.

FA-3(5) 11:50–12:10

Development of A Passive Type Dance Partner Robot

Zhao Liu *, Yoshinori Koike *, Takahiro Takeda *, Yasuhisa Hirata *, Ken Chen * + and Kazuhiro Kosuge *
* Department of Bioengineering and Robotics, Tohoku University, Japan
+ Department of Precision Instruments and Mechanology, Tsinghua University, China

- PDR (Passive Dance Robot) can realize ballroom dances in cooperation with a human.
- PDR is developed based on the concept of passive robotics to guarantee higher level of safety.
- The locations of the wheels are determined by analyzing the trajectories of the male dancer's feet.
- The dynamic manipulability is utilized to determine the best orientations of the wheels.

The Passive Dance Robot

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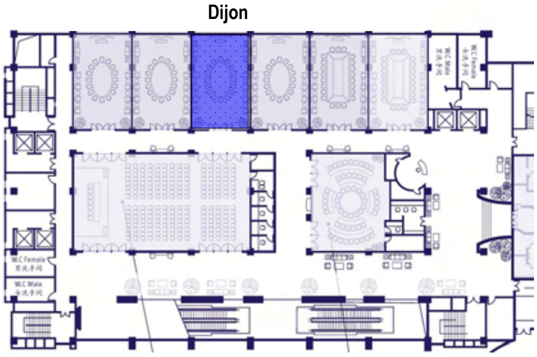
Room 3
Dijon



FA-4: Fuzzy/Neural I

Session Chairs: Simon X. Yang, University of Guelph
Jin-zhu Zhou, Xidian University

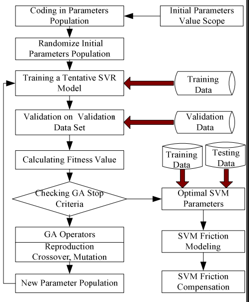
Room 4: Avignon 10:30-12:10, Friday, 4 July 2008

FA-4(1) 10:30–10:50

Friction Modelling Based on Support Vector Regression Machines and Genetic Algorithms

Jin-zhu Zhou, Jin Huang, Jing Zhou and Hua-ping Li
Research Institute of Mechatronics, Xidian University, Xi'an, China

- Data sets for friction modelling are obtained and preprocessed.
- Three optimization formulations based GA are proposed to select the parameters, and some comparisons using the polynomial kernel and RBF kernel are carried out .
- Friction modelling tool based on SVRM and GA is developed.
- According to comparison results, the friction model is obtained.



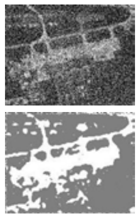
The Procedure of GA-SVRM Friction Model

FA-4(2) 10:50–11:10

Applications of Evolutionary Programming in Markov Random Field to IR Image Segmentation

Xiaodong Lu, Jun Zhou
College of Astronautics, Northwestern Polytechnical University
Shaanxi, China

- Image segmentation based on Markov Random Field with Evolutionary Programming for machine vision.
- Introduce the neighborhood interaction rules of under MRF model.
- The definitions of evolutionary rules and fitness value for individuals in MRF.
- The improved algorithm could accelerate the optimizing velocity and restrain the relative blur noise.



The noise image and the result image

FA-4(3) 11:10–11:30

Fuzzy Decision Method of Part Family Based on Similarity Measures between Vague Sets in FMS

Fuzhong Wu
Shaoxing College of Arts and Sciences
Shaoxing, China

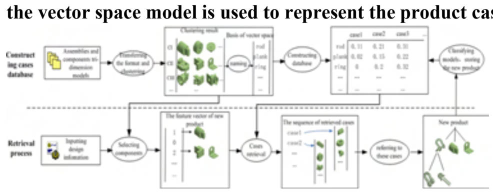
- The fuzzy choice method of part families in FMS is described.
- The similarity measures method between vague sets is employed to choose part families.
- The validity and reasonability are shown by an example

FA-4(4) 11:30–11:50

A novel method for design cases indexing and retrieval

ZHANG Xu-tang, HOU Xin, and JIN Tian-guo
School of Mechatronics , Harbin Institute of Technology
Heilongjiang, China

- **The similarity between 3D models of parts is measured by shape distribution method.**
- **Fuzzy C-means clustering algorithm is applied to classify products 3D models.**
- **the vector space model is used to represent the product case.**



framework of product design based on cases retrieval

FA-4(5) 11:50–12:10

A Fast Billet Location Algorithm using Particle Swarm Optimization

Wei Chen and Kangling Fang
School of Information Science and Engineering, Wuhan University of Science and Technology
Hubei, China

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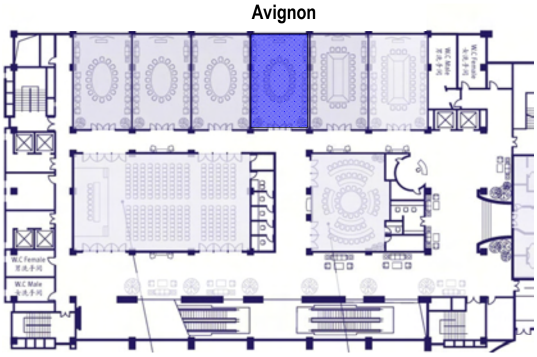
Room 4
Avignon



FA-5: Control Technology I

Session Chairs: Yasuo Yoshida, Chubu University
Yuen Kuan Yong, University of Newcastle

Room 5: Marseilles 10:30-12:10, Friday, 4 July 2008

FA-5(1) 10:30–10:50

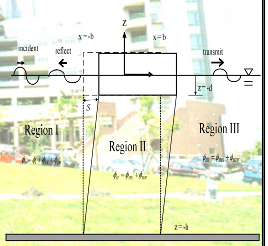
This work is partially supported by the National Science Council of Republic of China under Grant No. NSC 96-2628-E-366-004-MY2 & NSC 96-2628-E-132-001-MY2

Stability Analysis for Time Delay TLP Systems

C.W. Chen and C.Y. Chen

Department of Logistics Management, Shu-Te University, Kaohsiung, Taiwan 82445.
Department of Management Information System, Yung-Ta Institute of Technology and Commerce

- The nonlinear TLP system is modeled by T-S type fuzzy model.
- we design a nonlinear fuzzy controller by Parallel Distributed Compensation.
- A sufficient stability condition is derived in terms of Lyapunov theory and this control problem is reformulated into solving linear matrix inequalities (LMI) problem.

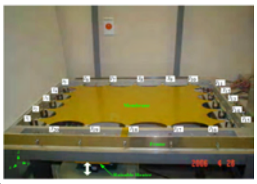


FA-5(2) 10:50–11:10

Active Flatness Control of Space Membrane Structures Using Discrete Boundary SMA Actuators

Xiaoyun Wang, Wanping Zheng, Yan-Ru Hu
Canadian Space Agency, 6767 route de l'Aeroport, St.-Hubert, QC, J3Y 8Y9, Canada

- Membrane structures may be used to build large space structures at reduced cost.
- Active flatness control is a vital technology to provide accuracy for precision applications.
- Membrane topology is designed to have tension evenly distributed.
- SMA actuators can control membrane flatness effectively.



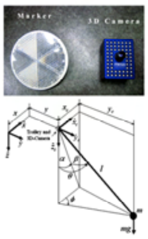
A Rectangular Membrane with Twenty Boundary SMA Actuators

FA-5(3) 11:10–11:30

Visual Feedback Control of an Overhead Crane and Its Combination with Time-Optimal Control

Yasuo Yoshida and Haruhisa Tabata
Department of Mechanical Engineering, Chubu University
Aichi, Japan

- Control of hoisting overhead crane is possible by visual feedback using 3D-camera with variable control gains.
- Combination control of the time-optimal feedforward for transportation and the visual feedback for swing suppression is practical for crane with various swing natural period.
- Installed location of a marker gives the combination control little influences.



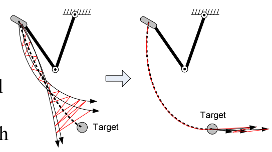
Crane with 3D-Camera

FA-5(4) 11:30–11:50

Arm Trajectory Planning by Controlling the Direction of End-point Position Error Caused by Disturbance

Tasuku YAMAWAKI, and Masahito YASHIMA
Dept. of Mechanical Systems Engineering, National Defense Academy of Japan, Kanagawa, Japan

- The present paper focuses on the generation "direction" of the end-point position error.
- We propose the technique to control the generation "direction" to the tangential direction of the target path as shown in the figure.
- We experimentally reveal that the proposed technique is very effective approach for robotic arms to achieve high robustness against a disturbance.



FA-5(5) 11:50–12:10

Research into the intelligent control of the cutter head drive system in Shield tunnelling machine based on the pattern recognition

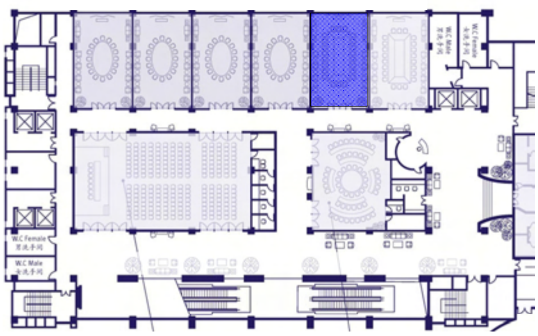
Xing Tong, Gong Guofang and Yang Huayong
State Key Laboratory of Fluid Power Transmission and Control, Zhejiang University
Zhejiang, China

- Test rig system
- Earth layer recognition method based on the statistical classification.
- Evaluation on the cutter head drive power.
- Intelligent control method to the speed of cutter head.

The shield machine test rig

2nd Floor
Sofitel Convention Centre

Room 5
Marseilles



FP-1: Aerospace Applications

Session Chairs: Takashi Kubota, JAXA
Panfeng Huang, Northwestern Polytechnical University

Room 1: Toulouse 14:00-15:40, Friday, 4 July 2008

FP−1(1) 14:00−14:20

Intelligent Micro Probe Robot for Small Body Exploration

Takashi Kubota and Tetsuo Yoshimitsu
ISAS, JAXA, Japan

- In-situ surface exploration of small body by micro probe robot
- New mobility system for micro probe robot
- Autonomous system for micro probe robot
- Flight data of the micro probe robot, MINERVA in MUSES-C missions

Small Body Exploration

FP−1(2) 14:20−14:40

Modeling and Coupling Effects Analysis of a High-speed Aircraft

Dongzhu Feng[1], Xin Wang[2]
1.School of electronic engineering, Xidian University
Xi'an, China

- The objective of this paper is to accomplish the modeling and coupling effect analysis of a high-speed aircraft.
- The model of High-speed aircraft (hypersonic waverider) has been assumed.
- The description of forces and moments system models is included.
- The analysis and policies of decoupling are put forward.

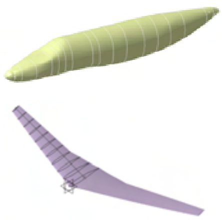
The waverider ☺

FP−1(3) 14:40−15:00

Advanced Configuration Generation Technique for the Complex Aircraft Geometry

Abdulaziz Irgashevich Azamatov, Jae-Woo Lee, Yung-Hwan Byun and Sang-Ho Kim
Department of Aerospace Information Engineering, Konkuk University
Seoul, Korea

- Proposed algorithm is effective for creation of various complex shapes
- Less design variables, time and expenses …
- Easy to implement in CAD (CATIA, NX, SolidWorks, etc.).
- Accuracy is advantage of this method



Jet Aircraft Shapes

FP−1(4) 15:00−15:20

Error Analysis of Rib Curves Based on Measured Data of Airfoil-wainscot

Xiaoqiang Wang, Zhuangde Jiang and Bing Li
Institute of Precision Engineering, Xi'an Jiaotong University
Xi'an, China

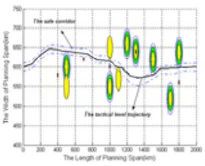
- The characteristics of accuracy control of large-scale airfoil-wainscot parts are analysed.
- The method of compensating the radius of measuring probe is presented also based on measured data from 1D scanning probe .
- Aiming at the inspection requirement of the measured part and the characteristics of rib curves, the algorithms of curve optimized matching and error analysis are proposed.
- The experimental results show that the proposed methods can meet the accuracy requirement of online in-situ inspection of airfoil-wainscot parts.

FP−1(5) 15:20−15:40

Trajectory Planning for Hypersonic Vehicle Using Improved Sparse A* Algorithm

Zhongjie Meng, Panfeng Huang, and Jie Yan
College of Astronautics, Northwestern Polytechnical University
Xi'an , China

- The characteristics of trajectory planning for hypersonic vehicle are analyzed in the paper.
- The model of the threat field and constraints are deduced.
- The planning flow and an improved S-parse A* algorithm with variable step (SAVA) are designed for the planning.
- The method has a high speed and a st-rong stability. The planned trajectory can satisfy all the flight demands.



The result of trajectory planning

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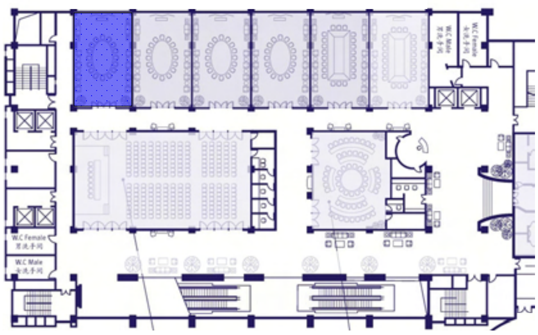
Room 1
Toulouse



FP-2: Humanoid Robots II

Session Chairs: Qiang Huang, Beijing Institute of Technology
Shumei Yu, SIA, Chinese Academy of Sciences

Room 2: Cannes 14:00-15:40, Friday, 4 July 2008

FP−2(1) 14:00−14:20

Study of Skating Robot

Takahiro Shibata, Kazuo Sato, Toshikazu Takeshita, Masami Iwase, Shoshiro Hatakeyama
Research Laboratory for Computers and Systems Engineering
Tokyo Denki University, Saitama, Japan

Walking movement in humanoid robots are needed moving on undulation plain. But energy loss by friction at grounding and changing fictitious force into thrust force are difficult. It is inefficient. Then, due to make a leg into a blade, its bearing area is reduced, and we consider a robot that realize efficient move by sliding on plane surface. In this research, we perform proposal of mechanics to realize robot like this, deriving of the dynamic equation and designing control system, and we aim to development a real system.

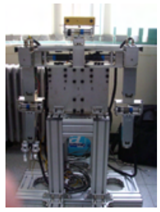
The Skating Robot

FP−2(2) 14:20−14:40

Hardware Implementation of a Neural Network Controller on FPGA for a Humanoid Robot Arm

J. S. Kim and S. Jung
Intelligent Systems and Emotional Engineering Laboratory,
Chungnam National University, Daejeon, Korea

- Control hardware for the ROBOKER is designed.
- The Radial Basis Function neural network is implemented on a FPGA chip for on-line learning and control.
- The back-propagation algorithm for the RBF network is developed.
- Experimental studies of controlling the robot arm are conducted.



The ROBOKER

FP−2(3) 14:40−15:00

Hand Posture Extraction for Object Manipulation of a Humanoid Robot

Dongyong Jia, Qiang Huang, Ye Tian, Junyao Gao, and Weimin Zhang
Intelligent Robotics Institute, School of Aerospace Science and Engineering,
Beijing Institute of Technology,Beijing, China

Hand posture extraction is important for object manipulation of a humanoid robot. This paper focuses on the problem of hand posture extraction for object manipulation of human robot BHR-2, and proposes a novel method based on blue mark to get the hand posture. Based on the attached marks, the hand is identified and segmented using a method based on multiple visual cues integration. The world coordinates of these feature points and the postures of the hand are. The effectiveness of the proposed method has been illustrated by the experimental results.

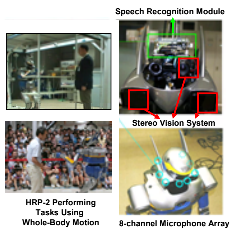
The grasp process of BHR-2

FP−2(4) 15:00−15:20

A Natural Language Instruction System for Humanoid Robots Integrating Situated Speech Recognition, Visual Recognition and On-line Whole-Body Motion Generation

Ee Sian Neo, Takeshi Sakaguchi and Kazuhito Yokoi
National Institute of Advanced Industrial Science and Technology, Japan

- We propose an integrated on-line operation system that enables a human user to operate humanoid robots by using natural language instructions.
- The proposed system is able to response to the direction of the sound source and trigger behaviors according to speech commands, by recognizing objects, triggering actions and generating whole body motions on-line.

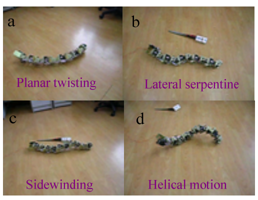


FP−2(5) 15:20−15:40

Analysis of Helical Gait of a Snake-like Robot

Shumei Yu[1,3], Shugen Ma[1,2] Bin Li[1], Yuechao Wang[1]
[1]State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences Shenyang, China
[2] Department of Robotics, Ritsumeikan University, Shiga-ken, Japan
[3]Graduate School of the Chinese Academy of Sciences Beijing, China

- Mechanism and control system of the SIA snake-like robot.
- Snake-like robot's gaits in the experiments.
- Educement of the snake-like robot's configuration under helical gait.
- Experimental study of the helical gait.



The SIA Snake-like Robot

Room 2
Cannes

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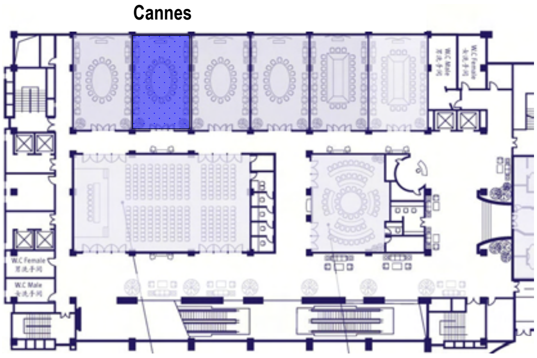


FP-3: Multi-Agents/Robots

Session Chairs: Guohui Tian, Shandong University
Songmin Jia, University of Electro-Communications

Room 3: Dijon 14:00-15:40, Friday, 4 July 2008

FP-3(1) 14:00–14:20

Programming a multi-agent system with MASL

Dominique Duhaut, Yann Le Guyadec, Michel Dubois
Valoria
Université de Bretagne Sud
Lorient Vannes, Morbihan, France

We give a formal definition of a general language:
MASL (multi-agent system language),
to express six properties:

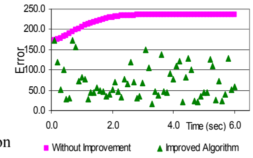
- Heterogeneous agents,
- Parallelism synchronous asynchronous,
- Communication variables, events,
- Dynamic integration of agent
- Message passing synchronous asynchronous
- Permeability dynamic

FP-3(2) 14:20–14:40

Communication Bandwidth Allocation for Decentralized Receding Horizon Control of Multiple Vehicles

Hojjat Izadi, Brandon W. Gordon, and Camille A. Rabbath
Department of Mechanical and Industrial Eng., Concordia University
Montreal, Quebec, Canada

- Cooperative Control
- Decentralized Control
- Receding Horizon Control (Model Predictive Control)
- Communication Delay
- Communication Bandwidth Allocation



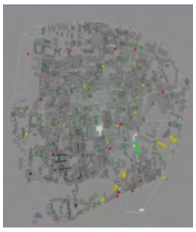
Error vs Mismatch

FP-3(3) 14:40–15:00

The Structure of Personality-Based Emotional Decision Making in Robotic Rescue Agent

Naser Ghasem Aghaei, Hamed Shahbazi ,Pedram Farzaneh, Abbas Abdolmaleki
Ali Khorsandian
Department of Computer Engineering University of Isfahan,Isfahan,Iran

- One of the most important factors which can affect decision making in a disaster environment is the structure of the agent's personality.
- we will introduce a new structure for decision making in emergency situations, which is based on emotional intelligence of the human being's mind.
- This new decision making model has been tested on a typical disaster space called Robocup Rescue Simulation .



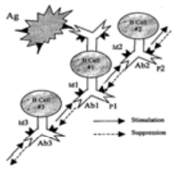
rescue simulation environment

FP-3(4) 15:00–15:20

Multi-robot Collaboration Exploration Based on Immune Network Model

Hao Wu, Guohui Tian, Bin Huang
School of Control Science and Engineering, Shandong University
Jinan, China

- Introduction
- Immune network model used to coordinate multi-robots
- Distributed robots exploration algorithm based on immune network model
- The flow of exploration strategy
- Simulation



The framework of AIS

FP-3(5) 15:20–15:40

Human Recognition Using RFID with Multi-Antenna

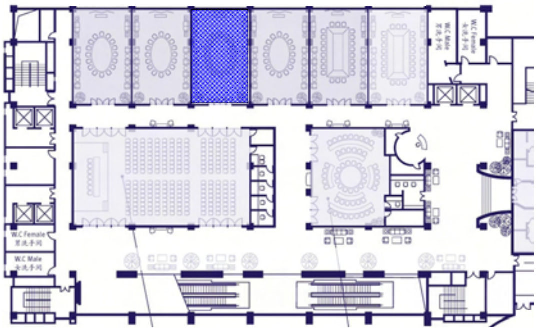
Songmin Jia, Jinbuo Sheng and Kunikatsu Takase
University of Electro-Communications
1-5-1 Chofugaoka, Chofu-City, Tokyo 182-8585, Japan

- ◆This paper proposed a method of human recognition for service mobile robot using RFID with multi-antenna and stereo vision.
- ◆The developed system used Bayes rule to calculate probability where the ID tag exists and determined ROI for stereo camera processing. We also developed the human recognition algorithm based on RFID and stereo vision.
- ◆This paper introduces the architecture of the proposed method and some experimental results.

The developed mobile robot with multi-antenna RFID

Room 3
Dijon

2[nd] Floor
Sofitel Convention Centre



FP-4: Fuzzy/Neural II

Session Chairs: Jianbo Cao, Xi'an Jiaotong University
Yoshida Toshiaki, University of Fukui

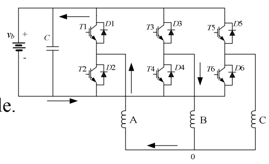
Room 4: Avignon 14:00-15:40, Friday, 4 July 2008

FP-4(1) 14:00-14:20

Regenerative-Braking Sliding Mode Control of Electric Vehicle Based on Neural Network Identification

Jianbo Cao, Binggang Cao, Peng Xu, and Zhifeng Bai
R&D Center of Electric Vehicle, Xi'an Jiaotong University
Xi'an, Shaanxi, China

- Designed the control system of electric vehicle.
- Designed and Applied neural network sliding mode controller (NNSMC) to the regenerative-braking process of electric vehicle.
- The experimental results show that: the control system with NNSMC has better performance and can recover more energy, increase the driving range than the one with traditional SMC.



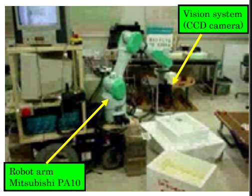
Regenerative-braking circuit

FP-4(2) 14:20-14:40

Prediction Servoing to Catch Escaping Fish Using Neural Network

Mamoru Minami and Toshiaki Yoshida
Faculty of Engineering, University of Fukui
Fukui, Japan

- This paper presents a method to predict a fish motion by Neural Network (N.N.) with on-line learning when a robot is pursuing fish-catching by a net at hand through hand-eye robot visual servoing.
- To overcome the fish's escaping strategy, which is to make a steady state distance error between the net at robot's hand and the fish, we propose prediction servoing utilizing estimeted future fish position by on-line adjusting N.N..
- The effectiveness have been proven through visual servoing and fish catching experiments.



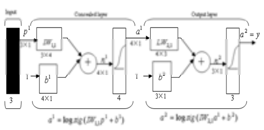
Photograph of Experimental Fish-catching System

FP-4(3) 14:40-15:00

Recognition of Wood Defects Based on Artificial Neural Network

Hongbo Mu, Dawei Qi
Department of Physics, Northeast Forestry University
Harbin, China

- X-ray is adopted as a measure method for log nondestructive testing.
- Applying MATLAB and VC++ image processing program to process the image of log with defects and extract the characters of the image.
- The mathematic model of defects recognition is established according to characteristic parameters.
- Back propagating networks is constructed.



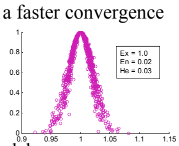
BP neural networks model

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

A Modified Particle Swarm Optimizer Based on Cloud Model

Jianping Wen, Binggang Cao
Research Institute of Electric Vehicle and System Control, Xi'an Jiaotong University,
Xi'an, China

- This paper introduces cloud model theory to the standard PSO to improve the global search ability and make a faster convergence speed of the algorithm.
- Cloud model:
  input: E_x, E_n, H_e, N.
  output: cloud drops.
- The modified PSO:
  Initialize the particle swarm using cloud model.
  update inertia weight using cloud model.
  update r_{1i}, r_{2i} using cloud model.
- Simulation.



FP-4(5) 15:20-15:40

Predictive Trajectory Planning of Vectored Thruster Underwater Vehicle with the Use of the Neuron Network

Vladimir Filaretov, and Dmitry Yukhimets
Institute for Automation and Control Processes FEB RAS

FP-5: Control Technology II

Session Chairs: Wei Wang, Nanjing University of Information Science and Technology
Simon X. Yang, University of Guelph

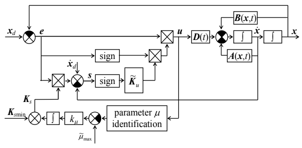
Room 5: Marseilles 14:00-15:40, Friday, 4 July 2008

FP-5(1) 14:00-14:20

Variable Structure System with the Adaptive Adjustment of Sliding Surfaces

Alexander Lebedev and Vladimir Filaretov
Robotics Laboratory, Institute of Automation and Control Processes
Vladivostok, Russia

- The multi-channel adaptive VSS for the centralized control of mechatronic object is developed.
- The conditions of stable sliding mode existence and the new law of adaptive tuning of sliding surfaces are obtained and proved.
- The high control quality and the maximal fast-action of the system are provided.



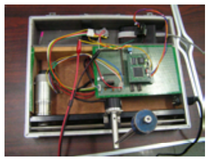
The block diagram of multi-channel adaptive variable structure system

FP-5(2) 14:20-14:40

Design and Control of an Inverted Pendulum System for Intelligent Mechatronics System Control Education

G. H. Lee and S. Jung
Intelligent Systems and Emotional Engineering Laboratory,
Chungnam National University, Daejeon, Korea

- A mechatronics system for intelligent control education is designed.
- The neuro-fuzzy control algorithm is used to control the inverted pendulum system.
- Control algorithm is embedded on a DSP chip.
- Experimental studies are conducted.



The educational kit

FP-5(3) 14:40-15:00

Design and Implementation of an Automatic Weighing System Based on CAN Bus

Xia Dong, Kedian Wang and Kai Zhao
School of Mechanical Engineering, Xi'an Jiaotong University
Xi'an, China, 710049

This paper presents a design method and its implementation of an automatic weighing system based on CAN Bus in process control of industry.

- The general situation of fieldbus and advantages of CAN bus are introduced.
- The mechanical configuration of a glass weighing system is designed and the interface circuits of its control system based on CAN bus network is implemented.
- The software design of the control system is introduced and applied into the real system.
- The efficiency and reliability of the system design is proved by the running result of the industrial system.

FP-5(4) 15:00-15:20

Placement process optimization of dual-gantry turret placement machine

Xuan DU, Zongbin LI
State Key Lab for Manu. Systems Eng., Xi'an Jiaotong Univ., Xi'an, China

- The placement process optimization of dual-gantry multi-head placement machine is decomposed to component allocation, component placement sequence and feeder arrangement.
- A two-dimensional piece-wise coding method is proposed to describe the three sub-problems in a chromosome simultaneously.
- A improved hybrid GA is used to optimize the placement process and improve the assembly efficiency.

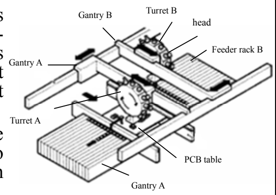
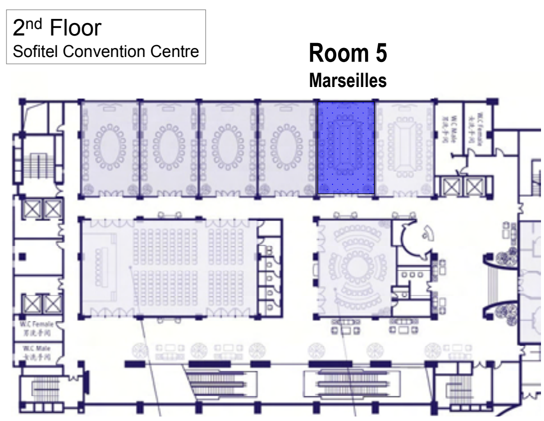


Diagram of dual-gantry multi-head gantry turret machine structure



FE-1: Advanced Control

Session Chairs: Peter X. Liu, Carleton University
Lilong Cai, Hong Kong University of Science and Technology

Room 1: Toulouse 16:00-17:40, Friday, 4 July 2008

FE-1(1) 16:00-16:20

An Improved Constrained Robust Model Predictive Control Algorithm for Linear Systems with Polytopic Uncertainty

Zhijun Li Yuntao Shi Dehui Sun Lifeng Wang

Department of Automation
North China University of TechnologyBeijing

1. **Introduction**
2. **Problem Statement**
3. **Main Results**
4. **Simulation Examples**
5. **Conclusion**

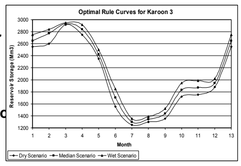
FE-1(2) 16:20-16:40

Non-Linear Multiobjective Optimization for Control of Hydropower Plants Network

S. Ali A. Moosavian A. Ghafari A. Salimi N. Abdi

Department of Mechanical Engineering, K. N. Toosi Univ. of Technology, Iran

- ✓ **A non-linear multiobjective optimization model is developed to obtain optimal annual scheduling for control of power generation in serial or parallel hydropower plants;**
- ✓ **Weighted-sum method is used to convert multiobjective optimization to single objective problem;**
- ✓ **Maximization of power generation benefits and minimization of specific water consumption are assumed as objective functions.**



Optimal rule curves for dry, median, and wet scenarios

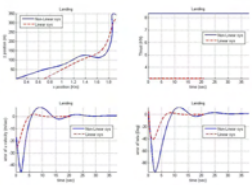
FE-1(3) 16:40-17:00

Optimal Control of an Aerial Robot

Payam Zarafshan, S. Bamdad Moosavian, S. Ali. A. Moosavian, and Mohsen Bahrami

Department of Mechanical Engineering, K. N. Toosi Univ. of Technology, Iran

- ✓ **The design procedure of a proposed optimal controller for an Aerial Robot or Unmanned Aerial Vehicle (UAV) is studied to perform a specific manoeuvre;**
- ✓ **The manoeuvre is defined as speeding on the runway, taking off, cruising, turning back to the airport, landing and braking on the runway;**
- ✓ **The two sets of longitudinal and lateral equations are simulated simultaneously and the considered UAV is studied as a 6 DOF system for performing mentioned manoeuvre.**



Performance of the optimal controller for the linear and nonlinear models in landing manoeuvre.

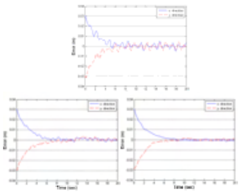
FE-1(4) 17:00-17:20

Learning-based Modified Transpose Jacobian Control of Robotic Manipulators

Mahmood Karimi S. Ali A. Moosavian

Department of Mechanical Engineering, K. N. Toosi Univ. of Technology, Iran

- ✓ **The Modified Transpose Jacobian (MTJ) algorithm, based on an approximated feedback linearization approach, does not need to a priori knowledge of the plant dynamics;**
- ✓ **In this paper, the MTJ control scheme is integrated into a learning procedure; such that the trajectory tracking converges very fast and the bettering performance is achieved after a few iterations.**



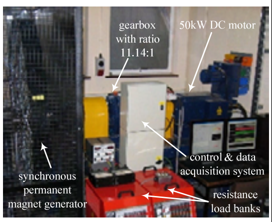
Tracking errors in the presence of un-repetitive disturbances:
(Top) MTJ, (Down Left) LMTJ 2nd trail, (Down Right) LMTJ 4th trial

FE-1(5) 17:20-17:40

Wind Turbine Condition Monitoring and Fault Diagnosis using both Mechanical and Electrical Signatures

Wenxian Yang[1], Peter J. Tavner[2], and M. Wilkinson[3]
[1]School of Mechanics, Civil Engineering & Architecture, Northwestern Polytechnical University, China
[2]School of Engineering, Durham University, Durham DH1 3LE, United Kingdom
[3]Garrad Hassan & Partners Ltd, Bristol BS2 0QD, United Kingdom

- Wind turbine drive train mechanical and generator electrical faults are detected by torque and power signal analyses.
- A new simple, cheap but effective wind turbine condition monitoring technique is heralded.



Wind Turbine Drive Train Test Rig

Room 1
Toulouse

2nd Floor
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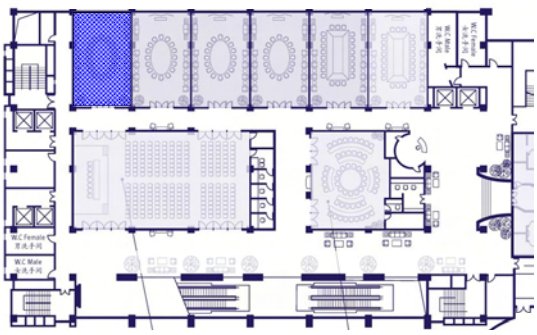


FE-2: Precision Mechatronics

Session Chairs: Aiguo Ming, University of Electro-Communications
Zhi-Dong Wang, Chiba University of Technology

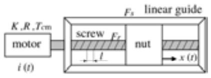
Room 2: Cannes 16:00-17:40, Friday, 4 July 2008

FE-2(1) 16:00-16:20

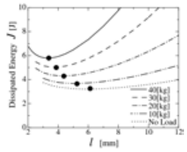
Minimization of Energy Dissipated in a Ball Screw-nut with All Kinds of Friction

Teruyuki Izumi, Zuowei Li, Hai Zhou and Masashi Kanesaka
Dept. Electronic and Control Systems Eng. Shimane University
Mastue, Japan

- In a position control, minimization of the total dissipated energy has been investigated.
- The rolling friction is represented by the forward and backward efficiencies of the ball screw-nut.
- An optimal velocity can be solved by introducing a zero crossing time.
- The dissipated energy can be reduced by applying the optimal velocity function and selecting the optimal lead.



Linear actuator with screw-nut



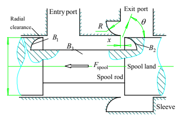
Optimal leads of screw-nut

FE-2(2) 16:20-16:40

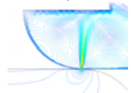
Water Hydraulics – A Novel Design of Spool-type Valves for Enhanced Dynamic Performance

Y.S.Yang, C. Semini, N.G.Tsagarakis , D.G.Caldwell
Italian Institute of Technology (IIT), Italy
Yuquan Zhu
Huazhong University of Science and Technology , China

- A novel spool-type valve for water hydraulic actuation systems was designed
- Flow field inside valves and effects of geometries, openings, and inlet/outlet condition on efflux angle were investigated numerically
- Anti-cavitation ability and effect of cavitation on efflux angle were studied



Arc spool valve



FE-2(3) 16:40-17:00

Linguistic Mechatronics

Robin Chhabra, M. Reza Emami
University of Toronto Institute for Aerospace Studies
Toronto, Canada

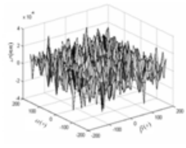
- Linguistic Mechatronics (LM) is a systematic design methodology for mechatronic systems that formalizes subjective notions of design.
- LM also simplifies the optimization process in the hope of better communication between different disciplines and considering numerous design variables concurrently.
- LM redefines the ultimate goal of design based on the qualitative notions of *wish* and *must* satisfactions.
- LM formalizes designer's subjective attitude and adjusts it based on the reality of system performance.

FE-2(4) 17:00-17:20

The High Precision-Measurement System of Gyro Rotor's Surface

Jianfeng Liu, Yong Jiang and Chuanhong Ding
The Second academy of china aerospace science & industry corporation(CASIC)
beijing, China

- The relations between the output voltage of the differential capacitance sensor and the change of the surface of a rotor are chiefly researched, and a distributing chart is obtained.
- We use the data to do some possibility analysis, error analysis and compensation.
- We get some useful parameters which can predict some dynamic properties of the rotor.

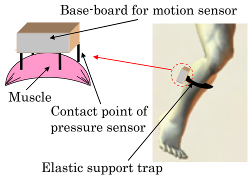

The mercator projection

FE-2(5) 17:20-17:40

Measurement of Muscle Motion for Improving Accuracy of Body-mounted Motion Sensor

Tao Liu, Yoshio Inoue, and Kyoko Shibata
Kochi University of Technology, Japan

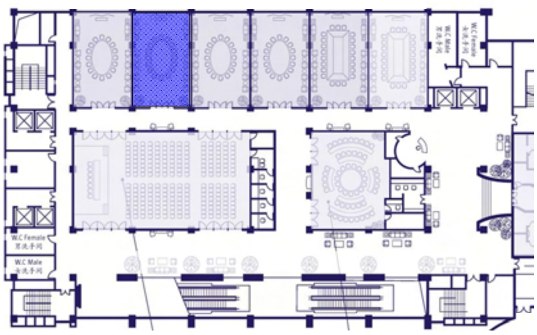
- Measure joint angle using a combination of 3D accelerometers and reaction force sensors.
- The effect of skin artefact was minimized based on the estimation of muscle motion measured using a new reaction force sensor banded with human body segment.
- The force sensor was designed using pressure sensitive electric conductive rubber (PSECR).



Muscle motion measurement

Room 2
Cannes

2nd Floor
Sofitel Convention Centre



FE-3: Industrial Robots

Session Chairs: Yunhui Liu, Chinese University of Hong Kong
Huosheng Hu, University of Essex

Room 3: Dijon 16:00-17:40, Friday, 4 July 2008

FE-3(1) 16:00–16:20

Estimation of Abnormalities in a Human Gait Using Sensor-Embedded Shoes

Kyoungchul Kong and Masayoshi Tomizuka
Department of Mechanical Engineering, University of California, Berkeley, USA

- In this paper, a new method for estimating abnormalities in the gait phases is proposed.
- The proposed method detects two major abnormalities:
  1) when the sensors measure improper foot pressure patterns, and
  2) when the human does not follow a natural sequence of gait phases.
- For mathematical realization of the algorithm, a vector analysis method is applied.

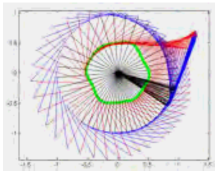

Smart Shoes

FE-3(2) 16:20–16:40

Modified Transpose Effective Jacobian Control of Underactuated Manipulators

Mahmood Karimi **S. Ali A. Moosavian**
Department of Mechanical Engineering, K. N. Toosi Univ. of Technology, Iran

- ✓ **The Modified Transpose Jacobian (MTJ) algorithm, based on an approximated feedback linearization approach, does not need to a priori knowledge of the plant dynamics. In this paper, this scheme is extended to the control problem of underactuated robots in Cartesian space;**
- ✓ **The MTEJ control law employs stored data of the control command in the revious time step, as a learning tool yield an improved performance.**


Schematics of the motion of manipulator for trajectory tracking.

FE-3(3) 16:40–17:00

Design and Hydrodynamic Modeling of A Lake Surface Cleaning Robot

Zhongli Wang, Yunhui Liu, Hoi Wut Yip, Biao Peng, Shuyuan Qiao, and Shi
Network Sensor and Robot Laboratory, Mechanical and Automation Eng.,
The Chinese University of Hong Kong, Hong Kong, China

- A robot for cleaning rubbish floating on the surface of a lake is designed
- A 3 DOF hydrodynamic model of the robot is developed
- CFD-based numerical simulations on viscous resistance have been conducted

FE-3(4) 17:00–17:20

Mobility and Agility Analysis of Walking Robot

Jihong Lee, Hyungwon Shim, and Doogyu Kim
BK21 Mechatronics Group, Chungnam National University
Daejeon, Korea

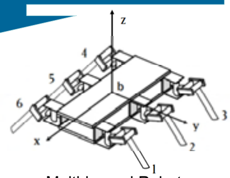
- Joint Torque Bounds: $\tau_{\min} \le \tau \le \tau_{\max}$
- Constraint Equation: $\alpha\tau \le \beta$
- Constrained Torques: $\tau_{lower} \le \tau \le \tau_{upper}$

- Dynamic Equation

$$\ddot{u} = A\tau + b$$

- Acceleration Boundary

$$\ddot{u}_b$$



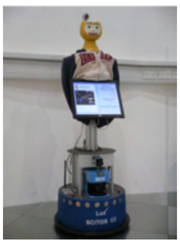
Multi-legged Robot

FE-3(5) 17:20–17:40

Lux - An Interactive Receptionist Robot for University Open Days

N. Bellotto, S. Rowland and H. Hu
Dept. of Computing and Electronic Systems, University of Essex
Colchester CO4 3SQ, United Kingdom

- Lux is an interactive service robot that provides information during university open days.
- It uses sensor fusion to track people and recognize members of staff.
- The interaction is multimodal, including touch-screen, speech, facial expressions.
- Experiments have been conducted in both laboratory and real public events



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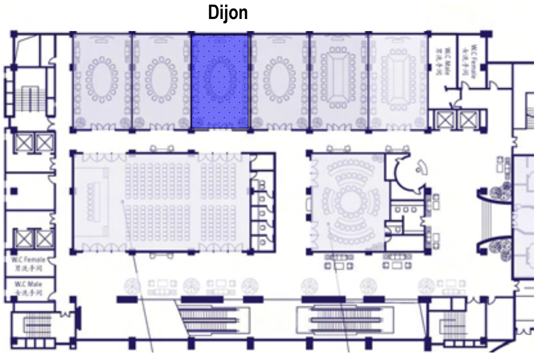
Room 3
Dijon



FE-4: Fuzzy/Neural III

Session Chairs: Dong Sun, City University of Hong Kong
Yongmin Zhong, Monash University, Australia

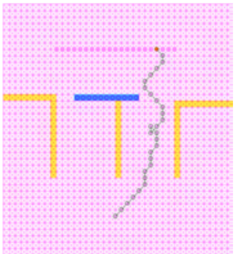
Room 4: Avignon 16:00-17:40, Friday, 4 July 2008

FE-4(1) 16:00-16:20

A New Neural Network for Robot Path Planning

Yongmin Zhong, Bijan Shirinzadeh and Yanling Tian
Robotics & Mechatronics Research Laboratory, Monash University, Australia

- An improved Hopfield-type neural network model is established for propagating the target activity among neurons;
- Elegant properties of harmonic functions are incorporated in the neural system for real-time path generation in both static and dynamic environments.



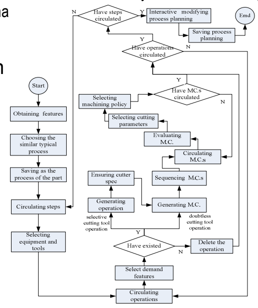
Path generation for tracking a moving target with avoidance of moving obstacles

FE-4(2) 16:20-16:40

Rule-fused Technology for Typical Processes Representation and Automatic Process Decision

Lijiang Huang, Shunuan Liu, Xitian Tian and Haicheng Yang
Institute of CAPP & Manufacturing Engineering Softerware, Northwestern Polytechnical University
Xi'an, China

- A rule-fused technology for typical processes representation and automatic process decision
- The presentation of rule-fused typical process
- The classification of production rules based on manufacturing features
- Automatic process making-decision based on rule-fused typical process



The rule-fused process decision flow

FE-4(3) 16:40-17:00

A Modified Differential Evolution Algorithm and Its Application in the Training of BP Neural Network

Yuelin Gao, School of Information & Computation Science
Junmin Liu, School of Mathematics & Computer

FE-4(4) 17:00-17:20

Orientation Correction Based Monocular SLAM for a Mobile Robot

Haoyao Chen[1], Dong Sun[2], Jie Yang[3] and Wen Shang[1]
[1]Joint Advanced Research Institute of USTC and CityU, Suzhou, China
[2]City University of Hong Kong, Hong Kong
[3]University of Science and Technology of China, Hefei, China

- Develop a new algorithm for SLAM that uses a PTZ-camera for visual observation of natural landmarks
- Propose a new Divided JCBB algorithm to quickly address the visual data association problem without bounding the number of image features.
- Propose a orientation correction method to well address the difficult SLAM orientation problem.

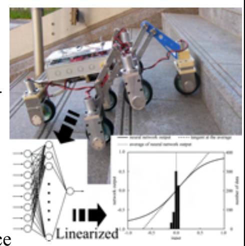
The Pioneer Robot

FE-4(5) 17:20-17:40

Controller Parameter Tuning Based on Neural Network Gradient

Masanori Sato, Atushi Kanda, and Kazuo Ishii
Department of Brain Science and Engineering, Kyushu Institute of Technology
Kitakyushu, Japan

- The wheeled mobile robot for rough terrain is developed.
- A neural network is introduced for adjustable controller for a mobile robot.
- A controller parameter tuning method using hyperplane gradient of adjusted neural network controller is proposed.
- The proposed method shows better performance than well-tuned PID controller, and almost same performance as adjusted neural network controller.



Controller Parameter Tuning

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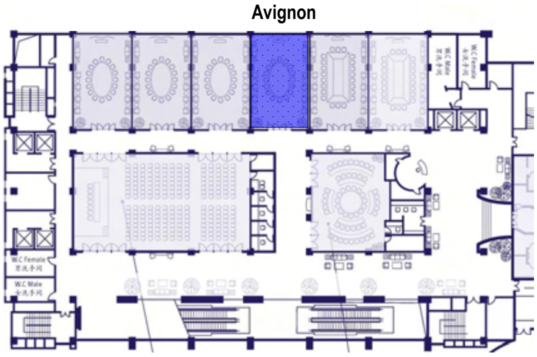
Room 4
Avignon



FE-5: Control Technology III

Session Chairs: Xutao Luo, Northwestern Polytechnical University
Denis Gillet, EPFL-LA

Room 5: Marseilles 16:00-17:40, Friday, 4 July 2008

FE-5(1) 16:00-16:20

Control of Bulk Modulus of Oil in Hydraulic Systems

Jing Wang, Guofang Gong and Huayong Yang
State Key Laboratory of Fluid Power Transmission and Control, Zhejiang University
Hangzhou, China

- A method of online vacuum degassing in a sealed system has been used to increase bulk modulus of oil.
- A device has been developed to measure bulk modulus of oil online.
- Experimental results show that bulk modulus of oil can be controlled in a real system.


Vacuum Degassing


Oil Bulk Modulus Measuring

FE-5(2) 16:20-16:40

A Self-Adaptive Control Approach for the Attitude of Aerocraft with Double-Loop SMC

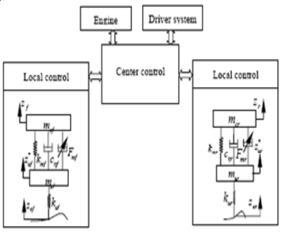
Luo Xutao, Liang Xiaogeng

FE-5(3) 16:40-17:00

Hierarchical Modeling Control of A Motorcycle Semi-Active Suspension with Six Degree-Freedoms

Wu Long, Cao Yunlu, and Chen Hualing
Department of Physics and Electromechanical Engineering, Sanming University
Sanming, China

- Construct a different motorcycle model compared to traditional model.
- The whole control framework is composed of a center control, two local controls and two uncontrollable parts.
- The method has less CPU time to depress response lag and improve ride quality.



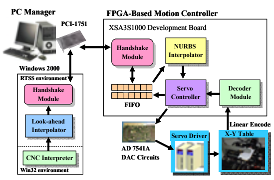
Hierarchical modeling control framework

FE-5(4) 17:00-17:20

FPGA-Based Motion Controller with Real-time Look-Ahead Function

Ming-Tzong Lin
MDE, National Formosa University, Yunlin, Taiwan, R.O.C.
Hong-Tzong Yau, Hao-Wei Nien, and Meng-Shiun Tsai
ME, National Chung Cheng University, Chia-Yi, Taiwan, R.O.C.

- PC-FPGA control architecture.
- Two-stage interpolation scheme: 1st-stage interpolation in PC; 2nd-stage interpolation in FPGA.
- Trajectory planning via PC real-time look-ahead function.
- NURBS interpolation via FPGA high-speed parallel computing.



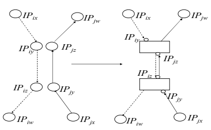
System architecture

FE-5(5) 17:20-17:40

A Novel Router Level Topology Discovery Algorithm

ZHAO Hong-Hua, CHEN Ming, Song Li-Hua, and BAI Hua-li
PLA Univ. Sci.&Tech.
Nanjing, China

- The characteristics of alias relation was concluded.
- Three Propositions was proposed when dealing with alias.
- In order to discovery router level topology efficiently the algorithm of alias filter and alias validate were put forward.


Alias Instance

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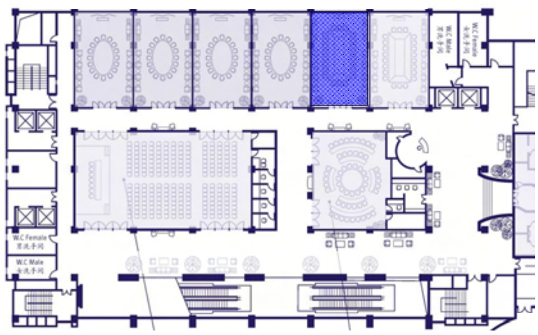
Room 5
Marseilles



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