Contents – Part I

Robot Control

Robust Backstepping Control for Spacecraft Rendezvous on Elliptical Orbits Using Transformed Variables .............................................. 3
   Yu Wang, Haibo Ji, and Kun Li

Sampled Adaptive Control for Multi-joint Robotic Manipulator with Force Uncertainties ............................................................ 14
   Hao Zhou, Hongbin Ma, Haiyang Zhan, Yimeng Lei, and Mengyin Fu

Rapid Developing the Simulation and Control Systems for a Multifunctional Autonomous Agricultural Robot with ROS ............ 26
   Zhenyu Wang, Liang Gong, Qianli Chen, Yanming Li, Chengliang Liu, and Yixiang Huang

Design of 3D Printer-Like Data Interface for a Robotic Removable Machining ................................................................. 40
   Fusaomi Nagata, Shingo Yoshimoto, Kazuo Kiguchi, Keigo Watanabe, and Maki K. Habib

Combined Model-Free Decoupling Control and Double Resonant Control in Parallel Nanopositioning Stages for Fast and Precise Raster Scanning .... 51
   Jie Ling, Zhao Feng, Min Ming, and Xiaohui Xiao

Towards the Development of Fractional-Order Flight Controllers for the Quadrotor .............................................................. 63
   Wei Dong, Jie Chen, Jiteng Yang, Xinjun Sheng, and Xiangyang Zhu

Design and Implementation of Data Communication Module for a Multi-motor Drive and Control Integrated System Based on DSP ...... 75
   Qijie Yang, Chao Liu, Jianhua Wu, Xinjun Sheng, and Zhenhua Xiong

A Novel Continuous Single-Spindle Doffing Robot with a Spatial Cam and Multiple Grippers ................................................. 87
   Sicheng Yang, Yue Lin, Wenzeng Zhang, and Liguo Cao

Robot Mechanism

Design of Wireframe Expansion and Contraction Mechanism and Its Application to Robot ................................................... 101
   Yuki Takei and Naoyuki Takesue
### Practical Robot Edutainment Activities Program for Junior High School Students
Noriko Takase, János Botzheim, Naoyuki Kubota, Naoyuki Takesue, and Takuya Hashimoto

---

### Modeling and Analysis on Position and Gesture of End-Effector of Cleaning Robot Based on Monorail Bogie for Solar Panels
Chengwei Shen, Lubin Hang, Jun Wang, Wei Qin, Yabo Huangfu, Xiaobo Huang, and Yan Wang

---

### PASA Hand: A Novel Parallel and Self-Adaptive Underactuated Hand with Gear-Link Mechanisms
Dayao Liang, Jiuya Song, Wenzeng Zhang, Zhenguo Sun, and Qiang Chen

---

### Topological Structure Synthesis of 3T1R Parallel Mechanism Based on POC Equations
Tingli Yang, Anxin Liu, Huiping Shen, and Lubin Hang

---

### Structural Analysis of Parallel Mechanisms Using Conformal Geometric Algebra
Lubin Hang, Chengwei Shen, and Tingli Yang

---

### Kinematics Analysis of a New Type 3T1R PM
Wei Qin, Lu-Bin Hang, An-Xin Liu, Hui-Ping Shen, Yan Wang, and Ting-Li Yang

---

### Power Efficiency-Based Stiffness Optimization of a Compliant Actuator for Underactuated Bipedal Robot
Qiang Zhang, Xiaohui Xiao, and Zhao Guo

---

### Analysis of the Stiffness of Modular Reconfigurable Parallel Robot with Four Configurations
Qisheng Zhang, Ruiqin Li, Qing Li, and Jingjing Liang

---

### Kinematic Analysis and Simulation of a Ball-Roller Pair for the Active-Caster Robotic Drive with a Ball Transmission
Masayoshi Wada and Kosuke Kato

---

### Robot Vision and Sensing

#### Fast Hierarchical Template Matching Strategy for Real-Time Pose Estimation of Texture-Less Objects
Chaoqiang Ye, Kai Li, Lei Jia, Chungang Zhuang, and Zhenhua Xiong

---

#### Latent Force Models for Human Action Recognition
Zhi Chao Li, Ryad Chellali, and Yi Yang

---
A Study on Classification of Food Texture with Recurrent Neural Network

Shuhei Okada, Hiroyuki Nakamoto, Futoshi Kobayashi, and Fumio Kojima

A Rotating Platform for Swift Acquisition of Dense 3D Point Clouds

Tobias Neumann, Enno Dülberg, Stefan Schiffer, and Alexander Ferrein

Kinematic Calibration and Vision-Based Object Grasping for Baxter Robot

Yanjiang Huang, Xunman Chen, and Xianmin Zhang

Stiffness Estimation in Vision-Based Robotic Grasping Systems

Chi-Ying Lin, Wei-Ting Hung, and Ping-Jung Hsieh

Contour Based Shape Matching for Object Recognition

Haoran Xu, Jianyu Yang, Zhanpeng Shao, Yazhe Tang, and Youfu Li

Robust Gaze Estimation via Normalized Iris Center-Eye Corner Vector

Haibin Cai, Hui Yu, Xiaolong Zhou, and Honghai Liu

Planning, Localization, and Mapping

Large Scale Indoor 3D Mapping Using RGB-D Sensor

Xiaoxiao Zhu, Qixin Cao, Hiroshi Yokoi, and Yinlai Jiang

Performance Comparison of Probabilistic Methods Based Correction Algorithms for Localization of Autonomous Guided Vehicle

Hyunhak Cho, Eun Kyeong Kim, Eunseok Jang, and Sungshin Kim

Driving Control by Based upon the Slip Pattern of the Ball Robot

Howon Lee, Moonjeon Hwan, Dongju Park, Seon-ho Park, and Jangmyung Lee

Straight Driving Improvement of Mobile Robot Using Fuzzy/Current Sensor

Ha-Neul Yoon, Dong-Eon Kim, Byeong-Chan Choi, Min-Chul Lee, and Jang-Myung Lee

Efficiency of Dynamic Local Area Strategy for Frontier-Based Exploration in Indoor Environments

Serkan Akagunduz, Nuri Ozalp, and Sirma Yavuz

Optimization of a Proportional-Summation-Difference Controller for a Line-Tracing Robot Using Bacterial Memetic Algorithm

Brandon Zahn, Ivan Ucherdzhiev, Julia Szeles, Janos Botzheim, and Naoyuki Kubota

Navigation and Control for an Unmanned Aerial Vehicle

Jiahao Fang, Xin Ye, Wei Dong, Xinjun Sheng, and Xiangyang Zhu
Robot Path Control with Rational-Order Calculus

Adrian Łęgowski, Michał Niezabitowski, and Tomasz Grzejszczak

Path Planning Based on Direct Perception for Unknown Object Grasping

Yasuto Tamura, Hiroyuki Masuta, and Hun-ok Lim

An Efficient RFID-Based Localization Method with Mobile Robot

Haibing Wu, Zeyu Gong, Bo Tao, and Zhouping Yin

Vector Maps: A Lightweight and Accurate Map Format for Multi-robot Systems

Khelifa Baizid, Guillaume Lozenguez, Luc Fabresse, and Noury Bouraqadi

Interactive Intelligence

Optimal Viewpoint Selection Based on Aesthetic Composition Evaluation Using Kullback-Leibler Divergence

Kai Lan and Kosuke Sekiyama

Guidance of Robot Swarm by Phase Gradient in 3D Space

Keita Horayama, Daisuke Kurabayashi, Syarif Ahmad, Ayaka Hashimoto, Takuro Moriyama, and Tatsuki Choh

Collective Construction by Cooperation of Simple Robots and Intelligent Blocks

Ken Sugawara and Yohei Doi

Can Haptic Feedback Improve Gesture Recognition in 3D Handwriting Systems?

Dennis Babu, Seonghwan Kim, Hikaru Nagano, Masashi Konyo, and Satoshi Tadokoro

Meta-module Self-configuration Strategy for Modular Robotic System

Zhen Yang, Zhuang Fu, Enguang Guan, Jiannan Xu, and Hui Zheng

Quantized Consensus of Multi-agent Systems with Additive Noise

Jiayu Chen and Qiang Ling

Design and Development of a Multi-rotor Unmanned Aerial Vehicle System for Bridge Inspection

Jie Chen, Junjie Wu, Gang Chen, Wei Dong, and Xinjun Sheng
Cognitive Robotics

Evaluating Trust in Multi-Agents System Through Temporal Difference Learning .................................................. 513
  Rishwaraj Gengarajoo, Ponnambalam S.G., and Chu Kiong Loo

Controlling Logistics Robots with the Action-Based Language YAGI .......................... 525
  Alexander Ferrein, Christopher Maier, Clemens Mühlbacher,
  Tim Niemueller, Gerald Steinbauer, and Stavros Vassos

Robots that Refuse to Admit Losing – A Case Study in Game Playing
Using Self-Serving Bias in the Humanoid Robot MARC ...................... 538
  Mriganka Biswas and John Murray

Cognitive Architecture for Adaptive Social Robotics ......................... 549
  Seng-Beng Ho

Accelerating Humanoid Robot Learning from Human Action Skills
Using Context-Aware Middleware ........................................ 563
  Charles C. Phiri, Zhaojie Ju, and Honghai Liu

Bio-inspired Robotics

Optimization of Throwing Motion by 2-DOF Variable Viscoelastic Joint
Manipulator ........................................................................ 577
  Hiroki Tomori, Hikaru Ishihara, Takahiro Nagayama,
  and Taro Nakamura

Development of the Attachment for the Cable of Peristaltic Crawling Robot
to Reduce Friction in Elbow Pipe ........................................ 589
  Ryutaro Ishikawa, Takeru Tomita, Yasuyuki Yamada,
  and Taro Nakamura

Multimodal Recurrent Neural Network (MRNN) Based Self Balancing
System: Applied into Two-Wheeled Robot .............................. 596
  Azhar Aulia Saputra, Indra Adji Sulistijono, and Naoyuki Kubota

A Prototype of a Laparoscope Holder Operated by a Surgeon Through
Head and Jaw Movements ................................................. 609
  Shunji Moromugi, Tamotsu Kuroki, Tomohiko Adachi, Kotaro Oshima,
  Daiki Ito, Hyan Gi Kim, Amane Kitasato, and Shinichiro Ohno

The Design and the Gait Planning Analysis of Hexapod Wall-Climbing
Robot ............................................................................. 619
  Yongjie Li, Jiaxin Zhai, Weixin Yan, and Yanzheng Zhao
Smart Material Based Systems

Adaptive Control of Magnetostrictive-Actuated Positioning Systems with Input Saturation .......................................................... 635
Zhi Li and Chun-Yi Su

Adaptive Dynamic Surface Inverse Output Feedback Control for a Class of Hysteretic Systems ........................................... 646
Xiuyu Zhang, Dan Liu, Zhi Li, and Chun-Yi Su

A Neural Hysteresis Model for Smart-Materials-Based Actuators ........ 663
Yu Shen, Lianwei Ma, Jinrong Li, Xiuyu Zhang, Xinlong Zhao, and Hui Zheng

Modeling of Rate-Dependent Hysteresis in Piezoelectric Actuators Using a Hammerstein-Like Structure with a Modified Bouc-Wen Model . . . 672
Chun-Xia Li, Lin-Lin Li, Guo-Ying Gu, and Li-Min Zhu

A High Efficiency Force Predicting Method of Multi-axis Machining Propeller Blades ......................................................... 685
Zerun Zhu, Rong Yan, Fangyu Peng, Kang Song, Zepeng Li, Chaoyong Guo, and Chen Chen

A High-Flexible ACC/DEC Look-Ahead Strategy Based on Quintic Bézier Feed Rate Curve .................................................... 697
Hui Wang, Chao Liu, Jianhua Wu, Xinjun Sheng, and Zhenhua Xiong

Data-Driven Feedforward Decoupling Filter Design for Parallel Nanopositioning Stages ..................................................... 709
Zhao Feng, Jie Ling, Min Ming, and Xiaohui Xiao

Study on the Relationship Between the Stiffness of RV Reducer and the Profile Modification Method of Cycloid-pin Wheel ............. 721
Jianing Wang, Jingjun Gu, and Yonghua Yan

Mechatronics Systems for Nondestructive Testing

Proposal of Carburization Depth Inspection of Both Surface and Opposite Side on Steel Tube Using 3D Nonlinear FEM in Consideration of the Carbon Concentration ...................................................... 739
Saijiro Yoshioka and Yuji Gotoh

Evaluation for Electromagnetic Non-destructive Inspection of Hardened Depth Using Alternating Leakage Flux on Steel Plate .......... 749
Kazutaka Nishimura and Yuji Gotoh
Estimation of Mutual Induction Eddy Current Testing Method Using Horizontal Exciting Coil and Spiral Search Coil

Tatsuya Marumoto, Yuta Motoyasu, Yuji Gotoh, and Tatsuo Hiroshima

Examination of Evaluation Method of Power Generation Current Using Static Magnetic Field Around Polymer Electrolyte Fuel Cell

Daiki Nagata, Yuji Gotoh, Ryota Naganoma, and Masaaki Izumi

Evaluation of Nondestructive Inspecting Method of Surface and Opposite Side Defect in Steel Plate Using Large Static and Minute Alternating Magnetic Field

Akira Fujii and Yuji Gotoh

Evaluation of Positions of Thinning Spots in a Dual Structure Using ECT with DC Magnetization

Daigo Kosaka

Author Index
Contents – Part II

Social Robotics

Location Monitoring Support Application in Smart Phones for Elderly People, Using Suitable Interface Design .................................................. 3
Julia Szeles and Naoyuki Kubota

Evaluating Human-Robot Interaction Using a Robot Exercise Instructor at a Senior Living Community ......................................................... 15
Lundy Lewis, Ted Metzler, and Linda Cook

Estimating the Effect of Dynamic Variable Resistance in Strength Training ................................................................. 26
Tomosuke Komiyama, Yoshiki Muramatsu, Takuya Hashimoto, and Hiroshi Kobayashi

Smart Device Interlocked Robot Partner for Elderly Care ................................................................. 36
Takenori Obo, Siqi Sun, and Naoyuki Kubota

Simplified Standing Function Evaluation System for Fall Prevention .................................................... 48
Mami Sakata, Keisuke Shima, Koji Shimatani, and Hiroyuki Izumi

Psychographic Profiling for Use in Assistive Social Robots for the Elderly ........................................ 58
Kayo Sakamoto, Sue-Ann Lee Ching Fern, Lin Han, and Joo Chuan Tong

Human Support Robotics

Interface Design Proposal of Card-Type Programming Tool ......................................................... 71
Naoki Tetsumura, Toru Oshima, Ken’ichi Koyanagi, Hiroyuki Masuta, Tatsuo Motoyoshi, and Hiroshi Kawakami

Direct Perception of Easily Visible Information for Unknown Object Grasping ......................................................... 78
Hiroyuki Masuta, Tatsuo Motoyoshi, Ken’ichi Koyanagi, Toru Oshima, and Hun-ok Lim

Multi-layer Situation Map Based on a Spring Model for Robot Interaction ........................................ 90
Satoshi Yokoi, Hiroyuki Masuta, Toru Oshima, Ken’ichi Koyanagi, and Tatsuo Motoyoshi

Service Robot Development with Design Thinking ......................................................... 102
Takeo Ainoya, Keiko Kasamatsu, Kouhei Shimizu, and Akio Tomita
Advancement in the EEG-Based Chinese Spelling Systems .......................... 110  
Minghui Shi, Changle Zhou, Min Jiang, Qingyang Hong, Fei Chao, Jun Xie, Weifeng Ren, Dajun Zhou, Tianyu Yang, and Xiangqian Liu

A Wearable Pressure Sensor Based on the Array of Polymeric Piezoelectric Fiber with Metal Core ................................................................. 118  
Ran Chen, Weiting Liu, Xiaodong Ruan, and Xin Fu

Practical-Use Oriented Design for Wearable Robot Arm ............................. 125  
Akimichi Kojima, Hirotake Yamazoe, and Joo-Ho Lee

Robot Fault Diagnosis Based on Wavelet Packet Decomposition and Hidden Markov Model ................................................................. 135  
You Wu, Zhuang Fu, Shuwei Liu, Jian Fei, Zhen Yang, and Hui Zheng

Assistive Robotics

Development of Pneumatic Myoelectric Hand with Simple Motion Selection ................................................................. 147  
Kotaro Nishikawa, Masayuki Shakutsui, Kentaro Hirata, and Masahiro Takaiwa

Research of Rehabilitation Device for Hemiplegic Knee Flexion Based on Repetitive Facilitation Exercise ................................................. 158  
Yong Yu, Mizuki Kodama, Hirokazu Matsuwaki, Kotaro Taniguchi, Shuji Matsumoto, Hiroko Yamanaka, Isamu Fukuda, Megumi Shimodozono, and Kazumi Kawahira

Development of an Add-on Driving Unit for Attendant Propelled Wheelchairs with Sensorless Power Assistance ........................................... 168  
Masashi Shibayama, Chi Zhu, and Wang Shui

Modeling Dynamic of the Human-Wheelchair System Applied to NMPC ...... 179  
Gabriela M. Andaluz, Víctor H. Andaluz, Héctor C. Terán, Oscar Arteaga, Fernando A. Chicaiza, José Varela, Jessica S. Ortiz, Fabricio Pérez, David Rivas, Jorge S. Sánchez, and Paúl Canseco

FESleeve: A Functional Electrical Stimulation System with Multi-electrode Array for Finger Motion Control .................................................. 191  
Tianqu Shao, Xiang Li, Hiroshi Yokoi, and Dingguo Zhang

A Calibration Method for Interbody Distance in Lumbosacral Alignment Estimation ................................................................. 200  
Yoshio Tsuchiya, Takashi Kusaka, Takayuki Tanaka, Yoshikazu Matsuo, Makoto Oda, Tsukasa Sasaki, Tamotsu Kamishima, and Masanori Yamanaka
Human-Wheelchair System Controlled by Through Brain Signals . . . . . . . . . . 211
Jessica S. Ortiz, Víctor H. Andaluz, David Rivas, Jorge S. Sánchez,
and Edison G. Espinosa

Adaptive Control of the Human-Wheelchair System Through Brain Signals . . . 223
Víctor H. Andaluz, Jessica S. Ortiz, Fernando A. Chicaiza, José Varela,
Edison G. Espinosa, and Paul Canseco

Intelligent Space

Acquiring Personal Attributes Using Communication Robots for
Recommendation System ....................................................... 237
Aoi Suzuki, Eri Sato-Shimokawara, Toru Yamaguchi,
and Kentaro Ikehata

Robot Control Interface System Using Glasses-Type Wearable Devices . . . . . 247
Eichi Tamura, Yoshihiro Yamashita, Yihsin Ho, Eri Sato-Shimokawara,
and Toru Yamaguchi

Relationship Between Personal Space and the Big Five with Telepresence
Robot ................................................................. 257
Yoshifumi Kokubo, Eri Sato-Shimokawara, and Toru Yamaguchi

Development of Behavior Observation Robot Ver.2. .......................... 266
Motoyasu Tooyama, Kazuyoshi Wada, and Mutsuki Yageta

A Collaborative Task Experiment by Multiple Robots in a Human
Environment Using the Kukanchi System .................................. 276
Kazuma Fujimoto, Takeshi Sasaki, Midori Sugaya, Takashi Yoshimi,
Makoto Mizukawa, and Nobuto Matsuhira

Mel-Frequency Cepstral Coefficient (MFCC) for Music Feature Extraction
for the Dancing Robot Movement Decision .................................. 283
Indra Adji Sulistijono, Renita Chulafa Urrosyda, and Zaqiatud Darojah

Sensing and Monitoring in Environment and Agricultural Sciences

Random Forests Hydrodynamic Flow Classification in a Vertical Slot
Fishway Using a Bioinspired Artificial Lateral Line Probe .................. 297
Shinji Fukuda, Jeffrey A. Tuhtan, Juan Francisco Fuentes-Perez,
Martin Schletterer, and Maarja Kruusmaa

Assessment of Depth Measurement Using an Acoustic Doppler Current
Profiler and a CTD Profiler in a Small River in Japan ....................... 308
Shinji Fukuda, Kazuaki Hiramatsu, and Masayoshi Harada
Potential for Automated Systems to Monitor Drying of Agricultural Products Using Optical Scattering ................................. 317
  Marcus Nagle, Giuseppe Romano, Patchimaporn Udomkun,
  Dimitrios Argyropoulos, and Joachim Müller

Online Monitoring System on Controlled Irrigation Experiment for Export Quality Mango in Thailand ............................... 328
  Eriko Yasunaga, Shinji Fukuda, Wolfram Spreer, and Daisuke Takata

Intensity Histogram Based Segmentation of 3D Point Cloud Using Growing Neural Gas .................................................. 335
  Shin Miyake, Yuichiro Toda, Naoyuki Kubota, Naoyuki Takesue,
  and Kazuyoshi Wada

Influence of Water Supply on CO₂ Concentration in the Rootzone of Split-Root Potted Longan Trees ............................. 346
  Winai Wiriya-Alongkorn, Wolfram Spreer, Somchai Ongprasert,
  Klaus Spohrer, and Joachim Müller

Human Data Analysis

Development of an Uchi Self-learning System for Mutsumi-ryu-style Shamisen Using VR Environment ............................... 359
  Takeshi Shibata, Kazutaka Mitobe, Takeshi Miura, Katsuya Fujiwara,
  Masachika Saito, and Hideo Tamamoto

Action Learning to Single Robot Using MARL with Repeated Consultation: Realization of Repeated Consultation Interruption for the Adaptation to Environmental Change .............................. 371
  Yoh Takada and Kentarou Kurashige

A Study on the Deciding an Action Based on the Future Probabilistic Distribution ....................................................... 383
  Masashi Sugimoto and Kentarou Kurashige

Rehabilitation Support System Using Multimodal Interface Device for Aphasia Patients ................................................. 395
  Takuya Mabuchi, Joji Sato, Takahiro Takeda, and Naoyuki Kubota

Post-operative Implanted Knee Kinematics Prediction in Total Knee Arthroscopy Using Clinical Big Data .......................... 405
  Belayat Md. Hossain, Manabu Nii, Takatoshi Morooka, Makiko Okuno,
  Shiichi Yoshiya, and Syoji Kobashi

Camera-Projector Calibration - Methods, Influencing Factors and Evaluation Using a Robot and Structured-Light 3D Reconstruction ................................. 413
  Jonas Lang and Thomas Schlegl


## Robot Hand

### Automatic Grasp Planning Algorithm for Synergistic Underactuated Hands

*Lei Hua, Xinjun Sheng, Wei Lv, and Xiangyang Zhu*

Feasibility of a Sensorimotor Rhythm Based Mobile Brain-Computer Interface.

*Shiyong Su, Xiaokang Shu, Xinjun Sheng, Dingguo Zhang, and Xiangyang Zhu*

### Brain Gamma Oscillations of Healthy People During Simulated Driving

*Min Lei, Guang Meng, Wenming Zhang, Joshua Wade, and Nilanjan Sarkar*

### Virtual Environments for Hand Rehabilitation with Force Feedback

*Wei Lv, Xinjun Sheng, Lei Hua, and Xiangyang Zhu*

### A Novel Tactile Sensing Array with Elastic Steel Frame Structure for Prosthetic Hand

*Chunxin Cu, Weiting Liu, Xiaodong Ruan, and Xin Fu*

### Visualization of Remote Taskspace for Hand/Arm Robot Teleoperation

*Futoshi Kobayashi, Yoshiyuki Kakizaki, Hiroyuki Nakamoto, and Fumio Kojima*

## Author Index

*489*
Intelligent Robotics and Applications
9th International Conference, ICIRA 2016, Tokyo, Japan,
August 22-24, 2016, Proceedings, Part I
Kubota, N.; Kazuo, K.; Liu, H.; Obo, T. (Eds.)
2016, XXIII, 801 p. 555 illus., Softcover
ISBN: 978-3-319-43505-3