

# **Joint 41st International Symposium on Robotics and 6th German Conference on Robotics 2010**

**(ISR/ROBOTIK 2010)**

**Munich, Germany  
7-9 June 2010**

**Volume 1 of 2**

**ISBN: 978-1-61738-719-7**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2010) by VDE Conference Department  
All rights reserved.

Printed by Curran Associates, Inc. (2010)

For permission requests, please contact VDE Conference Department  
at the address below.

VDE Conference Department  
Stresemannallee 15  
D-60596 Frankfurt/Main  
Germany

Phone: 49 69 630 8229  
Fax: 49 69 9631 52 13

vde-conferences@vde.com

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

Volume 1

## TACTILE AND ACOUSTIC SENSING

<b>Tracking Blood Vessels in Human Forearms Using Visual Servoing.....</b>	1
<i>Thiusius Rajeeth Savarimuthu, Morten Hansen, Lars-Peter Elekilde</i>	
<b>Development of Micro-Force Sensors for Testing Applications in Micro- and Nanorobotics.....</b>	8
<i>Manuel Mikczinski, Tim Luttermann, Thomas Wich, Sergej Fatikow</i>	
<b>Using a Piezo-Resistive Tactile Sensor for Detection of Incipient Slippage .....</b>	14
<i>Matthias Schöpfer, Carsten Schürmann, Michael Pardowitz, Helge Ritter</i>	
<b>Applying von Mises Distribution to Microphone Array Probabilistic Sensor Modelling.....</b>	21
<i>Ivan Markovic, Ivan Petrovic</i>	

## LOCALIZATION AND MAPPING 1

<b>Dynamic Frontier Based Exploration with a Mobile Indoor Robot .....</b>	28
<i>Jens Wettach, Karsten Berns</i>	
<b>Evaluating the Efficiency of Frontier-Based Exploration Strategies.....</b>	36
<i>Dirk Holz, Nicola Basilico, Francesco Amigoni, Sven Behnke</i>	
<b>Sampling-Based Multi-Robot Exploration .....</b>	44
<i>Zhi Yan, Nicolas Jouandeau, Arab Ali Cherif</i>	
<b>Vision Based Far-Range Perception and Traversability Analysis Using Predictive Probability of Terrain Classification.....</b>	50
<i>Masataka Suzuki, Eisuke Terada, Teppei Saitoh, Yoji Kuroda</i>	

## LEARNING AND ADAPTATION

<b>Behavioral Organization for Mobile Robotic Systems: An Attractor Dynamics Approach.....</b>	56
<i>Matthias A. Grimm, Ioannis Iossifidis</i>	
<b>Traveling Wave Locomotion of Snake Robot Along Symmetrical and Unsymmetrical Body Shapes .....</b>	62
<i>Hadi Kalani, Alireza Akbarzadeh, Javad Safehian</i>	
<b>Sensor Guided Robot Motions Using the Example of the Inverted Pendulum.....</b>	69
<i>Alexander Winkler, Jozef Suchý</i>	
<b>An Adaptive Robot Game .....</b>	76
<i>Søren Tranberg Hansen, Mikael Svenstrup, Lars Dalgaard</i>	

## HUMAN-ROBOT COLLABORATION

<b>PISA: Next Generation of Flexible Assembly Systems - From Initial Ideas to Industrial Prototypes .....</b>	84
<i>Jörg Krüger, Volker Katschinski, Dragoljub Surdilovic, Gerhard Schreck</i>	
<b>Development of Collaborative Robots (COBOTS) for Flexible Human-Integrated Assembly Automation.....</b>	90
<i>Dragoljub Surdilovic, Gerhard Schreck, Uwe Schmidt</i>	
<b>Measuring the Collision Potential of Industrial Robots .....</b>	98
<i>Susanne Oberer-Treitz, Arnold Puzik, Alexander Verl</i>	
<b>Learning Probabilistic Models to Enhance the Efficiency of Programming-by-Demonstration for Industrial Robots .....</b>	105
<i>Rebecca Hollmann, Martin Hägele, Alexander Verl</i>	

## 3D VISION 1

<b>Face Detection Using 3D Time-of-Flight and Colour Cameras .....</b>	112
<i>Jan Fischer, Daniel Seitz, Alexander Verl</i>	

<b>Automatic Layered 3D Reconstruction of Simplified Object Models for Grasping.....</b>	117
<i>Lucian Cosmin Goron, Zoltan Csaba Marton, Gheorghe Lazea, Michael Beetz</i>	
<b>3D-Vision Guided Robotics for Material Handling .....</b>	123
<i>Peter Nilsson</i>	
<b>3D Measurement of Moving Objects Using Quotient Image Stereo.....</b>	130
<i>Tagir Bakirov, Stephan Irgenfried, Kirill Safronov, Igor Tchouchenkov, H. Wörn</i>	

## **LOCALIZATION AND MAPPING 2**

<b>Exactly Sparse Delayed State Filter Based Robust SLAM with Stereo Vision.....</b>	136
<i>Andreja Kitanov, Ivan Petrovic</i>	
<b>A Comparison of Efficient Global Image Features for Localizing Small Mobile Robots.....</b>	143
<i>Marius Hofmeister, Philipp Vorst, Andreas Zell</i>	
<b>Off-Road Place Recognition Using Fused Image Features.....</b>	151
<i>Tobias Föhst, Michael Arndt, Karsten Berns, Christiano Couto Gava, Raquel Frizera Vassallo</i>	
<b>Automatic Robot Supervision Within a Lunar Crater Environment.....</b>	157
<i>Alexander Dettmann, Stefan Haase, Frank Kirchner</i>	

## **INDUSTRIAL HUMAN-ROBOT COOPERATION**

<b>When to Assist? - Modelling Human Behaviour for Hybrid Assembly Systems.....</b>	165
<i>Markus Huber, Alois Knoll, Thomas Brandt, Stefan Glasauer</i>	
<b>Injury Risk Quantification for Industrial Robots in Collaborative Operation with Humans.....</b>	171
<i>Bjoern Matthias, Susanne Oberer-Treitz, Harald Staab, Erich Schuller, Steffen Peldschus</i>	
<b>Occlusion Handling in Augmented Reality User Interfaces for Robotic Systems .....</b>	177
<i>Markus Sauer, Florian Leutert, Klaus Schilling</i>	
<b>Greenhouse Partner Robot System .....</b>	184
<i>Koshi Kashiwazaki, Yusuke Sugahara, Jun Iwasaki, Kazuhiro Kosuge, Shiro Kumazawa, Tomoki Yamashita</i>	

## **MOTION PLANNING**

<b>Dynamic Collision Avoidance for an Anthropomorphic Manipulator Using a 3D TOF Camera.....</b>	192
<i>Sankaranarayanan Natarajan, Andreas Vogt, Frank Kirchner</i>	
<b>Indoor-GPS Based Robots as a Key Technology for Versatile Production.....</b>	199
<i>Robert Schmitt, Alexander Schönberg, Björn Damm</i>	
<b>End-Effector Obstacle Avoidance Using Multiple Dynamic Variables.....</b>	206
<i>Hendrik Reimann, Ioannis Iossifidis, Gregor Schöner</i>	
<b>Learning Motion Skills From Expert Demonstrations and Own Experience Using Gaussian Process Regression .....</b>	212
<i>Kathrin Gräve, Jörg Stückler, Sven Behnke</i>	

## **POSTER SESSION 1**

<b>P1 Current State Model for Easy Reconfiguration of Robot Systems and Offline-Programming-Environments .....</b>	220
<i>Gunther Reinhart, Stefan Krug</i>	
<b>P2 ABB Service Agreements with Remote Services.....</b>	228
<i>René Nispeling</i>	
<b>P4 Intelligent Components for Miniature Drive Systems in Robotics .....</b>	230
<i>Jens Haug, Reiner Bessey, Herbert Wallner, Fritz Faulhaber</i>	
<b>P5 Automatic Generation of the Denavit-Hartenberg Convention .....</b>	235
<i>Wolfgang Weber</i>	
<b>P6 Mechanical Design Process for the Zippy Wrist.....</b>	242
<i>Navid Mahpeykar, Javad Enferadi, Alireza Akbarzadeh</i>	
<b>P7 Remotely Operated Inspection and Maintenance Robots.....</b>	250
<i>Charlotte Skourup, John Pretlove, Christoffer Apneseth</i>	
<b>P8 Towards a New Industrial Robotics.....</b>	252
<i>F. P. Bonsignorio</i>	

<b>P9 An Autonomous Robotized System for a Thermographic Camera.....</b>	254
<i>Alberto Pretto, Emanuele Menegatti, Paolo Bison, Ermanno Grinzato, Gianluca Cadelano, Enrico Pagello</i>	
<b>P10 Low-Power Microcontroller-Based Acoustic Modem for Underwater Robot Communication .....</b>	262
<i>Christoph Osterloh, Erik Maeble</i>	
<b>P11 Particle Filter Based Sensor Fusion of Range Measurements From Wireless Sensor Network and Laser Range Finder .....</b>	268
<i>Christof Röhrig, Christopher Kirsch</i>	
<b>P12 Fuzzy Stereovision Tracking Control for Non-Holonomic Mobile Robots.....</b>	276
<i>Mohand Said Djouadi, Samir Zeghlache</i>	
<b>P13 Pattern Recognition and Tracking Dynamic Objects with LIDAR .....</b>	278
<i>Levente Tamas, Gheorghe Lazea</i>	
<b>P14 Experimental Evaluation of a Low-Cost Mobile Robot Localization Technique for Large Indoor Public Environments .....</b>	284
<i>Inam-Ul Haque, Erwin Prassler</i>	
<b>P15 3-D-Environment Reconstruction for Mobile Robots Using fastSLAM and Feature Extraction.....</b>	291
<i>Georg Arbeiter, Jan Fischer, Alexander Verl</i>	
<b>P16 Map Updating in Dynamic Environments.....</b>	296
<i>Fabrizio Abrate, Basilio Bona, Marina Indri, Stefano Rosa, Federico Tibaldi</i>	
<b>P17 New Approach in Solving the Kidnapped Robot Problem.....</b>	304
<i>Andras Majdik, Mircea Popa, Levente Tamas, Istvan Szoke, Gheorghe Lazea</i>	
<b>P18 AUV Pipeline Following Using Reinforcement Learning.....</b>	310
<i>Sigurd A. Fjerdingen, Erik Kyrkjebø, Aksel A. Transeth</i>	

## **3D VISION 2**

<b>Probabilistic Phase Unwrapping for Time-of-Flight Cameras .....</b>	318
<i>David Droseschel, Dirk Holz, Sven Behnke</i>	
<b>High Performance Optical Flow Serves Bayesian Filtering for Safe Human-Robot Cooperation .....</b>	325
<i>J. Graf, F. Dittrich, H. Wörn</i>	
<b>Mobile Manipulation in Service Robotics: Scene and Object Recognition with Manipulator-Mounted Laser Ranger.....</b>	333
<i>Manuel Wopfner, Jonas Brich, Siegfried Hochdorfer, Christian Schlegel</i>	
<b>Development of a Robot Vision System for Measuring 3D Pose of Large Object Using Virtual Plane Algorithm .....</b>	340
<i>Chan-Ho Lee, Jong-Kyu Oh, Sang-Hun Lee, Sung-Hyun Jung, Jong-Sung Hur, Sangbum Park, Youngjoon Han, Hernsoo Hahn</i>	

## **LOCALIZATION AND MAPPING 3**

<b>Performances Evaluation of Global Navigation Satellite Systems and Satellite/Ground Based Augmentation Systems in Mobile Robotics .....</b>	346
<i>Donato Melita, Giovanni Muscato, Michèle Poncelet</i>	
<b>A Comparison of Similarity Measures for Localization with Passive RFID Fingerprints .....</b>	354
<i>Philipp Vorst, Andreas Zell</i>	
<b>UKF Sensor Data Fusion for Localisation of a Mobile Robot.....</b>	362
<i>Matthias Baumann, Daniel Eck, László Lemmer, Klaus Schilling</i>	
<b>Stabilizing and Global Localizing of Two-Wheeled Holonomic Mobile Robots Using Neuro-Fuzzy Algorithms.....</b>	370
<i>Hans Hansen, Karl Ihnengrat, Katinka Klein, Olga Petrovska, Vyacheslav Schostakowitsch</i>	

## **PERSONAL HUMAN-ROBOT COOPERATION**

<b>FRIEND - A Dependable Semiautonomous Rehabilitation Robot .....</b>	372
<i>R. Tschararow, Sorin M. Grigorescu, Axel Gräser</i>	
<b>Pneumatic Rehabilitation Robot: Modeling and Control.....</b>	379
<i>R. Morales, F. J. Badesa, L. M. Domenech, N. Garcia-Aracil, J. M. Sabater, C. Perez, E. Fernandez</i>	
<b>Human in Loop Integration of an Arm Mounted Wheelchair Robot Based on RT Middleware .....</b>	387
<i>Wei Wang, Yuki Suga</i>	
<b>Intuitive Multimodal Interaction for Domestic Service Robots.....</b>	393
<i>Matthias Nieuwenhuisen, Jörg Stückler, Sven Behnke</i>	

## **ROBOT CONTROL OF MACHINING PROCESSES**

<b>Markerless Visual Vibration Damping of a 3-DOF Flexible Link Robot Arm.....</b>	401
<i>Jörn Malzahn, Anh Son Phung, Rene Franke, Frank Hoffmann, Torsten Bertram</i>	
<b>A Motion Control Strategy for Robots in Laser Material Processing and Other High Speed Applications.....</b>	409
<i>Hartmut Brühm, Alexander Czink, Markus Lotz, Volker Wenzel</i>	
<b>Robot Machining with Additional 3D-Piezo-Actuation Mechanism for Error Compensation .....</b>	415
<i>Arnold Puzik, Christian Meyer, Alexander Verl</i>	
<b>A Feedback Control System for a Rapid Production Process Based on Robotic Welding Deposition .....</b>	422
<i>Filippo Bonaccorso, Carlo Bruno, Luciano Cantelli, Domenico Longo, Giovanni Muscato, Salvatore Rapisarda</i>	

## **APPLICATIONS FOR VISION SENSORS**

<b>Robotic Vision for Bin-Picking Applications of Various Objects .....</b>	428
<i>Ales Pochyly, Tomas Kubela, Martin Kozak, Petr Cihak</i>	
<b>Automatic Configuration of an Object Detection System .....</b>	433
<i>Martin Stotz, Alexander Verl</i>	
<b>Anticipation-Preprocessing for Object Pose Detection.....</b>	440
<i>Matthias Palzkill, Thomas Ledermann, Alexander Verl</i>	
<b>Camera Calibration for Reliable Object Manipulation in Care-Providing System FRIEND.....</b>	446
<i>Torsten Heyer, Sorin M. Grigorescu, Axel Gräser</i>	

## **PATH PLANNING AND NAVIGATION 1**

<b>A Set-Based Dynamic Window Algorithm for Robust and Safe Mobile Robot Path Planning.....</b>	452
<i>Sylvia Horn, Klaus Janschek</i>	
<b>A RRT Based Path Planning Algorithm for Rehabilitation Robots .....</b>	459
<i>Christos Fragkopoulos, Axel Gräser</i>	
<b>A New Probabilistic Path Planning Algorithm for (Dis)Assembly Tasks .....</b>	467
<i>Ulrike Thomas, Rene Iser</i>	
<b>Path Planning Process Optimization for a Bin Picking System .....</b>	473
<i>Ricardo A. Tauro, Benedikt Kaiser, H. Wörn</i>	

## **INDUSTRIAL GRASPING APPLICATIONS**

<b>Hybrid Robot Gripper and Tools for Handling and Bonding Micro Fluidic Chips.....</b>	480
<i>M. Altmeier, A. Koller-Hodac, S. Walpen, E. Krüttli, M. Lüthy, F. Kehl, J. Auerswald</i>	
<b>Visual Grasping Using Passive Joints and Clustered SIFT-Features.....</b>	486
<i>Nicolas Gorges, Andre Haase, H. Wörn</i>	
<b>Gripping Systems for Intralogistics - Aiming At the "Swiss Army Knife" of Intralogistics Solutions .....</b>	494
<i>Hendrik Mütherich, Florian Simons, Alexander Verl</i>	
<b>A New Handling System for Textile/Clothing Industry.....</b>	501
<i>Rezia Molfino, Matteo Zoppi, Enrico Carca, Roberto Avvenente</i>	

## **FORCE TORQUE CONTROL**

<b>Is a Linear Axis Really Required When Assembling Parts to a Moving Conveyor? .....</b>	507
<i>Friedrich Lange, Johannes Scharrer, G. Hirzinger</i>	
<b>Control of Large Forces and Torques Using an Asymmetrically Arranged Compliant Sensor .....</b>	515
<i>Friedrich Lange, Bertram Willberg, G. Hirzinger</i>	
<b>Is Force Monitoring in Cooperating Industrial Robots Necessary? .....</b>	523
<i>Gunther Reinhart, Sherif Zaidan, Jörg Hubele</i>	
<b>Superimposed Force/Torque-Control of Cooperating Robots .....</b>	531
<i>Alexander Spiller, Alexander Verl</i>	

## **SAFETY APPLICATIONS**

<b>A Real-Time Wearable Projector-Wiimote-System for Augmented Reality Interaction Scenarios on Plane Objects .....</b>	538
<i>Alexander Steiger, Björn Hein, H. Wörn</i>	
<b>A Stationary Sensor System to Support Manipulators for Safe Human-Robot Interaction .....</b>	544
<i>Christoph Walter, Christian Vogel, Norbert Elkemann</i>	
<b>Collision Avoidance Systems for Manual-Assisted Driving .....</b>	550
<i>Héctor Yuste, Leopoldo Armesto, Josep Tornero</i>	
<b>PISALA Project: Intelligent Sensorization for Line Tracking with Artificial Vision.....</b>	558
<i>Vicent Girbés, Leopoldo Armesto, Josep Tornero</i>	

## **PATH PLANNING AND NAVIGATION 2**

<b>Cooperative Docking Procedures for a Lunar Mission .....</b>	564
<i>Thomas M. Roehr, Florian Cordes, Frank Kirchner, Ingo Ahrens</i>	
<b>Deploying Mobile Maintenance Robots in Material Flow Systems Using Topological Maps and Local Calibration .....</b>	572
<i>Bernd Kuhlenkötter, Matthias Bücker, Tobias Brutscheck</i>	
<b>Evaluating Risk Estimation Methods and Path Planning for Safe Human-Robot Cooperation.....</b>	579
<i>J. Graf, P. Czapiewski, H. Wörn</i>	
<b>Experimental Study of Robot Formation Control and Navigation Using Potential Functions and Panel Method.....</b>	586
<i>Abdel-Razzak Merheb, Veysel Gazi, Nilay Sezer-Uzol</i>	

## **ANTHROPOMORPHIC ARMS AND HANDS**

<b>A Five Fingered Robotic Hand Prototype by Using Twist Drive.....</b>	594
<i>Ivan Godler, Takashi Sonoda</i>	
<b>Grasp Synthesis for Dextrous Hands Optimised for Tactile Manipulation .....</b>	600
<i>Jimmy Jørgensen, Henrik Petersen</i>	
<b>Development of a Multi-Fingered Robot Hand with Softness-Changeable Skin Mechanism .....</b>	606
<i>Hiroki Takeuchi, Tetsuyou Watanabe</i>	
<b>On the Control Problem of a Hyper-Redundant Arm.....</b>	613
<i>Mircea Ivanescu, Mihaela Florescu, Nirvana Popescu, Decebal Popescu</i>	

## **SIMULATION AND PROGRAMMING**

<b>Recent Progress on Programming Methods for Industrial Robots .....</b>	619
<i>Zengxi Pan, Joseph Polden, Nathan Larkin, Stephen Van Duin, John Norrish</i>	
<b>Robot Cutting in Ship Building Industry - A New Flexible Approach for Linking Parametric Design and Fully Automatic Robot Programming.....</b>	627
<i>Stefan Gasper, Jobst Bickendorf</i>	
<b>Automatic Generation of Robot Applications Using a Knowledge Integration Framework.....</b>	631
<i>Martin Naumann, Matthias Bengel, Alexander Verl</i>	
<b>RobWorkSim - An Open Simulator for Sensor Based Grasping.....</b>	639
<i>Jimmy Jørgensen, Henrik Petersen, Lars-Peter Ellekilde</i>	

## **EXPLORATION AND PERCEPTION**

<b>Robotic Analysis of Everyday Scenes.....</b>	647
<i>Robert Eidenberger, Thilo Grundmann, Martin Schneider, Wendelin Feiten, Michael Fiegert, Georg V. Wichert, Gisbert Lawitzky</i>	
<b>Visual Odometry Using Feature Point and Ground Plane for Urban Environments.....</b>	654
<i>Atsushi Sakai, Yuya Tamura, Yoji Kuroda</i>	

## Volume 2

<b>Multi-Sensor Fusion for Localization of a Mobile Robot in Outdoor Environments .....</b>	662
<i>Thomas Emter, Arda Saltoglu, Janko Petereit</i>	
<b>Online Road Surface Analysis Using Laser Remission in Structured Outdoor Environments.....</b>	668
<i>Teppei Saitoh, Yoji Kuroda</i>	

### **HUMANOID ROBOTICS 1**

<b>Development of a Highly Integrated Torque Sensor Concept for Drive Units of a Humanoid Robot .....</b>	676
<i>Albert Albers, Markus Frietsch, Christian Sander, Jens Otnad</i>	
<b>Mobile Experimental Platform for the Development of Environmentally Interactive Control Algorithms towards the Implementation on a Walking Humanoid Robot .....</b>	682
<i>Giulio Milighetti, Janko Petereit, Helge-Björn Kuntze</i>	
<b>Study of a Bipedal Robot with Elastic Elements .....</b>	689
<i>Daniela Förg, Heinz Ulbrich, Andre Seyfarth</i>	
<b>Towards Human-Like Bipedal Locomotion with Three-Segmented Elastic Legs.....</b>	696
<i>Katayon Radkhah, Dorian Scholz, Oskar Von Stryk, Moritz Maus, Andre Seyfarth</i>	

### **VISION-BASED MANIPULATION**

<b>Refining Visually Detected Object Poses .....</b>	704
<i>Preben H. S. Holm, Henrik Petersen</i>	
<b>Development of Image Guided Master-Slave Robot System for Minimal Invasive Brain Surgery .....</b>	710
<i>Sungmin Seung, Byungjeon Kang, Woo-Young Kim, Jong-Oh Park, Suk-Ho Park</i>	
<b>Image Processing for Sensing Guide Wire Behaviour During Endovascular Surgery Simulation.....</b>	716
<i>Carlos Tercero, Seiichi Ikeda, Toshio Fukuda, Makoto Negoro</i>	
<b>To Paint What is Seen: A System Implementation of a Novel Conceptual Hyper-Redundant Chain Robot with Monocular Vision.....</b>	722
<i>Kejun Ning, Florentin Wörgötter</i>	

### **INVITED INDUSTRIAL SESSION 1**

<b>euRobotics - Shaping the Future of European Robotics.....</b>	728
<i>Rainer Bischoff, Tim Guhl, Anne Wendel, Fariba Khatami, Herman Bruyninckx, Bruno Siciliano, Geoff Pegman, Martin Hägele, Erwin Prassler, Thilo Zimmermann, Jon Agirre Ibarbia, Christophe Leroux, Bruno Tranchero, Roberto Labruito, Alois Knoll, Reinhard Lafrenz</i>	
<b>Optimized SCARA Kinematic, Description and Examples.....</b>	736
<i>Volker Spanier</i>	
<b>The KUKA-DLR Lightweight Robot Arm - A New Reference Platform for Robotics Research and Manufacturing .....</b>	741
<i>Rainer Bischoff, Johannes Kurth, Günter Schreiber, Ralf Koeppel, Alin Albu-Schäffer, Alexander Beyer, Oliver Eiberger, Sami Haddadin, Andreas Stemmer, Gerhard Grunwald, G. Hirzinger</i>	
<b>Improve Safety and Reduce Cost: Dual Check Safety (DCS) Speed and Position Check Software .....</b>	749
<i>Josef Fruhmann</i>	

### **INDUSTRIAL ROBOT MODELING**

<b>Analysis of the Accuracy of Industrial Robots and Laser Scanners for Remote Laser Beam Welding and Cutting.....</b>	751
<i>Michael F. Zaeh, Jens Hatwig, Jan Musiol, Oliver Roesch, Gunther Reinhart</i>	
<b>"Viro-Con": Efficient Deployment of Modular Robots .....</b>	759
<i>E. Bayrhammer, M. Kennel, U. Schmucker, R. Tschakarow, C. Parlitz</i>	
<b>Inertia Parameter Identification Using a Stewart Platform.....</b>	765
<i>Juan Barreto, Luis E. Muñoz</i>	
<b>Calibration Techniques for Industrial Mobile Manipulators: Theoretical Configurations and Best Practices .....</b>	773
<i>Mads Hvilstøj, Simon Bøgh, Ole Madsen, Morten Kristiansen</i>	

## **POSTER SESSION 2**

<b>P19 Biped Robot "ROTT": Design, Simulation, Experiments .....</b>	780
<i>A. Melnykov, M. Konyev, F. Palis, U. Schmucker</i>	
<b>P20 The Energy Minimization Algorithm Using Foot Rotation for Hydraulic Actuated Quadruped Walking Robot with Redundancy .....</b>	786
<i>Tae-Ju Kim, Byungrok So, Ohung Kwon, Sangdoek Park</i>	
<b>P21 Development and Analysis of a Shape-Conformable Supporting Head for a Self-Reconfigurable Intelligent Swarm Fixture System .....</b>	792
<i>Roberto Avvenente, Aamir Khan, Xiong Li, Matteo Zoppi, Dimiter Zlatanov, Rezia Molino</i>	
<b>P22 RobWork: A Flexible Toolbox for Robotics Research and Education .....</b>	800
<i>Lars-Peter Ellekilde, Jimmy Jørgensen</i>	
<b>P23 An Integrated Tool Suite for Simulation and Programming of Palletizing Units .....</b>	807
<i>Mauro Argenti, Davide Buratti, Dario Lodi Rizzini, Stefano Caselli</i>	
<b>P24 A Co-Simulation Framework for Design, Test and Parameter Optimization of Robotic Systems .....</b>	813
<i>Mohammed Ahmed, Yong-Ho Yoo, Frank Kirchner</i>	
<b>P25 An Autonomous Excavator Project for Landscaping Tasks .....</b>	819
<i>Daniel Schmidt, Karsten Berns</i>	
<b>P26 UMTS One Way Delay Characterization for Mobile Robot Teleoperation .....</b>	827
<i>Florian Zeiger, Florian Kempf, Klaus Schilling</i>	
<b>P27 Integrated Robotic Gluing System .....</b>	835
<i>Thomas Wagner</i>	
<b>P28 Ambient Integrated Robotics (AIR): New Approach for Supporting Elderly People with Integrated Technology in Living Environments .....</b>	838
<i>Thomas Bock, Thomas Linner, S. Y. Lee</i>	
<b>P29 Measurement of Stress Distribution of Flexible Wheels for Lunar Rover .....</b>	842
<i>Kojiro Iizuka, Takeshi Kubota</i>	
<b>P30 Architecture of an Autonomous Mini Unmanned Aerial Vehicle Based on a Commercial Platform .....</b>	848
<i>Markus Ax, Lars Kuhnert, Matthias Langer, Jens Schlemper, Klaus-Dieter Kuhnert</i>	
<b>P32 Automatic Trajectory Generation for Robotic Painting Application .....</b>	854
<i>Xiongzi Li, Øyvind A. Landsnes, Heping Chen, Sudarshan M-V, Thomas A. Fuhlbrigge, Mary-Ann Rege</i>	
<b>P33 A Flexible Real-Time Control System for Autonomous Vehicles .....</b>	860
<i>Johannes Meyer, Armin Strobel</i>	
<b>P34 Path Planning of Reach Tasks for Dual-Arm Robots .....</b>	868
<i>Anders Lau Olsen, Henrik Petersen</i>	
<b>P35 Self-Adaptable Passive Gripping System for Industrial Robots .....</b>	869
<i>Torsten Felsch, Christian Herker</i>	
<b>P36 Flexible Assembly Systems Through Workplace-Sharing and Time-Sharing Human-Machine Cooperation (PISA) .....</b>	875
<i>Jörg Krüger, Volker Katschinski, Dragoljub Surdilovic, Gerhard Schreck</i>	
<b>P37 The Basis of Control-Related Robotics Research - Open High-Rate Low-Level Control Architectures for Industrial Manipulators .....</b>	880
<i>Alexander Sommerkorn, Daniel Kubus, Friedrich M. Wahl</i>	
<b>P38 Development of a Novel HyRoHILS System and Its Application to Parameter Identification of an Industrial Robot .....</b>	888
<i>Seung-Woo Son, Eui-Jin Kim, Chan-Ho Lee, Sang-Hun Lee, Sung-Hyun Jung, Jong-Sung Hur</i>	

## **SERVICE ROBOTS 1**

<b>Development of Robotic Transportation System -Shopping Support System Collaborating with Environmental Cameras and Mobile Robots - .....</b>	893
<i>Nobuto Matsuhira, Fumio Ozaki, Seiji Tokura, Takafumi Sonoura, Tsuyoshi Tasaki, Hideki Ogawa, Masahito Sano, Akiko Numata, Naohisa Hashimoto, Kiyoshi Komoriya</i>	
<b>Treading New Water with a Fully Automatic Sewer Inspection System .....</b>	899
<i>José Saenz, Norbert Elkmann, Christoph Walter, Erik Schulenburg, Heiko Althoff</i>	
<b>BioRob-Arm: A Quickly Deployable and Intrinsically Safe, Light-Weight Robot Arm for Service Robotics Applications .....</b>	905
<i>Thomas Lens, Jürgen Kunz, Oskar Von Stryk, Christian Trommer, Andreas Karguth</i>	

## **HUMANOID ROBOTICS 2**

<b>A Biomimetic Upper Body for Humanoids.....</b>	911
<i>Giuseppina Gini, Michele Folgheraiter, Ilaria Baroni, Francesco Boschetti, Gert Petja, Marco Traversoni</i>	
<b>Generation of Human-Like Motion for Humanoid Robots Based on Marker-Based Motion Capture Data.....</b>	919
<i>Stefan Gärtner, Martin Do, Tamim Asfour, Rüdiger Dillmann, Christian Simonidis, Wolfgang Seemann</i>	
<b>Scene Representation for Anthropomorphic Robots: A Dynamic Neural Field Approach.....</b>	927
<i>Stephan K. U. Zibner, Christian Faubel, Ioannis Iossifidis, Gregor Schöner</i>	
<b>A Humanoid Muscle Robot Torso with Biologically Inspired Construction .....</b>	934
<i>Ivo Boblan, Andreas Schulz</i>	

## **NEW MANIPULATION TECHNOLOGIES**

<b>A New Concept of Modular Kinematics to Design Ultra-High Precision Flexure-Based Robots .....</b>	940
<i>Murielle Richard, R. Clavel</i>	
<b>Experiments with Tentacle Robots.....</b>	948
<i>Dorian Cojocaru, Mircea Ivanescu, Razvan Tudor Tanasie, Sorin Dumitru, Florin Manta</i>	
<b>Observation-Oriented Design of a Monolithic Piezoelectric Microactuator with Optimally Integrated Sensor .....</b>	954
<i>Roba El Khoury Moussa, Mathieu Grossard, Mehdi Boukallel, Nicolas Chaillet, Arnaud Hubert</i>	
<b>A Behavior-Based Approach for Task Learning on Mobile Manipulators .....</b>	962
<i>Shu Huang, Erwin Aertbeliën, Hendrik Van Brussel, Herman Bruyninckx</i>	

## **INVITED INDUSTRIAL SESSION 2**

<b>BRICS - Best Practice in Robotics .....</b>	968
<i>Rainer Bischoff, Tim Guhl, Erwin Prassler, Walter Nowak, Gerhard Kraetzschmar, Herman Bruyninckx, Peter Soetens, Martin Haeghele, Andreas Pott, Peter Breedveld, Jan Broenink, Davide Brugali, Nicola Tomatis</i>	
<b>Innovative Technologies for Robot Grippers .....</b>	976
<i>Andreas Wolf</i>	

## **NEW INDUSTRIAL ROBOT APPLICATIONS**

<b>Production of Green Products in an Efficient Way .....</b>	982
<i>Martin Klinke, Gunter Börner</i>	
<b>Realization of Thermal Coating and Mechanical Compacting Processes Based on Industrial Multi Robot Systems.....</b>	986
<i>Bernd Kuhlenkötter, Carsten Scheele, Alfred Hypki</i>	
<b>Development of Robots for the Pipeline Industry .....</b>	993
<i>Frederico A. Ramalho Filho, Alexandre Queiroz Bracarense, Eduardo José Lima II, Kassio Maciel Kienitz, Emanuel Barbosa Ribeiro</i>	
<b>Large-Scale Assembly of Solar Power Plants with Parallel Cable Robots.....</b>	999
<i>Andreas Pott, Christian Meyer, Alexander Verl</i>	

## **SERVICE ROBOTS 2**

<b>Towards Bringing Robots Into Homes.....</b>	1005
<i>Markus Vincze, Walter Wohlkinger, Sven Olufs, Peter Einramhof, Robert Schwarz</i>	
<b>Dynamic Behaviour Conception for EmI Companion Robot .....</b>	1011
<i>Sébastien Saint-Aimé, Céline Jost, Brigitte Le-Pévédic, Dominique Duhaut</i>	
<b>Modeling a HexaPOD for Tumor Motion Compensation in Robot Assisted Radiotherapy.....</b>	1019
<i>Christian Herrmann, Klaus Schilling, Lei Ma</i>	
<b>A New Spherical Wrist for Minimally Invasive Robotic Surgery.....</b>	1026
<i>J. M. Sabater, N. Garcia, C. Perez, L. M. Lopez, F. J. Badesa, J. Mayol</i>	

## **BIOLOGICALLY INSPIRED MANIPULATION**

<b>Group Dancing Mobile Flower Robots with Moving Mechanism, Mobility, and Localization Functions</b> .....	1032
<i>Woo-Young Kim, Il-Hyeon Song, Kyung-Whan Kim, Suk-Ho Park, Jong-Oh Park</i>	
<b>Multi-Level Fuzzy-QFT Control of Conjugated Polymer Actuators</b> .....	1038
<i>Amir Ali Amiri Moghadam, Ali Akbarzadeh Tootoonchi</i>	
<b>Time Efficient Hybrid Motion Planning Algorithm for HOAP-2 Humanoid Robot</b> .....	1046
<i>Mohammed Elmogy, Christopher Habel, Jianwei Zhang</i>	
<b>Movement Control in Biologically Plausible Frames of Reference</b> .....	1054
<i>Michael Gienger, Christian Goerick, Edgar Körner</i>	

## **MODELING AND SIMULATION 1**

<b>A Uniform Framework to Program, Animate and Control Objects, Kinematics and Articulated Mechanisms in a Comprehensive Simulation System</b> .....	1061
<i>Jürgen Roßmann, Kevin Eilers, Christian Schlette, Michael Schluse</i>	
<b>A Knowledge Integration Framework for Robotics</b> .....	1068
<i>Jacob Persson, Axel Gallois, Anders Björkelund, Love Hafdell, Mathias Haage, Jacek Malec, Klas Nilsson, Pierre Nugues</i>	
<b>Robot Workcell Simulation with AutomationML Support - An Element of the CAx-Tool Chain in Industrial Automation</b> .....	1076
<i>Bernd Kuhlenkötter, Adrian Schyja, Alfred Hypki, Volker Miegel</i>	
<b>Robot Program Validation Using Virtualization, Components, and Physics Engines</b> .....	1083
<i>Wanli Jiang, Steve Murphy, Anders Ekelund, Volker Miegel, Xinguo Yin, Liwei Qi</i>	

## **MICRO AND NANO ROBOTICS**

<b>Robots for Micro and Desktop Factories: Examples and Experiences</b> .....	1088
<i>Timo Prusi, Asser Vuola, Niko Siltala, Riku Heikkilä, Reijo Tuokko</i>	
<b>Micro-/Nano-Integration for MEMS Based on Nano-Robotic Assembly</b> .....	1095
<i>Thomas Wich, Manuel Mikczinski, Sergej Fatikow</i>	
<b>Modeling and Compensation of Cutting-Forces Generated During the EDM Process for Ultra High-Precision Robots</b> .....	1103
<i>Emanuele Lubrano, Adrian Prodan, R. Clavel</i>	
<b>Design of a Tendon Driven Parallel Manipulator for Micro-Factory Applications</b> .....	1109
<i>Irene Fassi, Giovanni Legnani, Pier Luigi Magnani</i>	

## **SERVICE ROBOTS 3**

<b>Making High-Tech Service Robot Platforms Available</b> .....	1115
<i>Florian Weisshardt, Ulrich Reiser, C. Parlitz, Alexander Verl</i>	
<b>Development of Safe Autonomous Mobile Service Robots Using an Active Integrated Approach</b> .....	1121
<i>Philipp Ertle, Holger Voos, Dirk Söffker</i>	
<b>ModWall - A Morphological Boundary Concept for Pig Stable Design Based on Modular Robotics</b> .....	1129
<i>Lars Dalgaard, Bo Stjerne Thomsen</i>	
<b>Robotic Machine for High-Quality Shotcrete Process</b> .....	1137
<i>Samir Nabulsi, Angel Rodriguez, Olga Rio</i>	

## **BIOLOGICALLY INSPIRED LOCOMOTION**

<b>An Autonomous Flying Robot for Testing Bio-Inspired Navigation Strategies</b> .....	1145
<i>Verena V. Hafner, Ferry Bachmann, Oswald Berthold, Michael Schulz, Mathias Müller</i>	
<b>A Contribution to the Amoeboid Locomotion of Mobile Robots</b> .....	1152
<i>Klaus Zimmermann, Valter Böhm</i>	
<b>Fish-Inspired Swimming Simulation and Robotic Implementation</b> .....	1158
<i>Junzhi Yu, Min Tan, Jianwei Zhang</i>	

<b>A Single Actuated, Modular Swimming Robot Performing Different Styles of Steady Swimming Species.....</b>	1164
<i>Max Fremerey, Lars Fischheiter, Jörg Mämpel, Hartmut Witte</i>	

## **MODELING AND SIMULATION 2**

<b>Using Ego Motion Feedback to Improve the Immersion in Virtual Reality Environments .....</b>	1172
<i>Sebastian Noth, Ioannis Iossifidis, Eva Schrowangen</i>	
<b>Model-Predictive Undercarriage Control for a Pseudo-Omnidirectional, Wheeled Mobile Robot.....</b>	1178
<i>Christian P. Connette, Stefan Hofmeister, Alexander Bubeck, Martin Hägele, Alexander Verl</i>	
<b>Application of Pseudo-Elastic Wire for Hybrid Cutting Robotic Tool .....</b>	1184
<i>Jawad Masood, Matteo Zoppi, Rezia Molfino</i>	
<b>Fusion of Orientation Data into a Robot Program Using a Hand-Held Digitizer Stylus .....</b>	1192
<i>Jürgen Wahrburg, Hamza Shah</i>	

## **PARALLEL ROBOTS**

<b>The Linear Delta: Developments and Applications .....</b>	1198
<i>M. Bouri, R. Clavel</i>	
<b>Mathematical Modelling of 4 DOF Gantry Type Parallel Manipulator .....</b>	1206
<i>Forgó Zoltán, Târgu Mureş</i>	
<b>Development of Parallel Manipulators for Welding Robots .....</b>	1212
<i>Frederico A. Ramalho Filho, Alexandre Queiroz Bracarense, Eduardo José Lima II, Jordano Cordeiro Fernandes, Emanuel Barbosa Ribeiro</i>	
<b>A H-Scara Mini Robot - A Dual Parallel Kinematics Mini Manipulator.....</b>	1218
<i>Niko Siltala, Asser Vuola, Riku Heikkilä, Reijo Tuokko</i>	

## **SERVICE ROBOTS 4**

<b>Towards an Intelligent Foot for Walking and Climbing Robots .....</b>	1225
<i>Florian Cordes, Sebastian Bartsch, Timo Birnschein, Daniel Kühn, Frank Kirchner</i>	
<b>Design of a Hybrid Wheeled-Legged Robot - WheeHy .....</b>	1233
<i>Bojan Jakimovski, Martin Hörenz, Michael Kotke, Erik Maeble</i>	
<b>Very Compact Climbing Robot Rolling on Magnetic Hexagonal Cam-Discs, with High Mobility on Obstacles but Minimal Mechanical Complexity .....</b>	1239
<i>W. Fischer, G. Caprari, R. Siegwart, R. Moser</i>	
<b>Control of a Meal Assistance Robot Capable of Using Chopsticks .....</b>	1246
<i>Tomoki Koshizaki, Ryosuke Masuda</i>	

## **BIOLOGICALLY INSPIRED EXPLORATION**

<b>Kinematic Motion Analysis of the Human Arm During a Manipulation Task .....</b>	1252
<i>Andrea Maria Zanchettin, Paolo Rocco, Luca Bascetta, Ioannis Symeonidis, Steffen Peldschus</i>	
<b>Using Different Adhesion Technologies in Modular Robot for Climbing.....</b>	1258
<i>Jörg Mämpel, Sebastian Köhring, Cornelius Schilling, Hartmut Witte</i>	
<b>SpaceClimber: Development of a Six-Legged Climbing Robot for Space Exploration .....</b>	1265
<i>Sebastian Bartsch, Timo Birnschein, Florian Cordes, Daniel Kühn, Peter Kampmann, Jens Hilljegeerde, Steffen Planthaber, Malte Römmermann, Frank Kirchner</i>	
<b>Excavation Mechanism for a Planetary Underground Explorer Robot.....</b>	1273
<i>Hayato Omori, Taro Nakamura, Takayuki Yada, Taro Murakami, Hiroaki Nagai</i>	

## **MODELING AND SIMULATION 3**

<b>Integral Modelling of Objects for Service Robotic Systems .....</b>	1280
<i>Henning Kampe, Axel Gräser</i>	
<b>Dynamic Modeling and Hardware-in-the-Loop Simulation for the Parallel Cable Robot IPAnema.....</b>	1288
<i>Philipp Miermeister, Andreas Pott, Alexander Verl</i>	

<b>Knowledge-Driven Opto-Acoustic Scene Analysis Based on an Object-Oriented World Modeling Approach for Humanoid Robots .....</b>	1296
<i>Benjamin Kühn, Andrey Belkin, Alexej Swerdlow, Timo Machmer, Jürgen Beyerer, Kristian Kroschel</i>	
<b>Development of Simulation Software and Control System for Mechanism with Hybrid Kinematic Structure.....</b>	1304
<i>Viera Poppeová, Juraj Uricek, Vladimír Bulej, Peter Šindler</i>	

## **INDUSTRIAL ROBOT APPLICATIONS**

<b>3D Pendulum Swinging Control by an Industrial Robot Manipulator .....</b>	1310
<i>Wilhelm August, Jian Ren, Simon Notheis, Thomas Haase, Björn Hein, H. Wörn</i>	
<b>RANSAM for Industrial Bin-Picking.....</b>	1317
<i>Dirk Buchholz, Simon Winkelbach, Friedrich M. Wahl</i>	
<b>Modern Expert Arc and Spot Welding: World's First Arc and Spot Welding Robots with 7 Controlled Axes.....</b>	1323
<i>Stefan Hagspiel</i>	
<b>An Intelligent Assembly Cell for Automated Cell Production.....</b>	1329
<i>Sumihisa Iwashita, Keiji Kanehara, Hisashi Beppu</i>	
<b>Author Index</b>	