Contents

Human-Robot Interaction

An Optimization-Based Estimation and Adaptive Control Approach for Human-Robot Cooperation ......................................................... 1
Wilm Decré, Herman Bruyninckx, Joris De Schutter

Motion-Language Association Model for Human-Robot Communication ................................................................. 17
Wataru Takano, Minoru Kanazawa, Yoshihiko Nakamura

Grounding Verbs of Motion in Natural Language Commands to Robots ........................................................................... 31
Thomas Kollar, Stefanie Tellex, Deb Roy, Nicholas Roy

Mightability: A Multi-state Visuo-spatial Reasoning for Human-Robot Interaction ....................................................... 49
Amit Kumar Pandey, Rachid Alami

Learning from Demonstration: A Study of Visual and Auditory Communication and Influence Diagrams ......................... 65
Nathan Koenig, Leila Takayama, Maja J. Matarić

Reducing Uncertainty in Human-Robot Interaction: A Cost Analysis Approach ...................................................... 81
Junaed Sattar, Gregory Dudek

Medical and Assistive Robotics

Interface Design and Control Strategies for a Robot Assisted Ultrasonic Examination System .................................................. 97
François Conti, Jaeheung Park, Oussama Khatib
A Novel Discretely Actuated Steerable Probe for Percutaneous Procedures
Elif Ayvali, Mingyen Ho, Jaydev P. Desai

Continuous Control of the DLR Light-Weight Robot III by a Human with Tetraplegia Using the BrainGate2 Neural Interface System
Joern Vogel, Sami Haddadin, John D. Simeral, Sergey D. Stavisky, Daniel Bacher, Leigh R. Hochberg, John P. Donoghue, Patrick van der Smagt

Automotive Safety Solutions through Technology and Human-Factors Innovation
Jochen Heinzman, Alexander Zelinsky

Controlling Closed-Chain Robots with Compliant SMA Actuators: Algorithms and Experiments
Kyle Gilpin, Eduardo Torres-Jara, Daniela Rus

Calibration

Automatic Self-calibration of a Full Field-of-View 3D n-Laser Scanner
Mark Sheehan, Alastair Harrison, Paul Newman

Unsupervised Calibration for Multi-beam Lasers
Jesse Levinson, Sebastian Thrun

A General Framework for Temporal Calibration of Multiple Proprioceptive and Exteroceptive Sensors
Jonathan Kelly, Gaurav S. Sukhatme

Calibrating a Multi-arm Multi-sensor Robot: A Bundle Adjustment Approach
Vijay Pradeep, Kurt Konolige, Eric Berger

Soft Autonomous Materials—Using Active Elasticity and Embedded Distributed Computation
Nikolaus Correll, Çağdaş D. Önal, Haiyi Liang, Erik Schoenfeld, Daniela Rus

Grasping and Manipulation

Towards Reliable Grasping and Manipulation in Household Environments
Matei Ciocarlie, Kaijen Hsiao, Edward Gil Jones, Sachin Chitta, Radu Bogdan Rusu, Ioan A. Șucan
Using Near-Field Stereo Vision for Robotic Grasping in Cluttered Environments ......................................................... 253
Adam Leeper, Kaijen Hsiao, Eric Chu, J. Kenneth Salisbury

Aerial Grasping from a Helicopter UAV Platform ......................... 269
Paul E. Pounds, Aaron M. Dollar

Manipulation Capabilities with Simple Hands ............................... 285
Alberto Rodriguez, Matthew T. Mason, Siddhartha S. Srinivasa

Interactive Perception of Articulated Objects .............................. 301
Dov Katz, Andreas Orthey, Oliver Brock

MiniMag: A Hemispherical Electromagnetic System for 5-DOF Wireless Micromanipulation ................................................. 317
Bradley E. Kratochvil, Michael P. Kummer, Sandro Erni, Ruedi Borer, Dominic R. Frutiger, Simone Schürle, Bradley J. Nelson

Motor Control and Locomotion

Interaction Force, Impedance and Trajectory Adaptation:
By Humans, for Robots ............................................................. 331
Etienne Burdet, Gowrishankar Ganesh, Chenguang Yang, Alin Albu-Schäffer

Experiments with Motor Primitives in Table Tennis ...................... 347
Jan Peters, Katharina Mülling, Jens Kober

Trajectory Generation and Control for Precise Aggressive Maneuvers with Quadrotors ....................................................... 361
Daniel Mellinger, Nathan Michael, Vijay Kumar

Improved Stability of Running over Unknown Rough Terrain via Prescribed Energy Removal .............................................. 375
Bruce Miller, Ben Andrews, Jonathan E. Clark

On the Comparative Analysis of Locomotory Systems with Vertical Travel ................................................................. 389
G.C. Haynes, D.E. Koditschek

Planning and Control of a Humanoid Robot for Navigation on Uneven Multi-scale Terrain ................................................... 401
Koichi Nishiwaki, Joel Chestnutt, Satoshi Kagami

Robot Modeling, Object Modeling and Mapping

On-Line Mobile Robot Model Identification Using Integrated Perturbative Dynamics ......................................................... 417
Forrest Rogers-Marcovitz, Alonzo Kelly
Effects of Sensory Precision on Mobile Robot Localization and Mapping ................................. 433
John G. Rogers III, Alexander J.B. Trevor, Carlos Nieto-Granda,
Alex Cunningham, Manohar Paluri, Nathan Michael, Frank Dellaert,
Henrik I. Christensen, Vijay Kumar

Motion-Aided Network SLAM ........................................ 447
Joseph Djugash, Sanjiv Singh

A Bayesian Approach to Learning 3D Representations of Dynamic Environments ......................... 461
Ralf Kästner, Nikolas Engelhard, Rudolph Triebel, Roland Siegwart

RGB-D Mapping: Using Depth Cameras for Dense 3D Modeling of Indoor Environments .................. 477
Peter Henry, Michael Krainin, Evan Herbst, Xiaofeng Ren, Dieter Fox

Vision-Based Reacquisition for Task-Level Control ........................................... 493
Matthew R. Walter, Yuli Friedman, Matthew Antone, Seth Teller

Mapping and Tracking

Cost-Effective Mapping Using Unmanned Aerial Vehicles in Ecology Monitoring Applications .................. 509
Mitch Bryson, Alistair Reid, Calvin Hung, Fabio Tozeto Ramos, Salah Sukkarieh

Mapping Complex Marine Environments with Autonomous Surface Craft .............................. 525
Jacques C. Leedekerken, Maurice F. Fallon, John J. Leonard

Simultaneous Tracking and Sampling of Dynamic Oceanographic Features with Autonomous Underwater Vehicles and Lagrangian Drifters ........................................ 541
Jnaneshwar Das, Frédéric Py, Thom Maughan, Tom O’Reilly, Monique Messié, John Ryan, Kanna Rajan, Gaurav S. Sukhatme

An Experimental Validation of Robotic Tactile Mapping in Harsh Environments such as Deep Sea Oil Well Sites ........................................ 557
Francesco Mazzini, Steven Dubowsky

Delay and Dropout Tolerant State Estimation for MAVs ........................................ 571
Frédéric Bourgeois, Laurent Kneip, Stephan Weiss, Roland Siegwart

A Pipeline for the Segmentation and Classification of 3D Point Clouds ................................ 585
B. Douillard, J. Underwood, V. Vlaskine, A. Quadros, S. Singh
Contents

Multirobot Systems, Novel Sensors and Actuators

Smooth Coordination and Navigation for Multiple Differential-Drive Robots .................................................. 601
Jamie Snape, Stephen J. Guy, Jur van den Berg, Dinesh Manocha

Top-Down vs. Bottom-Up Model-Based Methodologies for Distributed Control: A Comparative Experimental Study ............................................................ 615
Grégory Mermoud, Utkarsh Upadhyay, William C. Evans, Alcherio Martinoli

An Experimental Study of Time Scales and Stability in Networked Multi-Robot Systems ........................................ 631
Nathan Michael, Mac Schwager, Vijay Kumar, Daniela Rus

Mechanics of Continuum Robots with External Loading and General Tendon Routing ........................................... 645
D. Caleb Rucker, Robert J. Webster III

Posters

Estimation of Thruster Configurations for Reconfigurable Modular Underwater Robots .......................................... 655
Marek Doniec, Carrick Detweiler, Daniela Rus

Characterization of Dynamic Behaviors in a Hexapod Robot ................................................................. 667
Haldun Komsuoglu, Anirudha Majumdar, Yasemin Özkan Aydin, Daniel E. Koditschek

HangBot: A Ceiling Mobile Robot with Robust Locomotion under a Large Payload (Basic Design and Development of Key Mechanisms) ........................................ 685
Rui Fukui, Hiroshi Morishita, Taketoshi Mori, Tomomasa Sato

FLIRT: Interest Regions for 2D Range Data with Applications to Robot Navigation ............................................... 695
Gian Diego Tipaldi, Manuel Braun, Kai O. Arras

Perception Quality Evaluation with Visual and Infrared Cameras in Challenging Environmental Conditions .................... 711
Christopher Brunner, Thierry Peynot

Multi-task Learning of Visual Odometry Estimators .................................................................................. 727
Vitor Campanholo Guizilini, Fabio Tozeto Ramos
Any-Com Multi-robot Path-Planning with Dynamic Teams: Multi-robot Coordination under Communication Constraints .......... 743
    Michael Otte, Nikolaus Correll

Compliant Leg Shape, Reduced-Order Models and Dynamic Running ................................................................. 759
    Jae Yun Jun, Duncan Haldane, Jonathan E. Clark

Towards Fully Autonomous Bacterial Microrobots ......................... 775
    Sylvain Martel

Closed-Loop Actuated Surgical System Utilizing Real-Time In-Situ MRI Guidance ............................................................ 785
    Gregory A. Cole, Kevin Harrington, Hao Su, Alex Camilo, Julie G. Pilitsis, Gregory S. Fischer

Fabrication of Highly Articulated Miniature Snake Robot Structures Using In-Mold Assembly of Compliant Joints .......... 799
    Arvind Ananthanarayanan, Felix Bussemer, Satyandra K. Gupta, Jaydev P. Desai

Control of an Omnidirectional Walking Simulator .................................................. 811
    Manish Chauhan, C.G. Rajeevlochana, Subir Kumar Saha, S.P. Singh

Control of Robotic Manipulators with Input-Output Delays: An Experimental Verification .................................................. 823
    Yen-Chen Liu, Nikhil Chopra

Model-Based Control and Estimation of Humanoid Robots via Orthogonal Decomposition .................................................. 839
    Michael Mistry, Akihiko Murai, Katsu Yamane, Jessica Hodgins

Enhancement of Multi-user Teleoperation Systems by Prediction of Dyadic Haptic Interaction .................................................. 855
    Daniela Feth, Angelika Peer, Martin Buss

The Reconfigurable Omnidirectional Articulated Mobile Robot (ROAMeR) ................................................................. 871
    Qiushi Fu, Xiaobo Zhou, Venkat Krovi

Practical Motion Planning in Unknown and Unpredictable Environments ................................................................. 883
    Rayomand Vatcha, Jing Xiao

Experiments in Vision-Laser Fusion Using the Bayesian Occupancy Filter ................................................................. 899
    John-David Yoder, Mathias Perrollaz, Igor E. Paromtchik, Yong Mao, Christian Laugier
Towards Experimental Analysis of Challenge Scenarios in Robotics .... 909
Geoffrey A. Hollinger, Sanjiv Singh

Sensitivity of Task Space Performance to Null Space Control in
Presence of Model Uncertainties .............................. 923
Ngoc Dung Vuong, Chongyou Ma, Marcelo H. Ang Jr.

Author Index ......................................................... 935