

8th International IFAC Symposium on Robot Control 2006

**Bologna, Italy
6-8 September 2006**

Volume 1 of 2

ISBN: 978-1-60560-753-5

Printed from e-media with permission by:

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

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

Copyright© (2006) by the International Federation of Automatic Control (IFAC)
All rights reserved.

Printed by Curran Associates, Inc. (2009)

For permission requests, please contact the publisher, International Federation of Automatic Control (IFAC)
at the address below.

IFAC Secretariat
Schlossplatz 12
A-2361 Laxenburg
Austria

Phone: +43 2236 71 447
Fax: +43 2236 72 859

secretariat@ifac-control.org

TABLE OF CONTENTS

VOLUME 1

SESSION WEA-1.1 – CONTROL TECHNIQUES I

ENERGY-BASED CONTROL OF THE BUTTERFLY ROBOT	1
<i>Massimo Cefalo Leonardo Lanari Giuseppe Oriolo</i>	
A NATURAL EXTENSION OF THE PD-WITH-DESIRED-GRAVITY-COMPENSATION CONTROL LAW FOR ROBOT MANIPULATORS WITH INPUT SATURATIONS	7
<i>A. Zavala-Rio, V. Santibanez</i>	
PREDICTIVE CONTROL OF ROBOTIC MANIPULATORS WITH CONSTRAINTS USING ON-LINE LINEARIZED MODELS	13
<i>Juan Vicente Martín Fraile, F. Valle, F. Tadeo, T. Alvarez</i>	
PREDICTIVE CONTROL OF AN UNDERACTUATED BRACHIATION ROBOT	19
<i>Vinicius Menezes de Oliveira, Walter Fetter Lages</i>	

SESSION WEA-1.2 – VISION BASED CONTROL

IMAGE-BASED VISUAL SERVOING OF GOUGH-STEWART PARALLEL MANIPULATORS USING LEGS OBSERVATION	25
<i>Nicolas Andreff Tej Dallej Philippe Martinet</i>	
IS IMPEDANCE-BASED CONTROL SUITABLE FOR TRAJECTORY SMOOTHING?	31
<i>Friedrich Lange, Mirko Frommberger and Gerd Hirzinger</i>	
VISUAL SERVOING WITH A PAIR OF COAXIAL CIRCLES	37
<i>Duccio Fioravanti, Carlo Colombo, Benedetto Allotta</i>	
POSITION-BASED VISUAL SERVOING IN INDUSTRIAL MULTI-ARM ROBOTIC CELLS USING MULTIPLE CAMERAS	43
<i>Vincenzo Lippiello, Bruno Siciliano and Luigi Villani</i>	

SESSION WEA-1.3 – TRAJECTORY PLANNING AND CONTROL I

PATH FOLLOWING CONTROL FOR A MOBILE ROBOT PUSHING A BALL	49
<i>Xiang Li Andreas Zell</i>	
MOTION PLANNING AMIDST MOVING OBSTACLES USING THE BUMP-HYPERSURFACE CONCEPT	55
<i>Elias K. Xidias, Nikos A. Aspragathos</i>	
NEURAL FIELDS FOR BEHAVIOR-BASED CONTROL OF MOBILE ROBOTS	61
<i>Mohamed Oubbati, Michael Schanz, and Paul Levi</i>	
A NEURAL ARCHITECTURE FOR ONLINE PATH LEARNING IN MAZE NAVIGATION	67
<i>Luciene de Oliveira Marin, Mauro Roisenberg, Edson Roberto De Pieri</i>	

SESSION WEP-1.1 – CONTROL TECHNIQUES II

OPTIMAL CONTROL OF TENDON-SHEATH TRANSMISSION SYSTEMS	73
<i>Gianluca Palli and Claudio Melchiorri</i>	
AN OPTIMAL CONTROL APPROACH TO STABLE-PUSHING PLANNING	79
<i>Qingguo Li and Shahram Payandeh</i>	
WALL-FOLLOWING STABLE CONTROL FOR WHEELED MOBILE ROBOTS	85
<i>J.M. Toibero, R. Carelli and B. Kuchen</i>	
ON-LINE SENSOR FAULT DETECTION SYSTEM FOR A SMART WHEELCHAIR	91
<i>Gianluca Ippoliti Sauro Longhi Andrea Monteriu</i>	

SESSION WEP-1.2 – MOBILE ROBOTS – INVITED SESSION

ROBOTIC UNMANNED AERIAL VEHICLE TRAJECTORY TRACKING CONTROL	97
<i>Y. Jiang, D. Neculescu and J. Sasiadek</i>	
3D MAP BUILDING FOR PLANETARY ROVER LOCALIZATION AND PATH PLANNING	103
<i>Joseph Nsasi Bakambu, Pierre Allard and Erick Dupuis</i>	
ROBOTIC MAPPING OF CORRIDOR TYPE ENVIRONMENTS WITH MULTIPLE LOOP CLOSING IN REAL TIME	109
<i>Jean-Julien Carriere, Vladimir Polotski</i>	
NAVIGATION OF AUTONOMOUS MOBILE ROBOT WITH GATE RECOGNITION AND CROSSING	115
<i>Jurek Z. Sasiadek, Yi Lu, Vladimir Polotski</i>	

SESSION WEP-1.3 – TRAJECTORY PLANNING AND CONTROL II

TRAJECTORY TRACKING FOR OMNI-DIRECTIONAL MOBILE ROBOTS BASED ON RESTRICTIONS OF THE MOTOR'S VELOCITIES	121
<i>André Scolari Conceição, A. Paulo Moreira, Paulo J. Costa</i>	
OPTIMAL VELOCITY PLANNING FOR AUTONOMOUS VEHICLES UNDER KINEMATIC CONSTRAINTS	126
<i>Corrado GUARINO LO BIANCO</i>	
OPTIMAL PLACEMENT OF PATH FOLLOWING ROBOT TASK USING GENETIC ALGORITHMS	132
<i>H. Valsamos, Th. Nektarios, N. A. Aspragathos</i>	
FAST GENERATION OF EFFICIENT MOTIONS FOR DIFFERENTIAL DRIVE ROBOTS	138
<i>Soonkyum Kim Frank C. Park</i>	

SESSION WEP-2.1 – CONTROL TECHNIQUES III

OPERATIONAL SPACE CONTROL OF COMPLEX MODULAR ROBOTIC STRUCTURES VIA DP BASED KINEMATIC INVERSION TECHNIQUES	145
<i>G. Casalino, A. Turetta, A. Sorbara</i>	

ITERATIVE LEARNING CONTROL FOR IMPROVED END-EFFECTOR ACCURACY OF AN INDUSTRIAL ROBOT	151
<i>W.B.J. Hakvoort, R.G.K.M. Aarts, J. van Dijk, J.B. Jonker</i>	
PACKET LOSS COMPENSATION IN NETWORKED CONTROL SYSTEMS	157
<i>D. Botturi, A. Fedrigo, P. Fiorini</i>	
A ROBUST NON MODEL-BASED FRICTION COMPENSATION APPROACH.....	163
<i>Marina Indri</i>	

SESSION WEP-2.2 – VISION SYSTEMS

DEPTH-DETECTION FOR MANIPULATION TASKS IN A SCANNING ELECTRON MICROSCOPE	169
<i>Marco Jähnisch, Marc Schiffner</i>	
RANGE ESTIMATION WITH AN OMNIDIRECTIONAL STEREO VISION SYSTEM	175
<i>Eduardo L. L. Cabral and José C. de Souza Jr.</i>	
LEARNING THE OBJECT MODEL FOR AUTOMATIC DETECTION AND TRACKING FOR ROBOT GRASPING	181
<i>Georg Biegelbauer, Matthias J. Schlemmer and Markus Vincze</i>	
DEVELOPMENT AND CONTROL OF A VERSATILE NANOHANDLING ROBOT CELL.....	187
<i>Sergej Fatikow, Volkmar Eichhorn, Christian Schrader, Christian Stolle, Torsten Sievers, Marco Jähnisch</i>	

SESSION WEP-2.3 – TRAJECTORY PLANNING AND CONTROL III

HOVER STABILIZATION OF AN AIRSHIP USING DYNAMIC INVERSION.....	193
<i>AlexandraMoutinho José Raul Azinheira</i>	
AN ADAPTIVE GENETIC ALGORITHM FOR REAL-TIME ROBOTIC TRAJECTORY TRACKING	199
<i>Mahmoud Tarokh and Xiaomang Zhang</i>	
THE UNCOMPUTING APPROACH TO THE ROBOT-MANIPULATOR MOVEMENTS PLANNING IN ENVIRONMENT WITH OBSTACLES.....	205
<i>Juriy Krak, Olexandr Barmak</i>	
INCREASING THE CONNECTIVITY OF PROBABILISTIC ROADMAPS VIA GENETIC POST-PROCESSING.....	211
<i>Giuseppe Oriolo, Stefano Panzieri, Andrea Turli</i>	

SESSION THA-1.1 – MODELING AND IDENTIFICATION OF ROBOTIC SYSTEMS I

TASK-BASED MODULAR CONFIGURATIONS FOR HYBRID AND REDUNDANT PARALLEL ROBOTS	217
<i>C. Stechert, H.-J. Franke , C. Wrege</i>	
ISSUES IN THE EXPERIMENTAL IMPLEMENTATION OF THE FAST TIME SCALE CONTROLLER FOR A FLEXIBLE ARM.....	223
<i>Luca Bascetta, Paolo Rocco</i>	

MODEL'S PARAMETERS EXPERIMENTAL IDENTIFICATION OF A FOUR WHEELED OMNI-DIRECTIONAL MOBILE ROBOT	229
<i>André Scolari Conceição, A. Paulo Moreira, Paulo J. Costa</i>	

MODELING AND CONTROL DESIGN USING THE BOLTZMANN-HAMEL EQUATIONS: A ROLLER-RACER EXAMPLE.....	235
<i>Elzbieta Jarzebowska Rafa- Lewandowski</i>	

SESSION THA-1.2 – FORCE CONTROL

EXPERIMENTS WITH POSITION AND INTERACTION CONTROL FOR A ROBOT WITH ONE FLEXIBLE LINK	241
<i>L.F. Baptista, J.M.M. Martins, J.M.G. S'a da Costa</i>	

A COMPARISON BETWEEN IMPLICIT AND EXPLICIT HYBRID CONTROL FOR CONTOUR TRACKING	247
<i>G. Legnani A. Visioli G. Ziliani</i>	

ABOUT EXPERIMENTAL IMPLEMENTATION OF FRICTION COMPENSATION TO POSITION AND FORCE CONTROL.....	253
<i>Francisco J. T. Vargas, Edson R. De Pieri, Eugenio B. Castelan, Cristiane C. Paim</i>	

KINEMATIC INSTABILITY OF KINEMATICALLY CONSTRAINED MANIPULATORS UNDER PURE FORCE CONTROL.....	259
<i>Nabil Zemiti, Guillaume Morel, Barthélemy Cagneau, Delphine Bellot and Alain Micaelli</i>	

SESSION THA-1.3 – LOCALIZATION I

HEURISTIC STRATEGIES FOR MULTI-ROBOT EXPLORATION AND OPTIMAL COLLABORATIVE EXPLORATION PROBLEM.....	265
<i>Lucilla Giannetti, Elena Lucchi, Paolo Valigi</i>	

GENETIC APPROACH FOR A LOCALISATION PROBLEM BASED UPON PARTICLE FILTERS	271
<i>Andrea Gasparri, Stefano Panzieri, Federica Pascucci, Giovanni Ulivi</i>	

EXPERIMENTAL VALIDATION OF FASTSLAM ALGORITHM CHARACTERIZED BY A LINEAR FEATURES BASED MAP	277
<i>Chiara Fulgenzi Gianluca Ippoliti Sauro Longhi</i>	

VISUAL SLAM – MOBILE ROBOT LOCALIZATION WITH ENVIRONMENT MAPPING.....	285
<i>Federico Bertolli Paolo Fiorini</i>	

SESSION THA-2.1 – MODELING AND IDENTIFICATION OF ROBOTIC SYSTEMS II

INVERSE DYNAMICS MODEL OF A PARALLEL ORIENTING DEVICE.....	291
<i>Massimo Callegari and Paolo Marzetti</i>	

EXPERIMENTAL SYSTEM IDENTIFICATION OF FORCE REFLECTING HAND CONTROLLER	297
<i>Fernando Zumbado and Marcia K. O'Malley</i>	

TOWARDS OPTIMAL CONTROL OF SELF-ORGANIZED ROBOTIC INSPECTION SYSTEMS	303
<i>Nikolaus Correll and Alcherio Martinoli</i>	

DESIGN OF SMA ACTUATED LIGHT WEIGHT PARALLEL MANIPULATOR WITH INTELLIGENT CONTROLLER	309
<i>M. Sreekumar, T. Nagarajan, M. Singaperumal, M. Zoppi and R. Molfino</i>	

SESSION THA-2.2 – CONTROL OF HAPTIC SYSTEMS

KINEMATIC ANALYSIS OF BACKHOES/EXCAVATORS FOR CLOSED-LOOP COORDINATED CONTROL	315
<i>Matthew E. Kontz, Wayne J. Book</i>	

STABILITY BOUNDARY AND DESIGN CRITERIA FOR HAPTIC RENDERING OF VIRTUAL WALLS	321
<i>Thomas Hulin, Carsten Preusche and Gerd Hirzinger</i>	

TOWARD UNIFICATION OF CONSTRAINED MECHANICS AND VIRTUAL FIXTURES IN HAPTIC RENDERING	327
<i>Shahram Payandeh Pierre Joli Zheng Feng</i>	

A 2-DOF FRICTION DRIVE FOR HAPTIC SURGERY SIMULATION OF HYSTEROSCOPY	333
<i>U. Spaelter, E. Samur, H. Bleuler</i>	

SESSION THA-2.3 – LOCALIZATION II

MOBILE ROBOT LOCALIZATION. REVISITING THE TRIANGULATION METHODS	339
<i>Josep Maria Font, Joaquim A. Baille</i>	

PATH PLANNING AND NAVIGATION USING VORONOI DIAGRAM AND FAST MARCHING	345
<i>Santiago Garrido, Mohamed Abderrahim, Luis Moreno</i>	

FAST POSITION TRACKING OF AN AUTONOMOUS VEHICLE IN CLUTTERED AND DYNAMIC INDOOR ENVIRONMENTS	351
<i>Francesco Capezio, Fulvio Mastrogiovanni, Antonio Sgorbissa, Renato Zaccaria</i>	

FAST MOBILE ROBOT LOCALIZATION USING LOW COST SENSORS	357
<i>Emanuele Frontoni, Adriano Mancini, Fabio Caponetti, Primo Zingaretti</i>	

SESSION THP-1.1 – CONTROL ARCHITECTURES

FORMALLY CORRECT ASYNCHRONOUS CONTROL FOR GUIDEPATH-BASED TRAFFIC SYSTEMS	363
<i>Elzbieta Roszkowska</i>	

FRACTIONAL PD_a CONTROL OF AN HEXAPOD ROBOT	369
<i>Manuel F. Silva, J. A. Tenreiro Machado</i>	

AN ARCHITECTURE FOR FORCE AND IMPACT CONTROL	375
<i>Zotovic Ranko, Ángel Valera Fernández, Pedro José García Gil, Ángel Llosá Guillén</i>	

REAL-TIME TRAJECTORY GENERATION FOR SENSOR-GUIDED ROBOTIC LASER WELDING	381
<i>Menno de Graaf, Ronald Aarts, Ben Jonker and Johan Meijer</i>	

SESSION THP-1.2 – SYSTEMS FOR VIRTUAL REALITY

A VIRTUAL REALITY BASED SYSTEM FOR PROGRAMMING MOBILE MANIPULATION TASKS	387
<i>Jacopo Aleotti, Alessandro Melzi, Stefano Caselli</i>	

VOLUME 2

HUMAN VESTIBULAR SYSTEM BASED OPTMAL WASHOUT FILTER DESIGN ON MOTION PLATFORM CONSTRAINT	393
<i>Chin-I Huang and Li-Chen Fu</i>	

FEEDBACK/FEEDFORWARD SCHEMES FOR MOTION CONTROL OF THE CYBERCARPET	399
<i>A. De Luca, R. Mattone, P. Robuffo Giordano</i>	

A VIRTUAL REALITY BASED TELELABORATORY FOR THE REMOTE LEARNING OF ROBOTICS	406
<i>M. L. CORRADINI and G. SAMMARCO</i>	

SESSION THP-1.3 – COMPUTER AIDED DESIGN AND SIMULATION TOOLS

WRAPPING A MOBILE ROBOT WITH RT-CORBA	412
<i>Ricardo Sanz, Adolfo Hernando, Carlos Mart nez, Ignacio Lopez</i>	

SIMULATING A LASER RANGE SCANNER UNDER APPLICATION CONDITIONS	418
<i>Holger Blume Bodo Heimann</i>	

GENERATION OF POSTURE AND HUMAN MOVEMENT FOR WORKSPACE DESIGN	424
<i>Valentin Hue, Jean-Yves Fourquet, Pascale Chiron, Guy Hourriez</i>	

ROBOTICAD: A MATLAB TOOLBOX FOR ROBOT MANIPULATORS	430
<i>Riccardo Falconi , Claudio Melchiorri, Luigi Biagiotti, Alessandro Macchelli</i>	

SESSION THP-2.1 – ADAPTIVE CONTROL

ADAPTIVE ROBUST CONTROLLER FOR ROBOT MANIPULATORS: EXPERIMENTS ON A PUMA 560 ROBOT	436
<i>S. Torres, J.A. Méndez, L. Acosta, V.M. Becerra</i>	

A SELF-TUNING TORQUE FEEDBACK FOR CONTROL OF MANIPULATORS	442
<i>Farhad Aghili and Mehrdad Namvar</i>	

ADAPTIVE TRAJECTORY TRACKING FOR DOUBLY NONHOLONOMIC MOBILE MANIPULATOR - 3-PENDULUM ON MOBILE PLATFORM OF (2,0) CLASS	449
<i>Alicja Mazur Marcin Kulawik</i>	

INVERTED PENDULUM ANGLE TRACKING CONTROL SUBJECT TO UNCERTAINTIES AND STOCHASTIC PERTURBATIONS	455
<i>H. E. Psillakis A. T. Alexandridis</i>	

SESSION THP-2.2 – TELEMANIPULATION SYSTEMS

BILATERAL TELEOPERATION OF MOBILE ROBOTS THROUGH INTERNET	461
<i>Emanuel Slawinski, Josè Postigo, Vicente Mut and Carlos Soria</i>	
ROBUST BILATERAL TELEOPERATION CONTROL UNDER UNKNOWN CONSTANT TIME DELAY WITHOUT VELOCITY MEASUREMENTS	467
<i>L.G. Garcia-Valdovinos, V. Parra-Vega and Marco A. Arteaga</i>	
VARIABLE DELAY IN SCALED PORT-HAMILTONIAN TELEMANIPULATION	475
<i>C. Secchi, S. Stramigioli, C. Fantuzzi</i>	
TOWARDS THE AUTOTUNING OF FORCE-FEEDBACK TELEOPERATORS	481
<i>L. Barbé, B. Bayle, M. de Mathelin</i>	

SESSION THP-2.3 – INDUSTRIAL APPLICATIONS

SAFERDRILL CONTROL SYSTEM ARCHITECTURE	487
<i>G. Pezzuto, J. Gancet, S. Nabulsi</i>	
A LOW-COST RECONFIGURABLE GRIPPER FOR ASSEMBLY AND DISASSEMBLY TASKS IN WHITE INDUSTRY	493
<i>Rezia Molfino, Roberto P. Razzoli and Matteo Zoppi</i>	
AN APPROACH TO COMPLIANT MOTION OF AN INDUSTRIAL MANIPULATOR	501
<i>Alexander Winkler, Jozef Suchy</i>	
MULTI-STAGE DEPLOYMENT OF ROBOT CONTROL SOFTWARE	507
<i>Sven Gesteg ard Robertz, Anders Nilsson, Klas Nilsson, Mathias Haage</i>	

SESSION FRA-1.1 – UAV I

APPLICATIONS OF NETWORKED UNMANNED AERIAL VEHICLES TO COOPERATIVE FIRE DETECTION USING GRID-BASED DATA FUSION TECHNIQUES	513
<i>Luis Merino, Fernando Caballero, Anibal Ollero</i>	
POSITION CONTROL AND ATTITUDE STABILIZATION OF A DUCTED FAN VTOL UAV IN CROSSWIND	519
<i>Jean Michel Pflimlin, Philippe Souères, Tarek Hamel, Robert Mahony</i>	
WIND GUSTS COMPENSATION ACTING ON AN AUTONOMOUS HELICOPTER USING VARIABLE STRUCTURE DIFFERENTIATION SCHEME	525
<i>T. Cheviron, F. Plestan, A. Chriette</i>	
NON LINEAR ROBUST CONTROL OF AN HELICOPTER FOR TRAJECTORY TRACKING	531
<i>L.Marconi and R. Naldi</i>	

SESSION FRA-1.2 – PASSIVITY-BASED CONTROL

A PASSIVITY-BASED COMMAND GOVERNOR CONTROL APPROACH	537
<i>Alessandro Casavola, Michela Sorbara, Stefano Stramigioli</i>	
CONTROL OF PORT HAMILTONIAN SYSTEMS BY DISSIPATIVE DEVICES AND ITS APPLICATION TO IMPROVE THE SEMI-ACTIVE SUSPENSION BEHAVIOUR.....	543
<i>Riccardo Morselli Roberto Zanasi</i>	
PASSIVE HAPTIC CONTROL DURING TELEOPERATION.....	549
<i>Benjamin Black, Wayne J. Book</i>	

SESSION FRA-1.3 – NONHOLONOMIC SYSTEMS

VIRTUAL TELEOPERATION AND REACTIVE MOTION OF A WHEELED MOBILE MANIPULATOR.....	555
<i>Vincent Padois, Jean-Yves Forquet, Pascale Chiron</i>	
ADAPTIVE NONLINEAR CONTROL OF DYNAMIC MOBILE ROBOTS WITH PARAMETER UNCERTAINTIES.....	561
<i>Daniele Fontanelli, Riccardo Viviani, Luca Greco, Andrea Caiti, Antonio Bicchi</i>	
CHEAP PATHS FOR NONHOLONOMIC MOTION PLANNING	569
<i>Ignacy Duleba, Pawel Ludwikow</i>	
THE MINIMUM-TIME CRASHING PROBLEM FOR THE DUBINS' CAR	575
<i>Paolo Robuffò-Giordano, Marilena Vendittelli</i>	

SESSION FRA-2.1 – UAV II

ADAPTIVE ON LINE PLANNING ALGORITHM FOR AUVS EXPLORATION OF UNKNOWN OCEAN ENVIRONMENTS.....	581
<i>Andrea Caiti, Andrea Munafò and Riccardo Viviani</i>	
ON SPATIAL TRAJECTORY PLANNING & OPEN-LOOP CONTROL FOR UNDERACTUATED AUVS.....	587
<i>Filoktimon Repoulas and Evangelos Papadopoulos</i>	
A FUZZY HYBRID APPROACH TO INVERSE KINEMATICS OF UNDERWATER VEHICLE-MANIPULATOR SYSTEMS	593
<i>Carlos Henrique dos Santos, Guilherme Bittencourt, Raul Guenther, Edson De Pieri</i>	
EXPERIMENTAL VALIDATION OF HIGH SPEED HAZARD AVOIDANCE CONTROL FOR UNMANNED GROUND VEHICLES	599
<i>Matthew Spenko, Steven Dubowsky, and Karl Iagnemma</i>	

SESSION FRA-2.2 – GRASPING AND MANIPULATION

STABILITY OF 3D-OBJECT GRASPING UNDER NON-HOLONOMIC CONSTRAINTS AND THE GRAVITY EFFECT.....	605
<i>S.Arimoto M.Yoshida and J.-H.Bae</i>	
WRIST-POSITION PARAMETERIZATION FOR FAST ON-LINE DETERMINATION OF GRASP CONFIGURATIONS.....	612
<i>Raul Suarez Gerrit Färber</i>	

GRASP PLANNING WITH FOUR FRICTIONAL CONTACTS ON POLYHEDRAL OBJECTS	618
<i>Ricardo Prado Raúl Suárez</i>	

GRASPING FORCE OPTIMIZATION USING DUAL METHODS	624
<i>Jordi Cornellà, Raul Suárez, Raffaella Carloni, Claudio Melchiorri</i>	

SESSION FRA-2.3 – TRAJECTORY PLANNING FOR NONHOLONOMIC SYSTEMS

PRELIMINARY EXPERIMENTS OF FORMATION CONTROL USING THE NULL-SPACE-BASED BEHAVIORAL CONTROL	630
<i>Gianluca Antonelli Filippo Arrichiello Stefano Chiaverini Koustubh J. Rao</i>	

EXPERIMENTAL ANALYSIS OF COLLECTIVE CIRCULAR MOTION FOR MULTI-VEHICLE SYSTEMS	636
<i>N. Ceccarelli, M. Di Marco, A. Garulli, A. Giannitrapani</i>	

MOTION PLANNING IN THE PRESENCE OF MOVING OBSTACLES USING RRT SEARCH AND B-SPLINES	642
<i>Kristijan Macek , Roland Siegwart</i>	

SESSION FRP-1.1 – VEHICLES

DESIGN OF A CONTROLLER ALLOWED THE INTUITIVE CONTROL OF AN X4-FLYER	648
<i>N.Guenard, T.Hamel, V.Moreau, R.Mahony</i>	

DOOR CROSSING AND STATE IDENTIFICATION USING ROBOTIC VISION	654
<i>Eliana P. L. Aude, Ernesto P. Lopes, Cristiano S. Aguiar, Mario F. Martins</i>	

DYNAMIC MODELING OF FOUR-WHEEL FULL-SUSPENSION VEHICLE	660
<i>S. Murat Yesiloglu, Hakan Temeltas</i>	

MANAGEMENT AND TRANSPORT AUTOMATION IN WAREHOUSES BASED ON AUTO-GUIDED VEHICLES	666
<i>Marta C. Mora Leopoldo Armesto Josep Tornero</i>	

SESSION FRP-1.2 – BIPED ROBOTS

VIRTUAL FORCES BASED LOCOMOTION STRATEGY AND ENERGY BALANCE ANALYSIS	672
<i>G. Muscato, G. Spampinato, M. Costa</i>	

A CONTROL ARCHITECTURE FOR DYNAMICALLY STABLE GAITS OF SMALL SIZE HUMANOID ROBOTS	678
<i>Andrea Manni, Angelo di Noi and Giovanni Indiveri</i>	

STABLE PERIODIC GAITS OF N-LINK BIPED ROBOT IN THREE DIMENSIONAL SPACE	684
<i>Oumnia Licer, Nacer K. M'Sirdi, Nouredine Manamanni, Nouredine El Alami</i>	

HIGH FREQUENCY DYNAMICALLY STABLE WALKING PATTERN GENERATION THAT ENABLES CHANGE OF FOOT PLACEMENT DURING THE STEP	690
<i>Koichi Nishiwaki, Satoshi Kagami</i>	

SESSION FRP-1.3 – BIOROBOTICS

LEARNING HIGH-LEVEL SENSORS FROM REFLEXES VIA SPIKING NETWORKS IN ROVING ROBOTS	696
<i>P. Arena, L. Fortuna, M. Frasca, L. Patanè, D. Barbagallo, C. Alessandro</i>	
ARTIFICIAL HAND CONTROL PROBLEMS: HUMAN INTENTION RECOGNITION	702
<i>Andrzej Wo-czowski, Krzysztof Krzysztoforski</i>	
IMPLEMENTATION OF LISTING’S LAW FOR A ROBOT EYE	708
<i>Giorgio Cannata, Mirko D’Andrea, Marco Maggiali, Francesca Monti</i>	

SESSION FRP-2.1 – SPACE ROBOTS

VIBRATION CONTROL IN THE ASSEMBLY OF LARGE FLEXIBLE STRUCTURES BY TEAMS OF SPACE ROBOTS	714
<i>Dimitrios Tzeranis and Steven Dubowsky</i>	
BALANCE CONTROL OF ARTICULATED ROVERS WITH ACTIVE SUSPENSION	720
<i>Gregory McDermott, Mahmoud Tarokh and Lorena Mireles</i>	
A PRACTICAL IMPLEMENTATION OF THE VIRTUAL FORCES METHOD FOR THE OBSTACLE AVOIDANCE OF A MULTI-ARM SPACE ROBOT	726
<i>M. Fumagalli, P. Guagliardo, F. Fusco, A. Rusconi</i>	
A NEW TRACTION CONTROL ARCHITECTURE FOR PLANETARY EXPLORATION ROBOTS	732
<i>Daniele Caltabiano and Giovanni Muscato</i>	

SESSION FRP-2.2 – DESIGN OF ROBOTIC SYSTEMS

PHYSICAL MODELLING OF THE μWALKER, A MEMS LINEAR STEPPER ACTUATOR	738
<i>Mihai Patrascu and Stefano Stramigioli</i>	
SYSTEMATIC DEVELOPMENT OF ADAPTRONIC JOINTS FOR PARALLEL KINEMATIC STRUCTURES	744
<i>Nenad Pavlovic, Ralf Keimer, H.-J. Franke</i>	
A MULTI-LAYER ANALOG/DIGITAL ARCHITECTURE FOR AUTONOMOUS LOCOMOTION IN A HEXAPOD ROBOT WITH SENSORY FEEDBACK	750
<i>P. Arena, L. Fortuna, M. Frasca, L. Patané</i>	
TOWARDS THE THERAPEUTIC SPHERICAL ROBOT: DESIGN, PROGRAMMING AND CONTROL	756
<i>Krzysztof Arent Marek Kabala Marek Wnuk</i>	

SESSION FRP-2.3 – HUMANOID ROBOTS

MULTI-SENSOR CONTROLLED SKILLS FOR HUMANOID ROBOTS762
G. Milighetti, H.-B. Kuntze

**MOTION PLANNING AND CONTROL STRATEGIES FOR A DISTRIBUTED
ARCHITECTURE HUMANOID ROBOT**768
José R. T. Puga, Filipe M. T. Silva, Vítor M. F. Santos

**SUB-MATRIX ANALYSIS FOR CONTACT FORCE RESOLUTION IN HUMANOID
SIMULATION**.....774
Joshua G. Hale

**CONTROL OF A BIOMIMETIC “SOFT-ACTUATED” LOWER BODY 10DOF
EXOSKELETON**780
Nelson R. S. Costa, Darwin G. Caldwell

Author Index