Contents

Preface ix
List of Authors xi

1. Mechanisms 1

Dimensional synthesis of robots using a double quaternion formulation of the workspace
J.M. McCarthy and S. Ahlers. 3

Theory of stiffness control in robotics using the Conservative Congruence Transformation
S.-F. Chen and I. Kao. 9

Design of a spider robot based on second-order immobilization theory
E. Rimon, S. Shoval, and A. Shapiro. 17

Parallel robots: open problems
J.-P. Merlet. 27

Grasp and manipulation of multiple objects
M. Kaneko and K. Harada. 33

2. Controls I 41

Distributed computational environments that accelerate humanoid robot research and application—the HRP Virtual Platform Project
Y. Nakamura, K. Yamane, H. Hirukawa, and F. Nagashima. 43

Control of underactuated manipulation by real-time nonlinear optimization
K.M. Lynch and C.K. Black. 51

Quaternion-based impedance control for dual-robot cooperation
F. Caccavale, C. Natale, B. Siciliano, and L. Villani. 59

3. Sensing I 67

Geometric pattern matching for industrial robot guidance
W. Silver. 69

Shape and enlightenment: reconstruction and recognition under variable illumination
D.J. Kriegman, P.N. Bellhumeur, and A.S. Georghiades. 79

A resampling method for computer vision
C. Tomasi, J. Zhang, and G. Golub. 89

Visual servoing using projective kinematics
A. Ruf, F. Martin, B. Lamiroy, and R. Horaud. 97

The world of odour: a relatively unexplored sensory dimension for robots
R.A. Russell. 105

4. Automation 113

Towards motion autonomy for future vehicles
C. Laugier and M. Parent. 115

Manipulating parts with an array of pins: a method and a machine
S.J. Blind, C.C. McCullough, S. Akella, and J. Ponce. 123

Distributed programming and coordination for agent-based modular automation
A.A. Rizzi, J. Gowdy, and R.L. Hollis. 131

Geometric trap design for automatic part feeders
R.-P. Berretty, K. Goldberg, M.H. Overmars, and A. Frank van der Stappen. 139

5. Maps and Navigation 145

Precision 3-D modeling for autonomous helicopter flight
R. Miller, O. Amidi, C. Thorpe, and T. Kanade. 147

Efficient multi-robot localization based on Monte Carlo approximation
D. Fox, W. Burgard, H. Kruppa, and S. Thrun. 153

Toward deployment of large scale simultaneous localisation and map building (SLAM) systems
H.F. Durrant-Whyte, M.W.M.G. Dissanayake, and P.W. Gibbens. 161

A computationally efficient method for large-scale concurrent mapping and localization
J.J. Leonard and H.J.S. Feder. 169

6. Interfaces I 177

Experimental validation of a psychological conjecture on a simplified model of the haptic perceptual channel
A. Bicchi, E. Pasquale Scilingo, and D. De Rossi. 179

Collision/contact models for dynamic simulation and haptic interaction
D.C. Ruspini and O. Khatib. 185

A robot system for medical ultrasound
T. Salcudean, W. Zhu, P. Abolmaesumi, S. Bachmann, and P. Lawrence. 195

From scans to sutures: Robotics methods for computer-enhanced surgery
R.E. Ellis. 203

7. Controls II 211

Planning and control of robot motion based on time-scale transformation and iterative learning control
S. Kawamura, N. Fukao, and H. Ichii. 213

To learn or to be taught? Design issues towards cognitive robotics
M. Asada and K. Hosada 221

Learning robot behaviour and skills based on human demonstration and advice: the machine learning paradigm
R. Dillmann, O. Rogalla, M. Ehrenmann, R. Zöllner, and M. Bordegoni. 229

Sensorimotor skill transfer of compliant motion
R. Koeppe and G. Hirzinger. 239

8. Interfaces and Architectures 247

Automated robot behavior recognition
K. Han and M. Veloso. 249

FROB: a transformational approach to the design of robot software
G.D. Hager and J. Peterson. 257

Mobile manipulation–getting a grip?
H. Christensen, L. Petersson, and M. Eriksson. 265

9. Interfaces II 273

Locomotion interface for virtual environments
H. Iwata. 275

Realtime control of a robot arm using simultaneously recorded brain neurons
J. Chapin. 283

Interfacing agents through boundaries of interaction dynamics
Y. Kuniyoshi, A. Nagakubo, L. Berthoze, and G. Cheng. 289

An anthropomorphic robot head having autonomous facial expression function for natural communication with humans
A. Takanishi. 297

Building human-friendly robot systems
J. Heinzmann and A. Zelinsky. 305

10. Biomimesis 313

AIBO: towards the era of digital creatures
M. Fujita. 315

Robotics as a tool for neuroscience: cerebellar internal models for robotics and cognition
M. Kawato. 321

Biologically inspired adaptive dynamic walking of the quadruped on irregular terrain
H. Kimura, Y. Fukuoka, and H. Nakamura. 329

Biological inspiration: lessons from many-legged locomotors
R.J. Full. 337

11. Sensing II 343

Planning robot motion strategies for efficient model construction
H. González-Baños, E. Mao, J.-C. Latombe, T.M. Murali, and A. Efrat. 345

Robotics in reality-based modeling
D. Pai. 353

1ms sensory-motor fusion system
M. Ishikawa, T. Komuro, A. Namiki, and I. Ishii. 359

Object manipulation by soft fingers and vision
Y. Yokokohji, M. Sakamoto, and T. Yoshikawa. 365

12. MEMS 375

What can MEMS do for robotics?
H. Fujita. 377

Integrated sensor systems for advanced machines
S.C. Jacobsen, M. Olivier, M.G. Mladejovsky, M.R. Whitaker, C.C. Davis, and B.J. Maclean. 385

A single universal force field can uniquely orient non-symmetric parts
K.-F. Böhringer, B.R. Donald, L.E. Kavraki, and F. Lamiraux. 395

Biomimetic robotic mechanisms via shape deposition manufacturing
S.A. Bailey, J.G. Cham, M.R. Cutkosky, and R.J. Full. 403

13. Mobile Systems 411

Aggressive maneuvering of autonomous aerial vehicles: a human-centered approach
M. Piedmonte and E. Feron. 413

An expectation-based, multi-focal, saccadic (EMS) vision system for vehicle guidance
E.D. Dickmanns. 421

Results of NASDA'S ETS-VII robot mission and its application
M. Oda and N. Inaba. 431

Advances in underwater robot vehicles for deep ocean exploration: navigation, control, and survey operations
L. Whitcomb, D.R. Yoerger, H. Singh, and J. Howland. 439

Space robot dynamics and control: to orbit, from orbit, and future
K. Yoshida. 449

List of Participants 457