

Contents :

Front Matter

Part I — From Everyday Physics to Robot Control

1. Human Robotics: A Vision and A Dream

Suguru Arimoto — pp. 1–5

An introductory vision of **human robotics**, discussing the relationship between robotics, human movement and the physical principles underlying natural motion.

2. Natural Motion and Singularity-Consistent Inversion of Robot Manipulators

Dragomir N. Nenchev — pp. 9–33

- Natural robot motion
- Robot-manipulator kinematics
- Singular configurations
- Singularity-consistent inversion
- Manipulator motion generation
- Kinematic control

3. Approximate Jacobian Control for Robot Manipulators

Chien Chern Cheah — pp. 35–53

- Robot Jacobian
- Approximate Jacobian
- Manipulator control
- Kinematic uncertainties
- Feedback control
- Robust motion control

4. Adaptive Visual Servoing of Robot Manipulators

Yun-Hui Liu, Hesheng Wang — pp. 55–82

- Visual servoing
- Image-based control
- Adaptive control
- Camera parameters
- Feature-point coordinates
- Image Jacobian
- Fixed-camera configuration

- Eye-in-hand configuration
- Uncalibrated cameras

The chapter specifically develops an adaptive controller for image-based dynamic control when camera parameters and feature-point coordinates are unknown.

5. Orthogonalization Principle for Dynamic Visual Servoing of Constrained Robot Manipulators

Vicente Parra-Vega, Emmanuel Dean-Leon — pp. 83–105

- Dynamic visual servoing
- Constrained manipulators
- Orthogonalization principle
- Visual feedback
- Robot dynamics
- Constraint handling

6. Passivity-Based Control of Multi-Agent Systems

Nikhil Chopra, Mark W. Spong — pp. 107–134

- Passivity
- Multi-agent systems
- Networked robots
- Interconnected dynamical systems
- Stability
- Cooperative control

7. Navigation Functions for Dynamical, Nonholonomically Constrained Mechanical Systems

Gabriel A. D. Lopes, Daniel E. Koditschek — pp. 135–155

- Robot navigation
- Navigation functions
- Nonholonomic constraints
- Mechanical systems
- Motion planning
- Obstacle avoidance
- Dynamical systems

8. Planning and Control of Robot Motion Based on Time-Scale Transformation

Sadao Kawamura, Norimitsu Sakagami — pp. 157–178

- Robot motion planning
- Motion control
- Time-scale transformation

- Trajectory generation
 - Dynamic motion
 - Robot manipulation
-

Part II — From Robot Control to Human-Like Movements

9. Modularity, Synchronization, and What Robotics May Yet Learn from the Brain

Jean-Jacques Slotine — pp. 181–200

- Modularity
- Synchronization
- Neural control
- Brain-inspired robotics
- Human motor coordination
- Biological principles of movement

10. Force Control with A Muscle-Activated Endoskeleton

Neville Hogan — pp. 201–216

- Force control
- Endoskeletons
- Muscle activation
- Human movement
- Mechanical compliance
- Human-like actuation

11. On Dynamic Control Mechanisms of Redundant Human Musculo-Skeletal System

Kenji Tahara, Zhi-Wei Luo — pp. 217–247

- Human musculoskeletal system
- Redundant muscles
- Reaching movements
- Pinching movements
- Sensory-motor control
- Internal forces
- Nonlinear muscles
- Gravity compensation
- Passivity
- Redundancy

The authors model reaching using a two-link planar arm with six redundant muscles and examine sensory-motor control, gravity compensation and muscle co-contraction during pinching.

12. Principle of Superposition in Human Prehension

Mark L. Latash, Vladimir M. Zatsiorsky — pp. 249–261

- Human prehension
- Grasping
- Motor coordination
- Superposition principle
- Hand movements
- Force distribution
- Human motor control

13. Motion Planning of Human-Like Movements in the Manipulation of Flexible Objects

Mikhail Svinin, Igor Goncharenko, Shigeyuki Hosoe — pp. 263–291

- Human-like motion
- Motion planning
- Flexible objects
- Object manipulation
- Dynamic interaction
- Trajectory planning
- Robot manipulation

14. Haptic Feedback Enhancement Through Adaptive Force Scaling: Theory and Experiment

Jaydeep Roy, Daniel L. Rothbaum, Louis L. Whitcomb — pp. 293–316

- Haptic feedback
- Force scaling
- Adaptive control
- Haptic interfaces
- Human perception
- Force feedback
- Experimental validation

15. Learning to Dynamically Manipulate: A Table Tennis Robot Controls a Ball and Rallies with a Human Being

Fumio Miyazaki, Michiya Matsushima, Masahiro Takeuchi — pp. 317–341

- Robot learning
- Dynamic manipulation
- Learning control

- Table-tennis robot
- Ball tracking
- Trajectory prediction
- Dynamic interaction
- Human–robot interaction
- Skill acquisition