Contents

Part I: Coordination for Perception, Coverage and Tracking	
Adaptive Multi-Robot Coverage of Curved Surfaces	3
Nonlinear Cyclic Pursuit Based Cooperative Target Monitoring	17
High Resolution Atmospheric Sensing Using UAVs Bobby Hodgkinson, Doug Lipinski, Liqian Peng, Kamran Mohseni	31
A Physics Inspired Finite State Machine Controller for Mobile Acoustic Arrays Thomas Apker, Eric Martinson	47
Vision Based Mobile Target Geo-localization and Target Discrimination Using Bayes Detection Theory Rajnikant Sharma, Josiah Yoder, Hyukseong Kwon, Daniel Pack	59
Part II: Task Allocation and Coordination Strategies	
A Real World Coordination Framework for Connected Heterogeneous Robotic Systems	75
Optimizing for Transfers in a Multi-vehicle Collection and Delivery Problem	91
Distributed Amorphous Ramp Construction in Unstructured Environments	105

On Segregative Behaviors Using Flocking and Velocity Obstacles	121
Object Transportation by Granular Convection Using Swarm Robots Ken Sugawara, Nikolaus Correll, Dustin Reishus	135
Multi-Robot Control for Circumnavigation of Particle Distributions Sarah Tang, Dylan Shinzaki, Christopher G. Lowe, Christopher M. Clark	149
Part III: Modular Robots and Novel Mechanisms and Sensors	
A One-Hour Curriculum to Engage Middle School Students in Robotics and Computer Science Using Cubelets	165
A Fast Coalition Structure Search Algorithm for Modular Robot Reconfiguration Planning under Uncertainty	177
Flexible Self-reconfigurable Robots Based on Thermoplastic Adhesives Fumiya Iida, Liyu Wang, Luzius Brodbeck	193
Self-assembly and Self-reproduction by an M-TRAN Modular Robotic System	208
Self-assembly in Heterogeneous Modular Robots Wenguo Liu, Alan F.T. Winfield	219
Error-Tolerant Cyclic Sequences for Vision-Based Absolute Encoders	233
Arbitrary Lattice Formation with Flocking Algorithm Applied to Camera Tracking System	247
Part IV: Formation Control and Motion Planning for Robot Teams	
A Stochastic Optimal Enhancement of Feedback Control for Unicycle Formations	261

Maximum-Leaf Spanning Trees for Efficient Multi-Robot Recovery with Connectivity Guarantees	275
Multi-Robot Formation Morphing through a Graph Matching Problem	29 1
Hexagonal Lattice Formation in Multi-Robot Systems Sailesh Prabhu, William Li, James McLurkin	307
Direct Policy Search with Variable-Length Genetic Algorithm for Single Beacon Cooperative Path Planning Tan Yew Teck, Mandar Chitre	321
Optimal Multi-Robot Path Planning with LTL Constraints: Guaranteeing Correctness through Synchronization	337
Part V: Learning, Adaptation, and Cognition in Many Robot Systems	
Evolving Aggregation Behaviors in Multi-Robot Systems with Binary Sensors	355
Robot Teams: Sharing Visual Memories	369
Distributed Particle Swarm Optimization for Limited Time Adaptation in Autonomous Robots	383
A Multi-Robot Cognitive Sharing System Using Audio and Video Sensors	397
Conditional Random Fields for Behavior Recognition of Autonomous Underwater Vehicles	409

XXII Contents

nitation Learning and Behavior Generation in a Robot	
Team	423
Supervised Learning in Robotic Swarms: From Training	405
Samples to Emergent Behavior	435
Gregory Vorobyev, Andrew Vardy, Wolfgang Banzhaf	
Author Index	449