

Contents

1	Introduction	1
2	Related Work	5
2.1	Position-based Routing	5
2.1.1	Greedy forwarding	6
2.1.2	Face Traversal	6
2.1.3	Graph Planarization	8
2.1.4	Beacon-less routing	10
2.1.5	Position-based Multi-path Strategies	10
2.1.6	Geographic Clustering	11
2.1.7	Location Services	11
2.1.8	Related Online Routing Problems	12
2.2	Routing in Faulty Networks	12
2.3	Online Problems and Performance Measures	12
2.4	Online Navigation and Searching	13
2.4.1	Navigation	13
2.4.2	Searching and Exploration	15
2.4.3	Maze Traversal Algorithms	17
2.4.4	Complexity of Labyrinth Problems	17
2.5	Robot Motion-Planning Algorithms	18
2.5.1	Online Planning in Continuous Environments	18
2.5.2	Motion Planning in Grid-based Environments	20
3	Position-based Routing using a Cell Structure	23
3.1	The Network Model	24
3.2	Proactive Versus Reactive Information Dissemination	24
3.3	The Cell-based Geographic Forwarding Protocol	26
3.3.1	Establishing the Cell Structure	27
3.3.2	Cell-based Routing	33
3.4	Equivalence of Network and Cell Structure	37
3.4.1	Distributed Route Construction	39
3.5	Conclusion and Outlook	40

Contents

4 Online Routing in Faulty Mesh Networks	43
4.1 Basic Definitions and Techniques	44
4.1.1 Barriers, Borders and Traversals	44
4.2 Comparative Measures	45
4.2.1 The Competitive Time Ratio	45
4.2.2 The Comparative Traffic Ratio	45
4.3 Lower Bounds	46
4.3.1 A Trade-off between Time and Traffic	47
4.4 Basic Strategies	52
4.4.1 Lucas' Algorithm	52
4.4.2 Expanding Ring Search	53
4.4.3 Continuous Ring Search	53
4.5 The Alternating Algorithm	54
4.6 The JITE Algorithm	55
4.6.1 Overview	55
4.6.2 Fast Exploration	56
4.6.3 Slow Search	60
4.6.4 Time Analysis	61
4.6.5 Traffic Analysis	67
4.7 Conclusion and Outlook	71
5 Summary	73
Bibliography	75
Index	85