

Contents

Abstract	i
Résumé	iii
Acknowledgements	v
Preface	1
1 Introduction	3
1.1 Motivation and Objectives	5
1.2 Approach	7
2 Contributions	11
2.1 Part A: Place Recognition in 3D Point Clouds	11
2.2 Part B: Multi-Robot LiDAR SLAM	14
2.3 List of Publications	18
2.4 List of Supervised Students	20
3 Conclusion and Outlook	23
3.1 Part A: Place Recognition in 3D Point Clouds	23
3.2 Part B: Multi-Robot LiDAR SLAM	25
A. PLACE RECOGNITION IN 3D POINT CLOUDS	29
Paper I: <i>SegMatch</i>: Segment-Based Place Recognition in 3D Point Clouds	31
1 Introduction	32
2 Related Work	33
3 <i>SegMatch</i> Algorithm	35
4 Experiments	37
5 Conclusion	44
Paper II: Incremental Segment-Based Localization in 3D Point Clouds	45
1 Introduction	46
2 Related Work	47
3 Method	48

4	Experiments	57
5	Conclusion	62
B.	MULTI-ROBOT LIDAR SLAM	65
Paper III: Non-Uniform Sampling Strategies for Continuous Correction Based Trajectory Estimation		67
1	Introduction	68
2	Related Work	68
3	Theory	69
4	Experiments	72
5	Conclusion	80
6	Appendix A: Metrics for pose estimate's error accumulated over traveled distance	82
Paper IV: An Online Multi-Robot SLAM System for 3D LiDARs		85
1	Introduction	86
2	Related Work	88
3	System Architecture	90
4	System Front-End	91
5	Experiments	95
6	Conclusion	99
Paper V: <i>SegMap</i>: 3D Segment Mapping using Data-Driven Descriptors		103
1	Introduction	104
2	Related Work	106
3	The <i>SegMap</i> Approach	107
4	The <i>SegMap</i> Descriptor	108
5	Experiments	112
6	Conclusion	119
Bibliography		121
Curriculum Vitae		135