

Contents

Preface

vii

Chapter 1: Introduction 1

1.1	Spread Spectrum Multiple Access Scheme	3
1.2	Antenna Array Communications	7
1.2.1	Wireless Multipath Channel Characterisation	8
1.2.2	Space-Time Array Processing	12
1.3	Motivation and Organisation of Book	16

Chapter 2: Spatial-Temporal ARray (STAR) Architecture 19

2.1	Basic Elements of System Model	20
2.2	Spread Spectrum Transmission	21
2.3	Multuser Space-Time Vector Channel	23
2.3.1	Sensor Array Manifold Vector	23
2.3.2	Vector Channel Mathematical Model	24
2.3.3	Continuous-Time Signal Model	25
2.4	Space-Time Array Reception	28
2.4.1	Front-End Temporal Windowing	28
2.4.2	Spatial-Temporal Array Manifold Vector	30
2.4.3	Discrete-Time Signal Model	32
2.5	Summary	35

Chapter 3: Polarisation-Space-Time Estimation and Reception 37

3.1	Introductory Background	38
3.2	Polarised Array Manifold Vector	40
	3.2.1 Polarisation of Electromagnetic Wave	40
	3.2.2 Polarisation-Sensitive Array Response	43
	3.2.3 Diversely-Polarised Manifold Shape	46
3.3	Polar-STAR Signal Modelling	47
3.4	Vector Channel Estimation and Reception	49
	3.4.1 Operation of Preprocessor	49
	3.4.2 Spatial-Temporal Smoothing Technique	51
	3.4.3 Polarisation-Angle-Delay Estimation (PADE) Algorithm ...	54
	3.4.4 Polarisation-Space-Time Reception	57
3.5	Simulation Studies	59
	3.5.1 Performance of Polarisation-Space-Time Algorithm	59
	3.5.2 Studies of Closely-Located Paths	64
	3.5.3 Exemplification of Ill-Conditioned Event	67
3.6	Summary	68

Chapter 4: Diffuse-Space-Time Estimation and Reception 69

4.1	Introductory Background	70
4.2	Diffuse Array Manifold Vector	72
4.3	Diffuse-STAR Signal Modelling	75
4.4	Vector Channel Estimation and Reception	76
	4.4.1 Blind Diffuse-Space-Time Estimation	76
	4.4.2 Co-code/Non Co-code Diffusion-Based Reception	80
4.5	Simulation Studies	83
	4.5.1 Performance of Diffuse-Space-Time Algorithm	83

4.5.2	Robustness to Channel Estimation Errors	87
4.5.3	Evaluation of Diffusion Framework Reception	89
4.6	Summary	91

Chapter 5: Doppler-Space-Time Estimation and Reception 93

5.1	Introductory Background	94
5.2	MIMO Array System Formulation	96
5.2.1	Continuous Time-Varying Signal Model	96
5.2.2	Discrete Time Doppler-STAR Signal Model	98
5.3	Vector Channel Estimation and Reception	100
5.3.1	Joint Space-Time Channel Estimation	100
5.3.2	MUSIC/Analytical Approach to Doppler Estimation	101
5.3.3	Robust MIMO Array Reception	103
5.4	Simulation Studies	106
5.4.1	Performance of Doppler-Space-Time Algorithm	106
5.4.2	Comparison of Doppler Estimation Approaches	110
5.4.3	Investigation of Near-Far Resistant Capability	112
5.5	Summary	112
5.6	Recommendations	113

Chapter 6: Estimation and Reception Application Examples 115

6.1	SIMO Sensor Network Array System	116
6.1.1	SIMO Sensor Network Signal Model	116
6.1.2	Blind Estimation and Reception	118
6.1.3	Performance Analysis	121
6.1.4	Concluding Summary	124

