

Table of Contents

TABLE OF CONTENTS	4
VITA	6
ACKNOWLEDGEMENTS	7
DEDICATION	8
LIST OF FIGURES	9
LIST OF TABLES	11
LIST OF ABBREVIATIONS	12
ABSTRACT	14
CHAPTER 1: INTRODUCTION	16
1.1 BACKGROUND	16
1.2 PROBLEM STATEMENT	23
1.3 RESEARCH METHODOLOGY	24
1.4 ORGANIZATION	27
CHAPTER 2: ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER.....	29
2.1 CONSTRUCTION	29
2.2 BEAM PATTERN FORMULATION	30
2.3 ORTHOGONAL BEAMS IN SPATIAL SPACE	38
2.4 BEAMSPACE MATRIX AND BEAMSPACE WEIGHT VECTOR	43
2.5 ADAPTATION OF BEAMSPACE WEIGHT VECTOR	46
CHAPTER 3: BEAM PATTERN EVOLUTION AND BEAMSPACE WEIGHT VECTOR CONVERGENCE.....	50
3.1 SYSTEM MODEL	50
3.1.1 Transmit data signal	51
3.1.2 Static channel.....	52
3.1.3 Received data signal	52
3.2 COST FUNCTION/PERFORMANCE METRIC	53
3.3 SYSTEM IMPLEMENTATION OF BEAMSPACE WEIGHT VECTOR ADAPTATION	55
3.3.1 At the base station transmitter	55
3.3.2. At the mobile receiver	57
3.3.3 Returning to the base station transmitter	59
3.4 BEAM PATTERN EVOLUTION AND CONVERGENCE OF BEAMSPACE WEIGHT VECTOR	59
3.4.1 Single multipath channel.....	62
3.4.2 Double multipath channel	63
3.4.3 Triple multipath channel.....	68
3.5 BEAM PATTERN AND WEIGHT VECTOR COMPARISONS BETWEEN ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER AND ELEMENT SPACE TRANSMIT BEAMFORMER	71
CHAPTER 4: PERFORMANCE ANALYSIS IN STATIC AND DYNAMIC CHANNELS	76
4.1 EIGEN ANALYSIS OF A STATIC CHANNEL CORRELATION MATRIX	76
4.2 STATIC CHANNEL PERFORMANCE OF A FULL DIMENSIONAL ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER	78
4.3 PERFORMANCE OF A REDUCED DIMENSION ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER IN STATIC CHANNEL	79
4.3.1 Implementation	79
4.3.2 Beam pattern and beamspace weight vector convergence	85
4.3.3 Performance comparisons	87

4.4 DYNAMIC CHANNEL.....	91
4.5 PERFORMANCE ANALYSIS IN A DYNAMIC CHANNEL.....	93
4.6 PERFORMANCE METRIC SIMULATION IN DYNAMIC CHANNEL	101
CHAPTER 5: PERFORMANCE IMPROVEMENT IN DYNAMIC CHANNELS.....	108
5.1 BIT ERROR RATE SIMULATIONS AND ANALYSIS	109
5.1.1 Bit error rate studies on variation of the adaptation rate parameter at constant signal to noise ratio	109
5.1.2 Bit error rate studies on variation of signal to noise ratio at a constant adaptation rate parameter.....	116
5.2 SPACE TIME CODED ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER	121
5.2.1 Transmit signal vector	123
5.2.2 Received signal	126
5.3 COST FUNCTION OF SPACE TIME CODED ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER.....	128
5.4 SYSTEM IMPLEMENTATION OF BEAMSPACE WEIGHT VECTOR ADAPTATION IN SPACE TIME CODED ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER	133
5.4.1 At the base station transmitter	133
5.4.1 At the mobile receiver	135
5.4.3 Returning to the base station transmitter	137
5.5 CHANNEL INDEPENDENCE.....	138
5.6 PERFORMANCE OF SPACE TIME CODED ADAPTIVE TRANSMIT BEAMSPACE BEAMFORMER IN DYNAMIC CHANNELS	143
5.6.1 Bit error rate studies on varying adaptation rate parameter at constant signal to noise ratio	143
5.6.2 Bit error rate studies on varying signal to noise ratio at constant values of the adaptation rate parameter	146
5.6.3 Identification of beamforming and diversity gain in the bit error rate performance	149
CHAPTER 6: CONCLUSION	153
REFERENCES	164
APPENDIX A: PUBLISHED PAPERS.....	170