
Contents At A Glance

1	Introduction	1
2	Waveform Design and Matched Filtering	11
3	New Methods for Optimum Transmitter and Receiver Design	69
4	Constant Envelope Transmit Signals	131
5	Optimum Waveform Design	177
6	Discrete-Time Waveform Design	207
7	Sparsity-Based Receivers	255
	Index	295

Contents

List of Abbreviations	xiii
1 Introduction	1
1.1 Introduction	1
1.2 Organization of the Book and Notations	4
References	6
2 Waveform Design and Matched Filtering	11
2.1 Introduction	12
2.2 Matched Filter Receivers	15
2.2.1 Matched Filter Receivers in White Noise	17
2.2.2 Matched Filter Receivers in Colored Noise	25
2.3 Chirp and Pulse Compression	31
2.4 Joint Transmitter-Receiver Design in Noise	37
2.5 Joint Time-Bandwidth Optimization	50
2.6 Transform of a Chirp Signal	59
References	66
3 New Methods for Optimum Transmitter and Receiver Design	69
3.1 Introduction	69
3.2 Transmitter Waveform Design	74
3.2.1 Transmitter Threshold Energy	76
3.3 Method I: Desired Band Approach	79
3.3.1 Threshold Energy	80
3.3.2 Energy-Bandwidth Tradeoff	91
3.3.3 Simultaneous Savings on Energy and Bandwidth	98
3.4 Method II: Whitening Approach	107
3.4.1 Energy-Bandwidth Tradeoff	120
3.5 Optimization of a Functional	127
References	129

X Waveform Diversity

4	Constant Envelope Transmit Signals	131
4.1	Convex Sets	132
4.1.1	Methods of Alternating Projections	134
4.1.2	Relaxed Projection Operators	136
4.2	Unimodular Sequences Using Cyclic Algorithms	145
4.2.1	General Unimodular Sequences	152
4.3	Constant Envelope Signals with Prescribed Discrete Fourier Transform Magnitude	157
4.4	Pulse Compression and Huffman Code	166
	References	174
5	Optimum Waveform Design	177
5.1	Point Target in White Noise and Arbitrary Clutter	177
5.1.1	Point Target, White Noise, White Clutter (Flat-Flat-Flat Case)	178
5.1.2	Finite Transmit Bandwidth	179
5.1.3	Optimality of Chirp Waveforms	182
5.2	Optimum Tx-Rx: Causal Case	183
5.2.1	Noise Only Case	188
5.2.2	High Clutter Case	192
5.2.3	General Case: Clutter and Noise	194
5.3	Rational all-Pass Filters	200
	References	205
6	Discrete-Time Waveform Design	207
6.1	Matched Filter	207
6.1.1	Optimum Causal Matched Filter	211
6.2	Tx-Rx Design in Colored Noise and Interference	225
6.3	Multichannel Transmit Signal Design	233
	References	250
7	Sparsity-Based Receivers	255
7.1	Introduction	255
7.2	Majorization-Minimization	257
7.2.1	The Landweber Iteration	260
7.3	Soft-Thresholding	262
7.3.1	Iterated Soft-Thresholding Algorithm	264
7.3.2	Fast ISTA (FISTA)	272
7.4	Nonlinear Receiver as a Bayesian Estimator	273
7.5	Sparsity-Based Range-Doppler Processing	276

7.6	Space-Time Adaptive Processing	282
7.7	ℓ_2 Regularization	290
	References	292
Index		295