

## Contents

	<i>List of Contributors</i>	page xi
	<i>Introduction</i>	xiv
	<i>List of Symbols</i>	xx
<b>1</b>	<b>Sub-Nyquist Radar: Principles and Prototypes</b>	<b>1</b>
	Kumar Vijay Mishra and Yonina C. Eldar	
	1.1 Introduction	1
	1.2 Prior Art and Historical Notes	3
	1.3 Temporal Sub-Nyquist Radar	5
	1.4 Doppler Sub-Nyquist Radar	15
	1.5 Cognitive Sub-Nyquist Radar and Spectral Coexistence	18
	1.6 Spatial Sub-Nyquist: Application to MIMO Radar	29
	1.7 Sub-Nyquist SAR	39
	1.8 Summary	43
	<i>References</i>	44
<b>2</b>	<b>Clutter Rejection and Adaptive Filtering in Compressed Sensing Radar</b>	<b>49</b>
	Peter B. Tuuk	
	2.1 Introduction	49
	2.2 Problem Formulation	50
	2.3 Interference Sources	53
	2.4 Signal Processing Treatment of Clutter	55
	2.5 Measurement Compression	58
	2.6 Estimating Interference Statistics from Compressed Measurements	59
	2.7 Mitigating Clutter in Compressed Sensing Estimation	66
	2.8 Summary	68
	<i>References</i>	69
<b>3</b>	<b>RFI Mitigation Based on Compressive Sensing Methods for UWB Radar Imaging</b>	<b>72</b>
	Tianyi Zhang, Jiaying Ren, Jian Li, David J. Greene, Jeremy A. Johnston, and Lam H. Nguyen	
	3.1 Introduction	72
	3.2 RPCA for RFI Mitigation	75
	3.3 CLEAN-BIC for RFI Mitigation	82
		vii

3.4	Enhanced Algorithms for RFI Mitigation	91
3.5	Performance Evaluations	92
3.6	Conclusions	101
3.7	Acknowledgment	102
	<i>References</i>	102
<b>4</b>	<b>Compressed CFAR Techniques</b>	<b>105</b>
	Laura Anitori and Arian Maleki	
4.1	Introduction	105
4.2	Radar Signal Model	105
4.3	Classical Radar Detection	106
4.4	CS Radar Detection	110
4.5	Complex Approximate Message Passing (CAMP) Algorithm	112
4.6	Target Detection Using CAMP	115
4.7	Adaptive CAMP Algorithm	118
4.8	Simulation Results	120
4.9	Experimental Results	127
4.10	Conclusions	131
	<i>References</i>	132
<b>5</b>	<b>Sparsity-Based Methods for CFAR Target Detection in STAP Random Arrays</b>	<b>135</b>
	Haley H. Kim and Alexander M. Haimovich	
5.1	Introduction	135
5.2	STAP Radar Concepts	137
5.3	STAP Detection Problem	145
5.4	Compressive Sensing CFAR Detection	148
5.5	Numerical Results	157
5.6	Summary	161
	<i>References</i>	162
<b>6</b>	<b>Fast and Robust Sparsity-Based STAP Methods for Nonhomogeneous Clutter</b>	<b>165</b>
	Xiaopeng Yang, Yuze Sun, Xuchen Wu, Teng Long, and Tanpan K. Sarkar	
6.1	Introduction	165
6.2	Signal Models	166
6.3	Sparsity Principle Analysis of STAP	168
6.4	Fast and Robust Sparsity-Based STAP Methods	172
6.5	Conclusions	190
	<i>References</i>	190
<b>7</b>	<b>Super-Resolution Radar Imaging via Convex Optimization</b>	<b>193</b>
	Reinhard Heckel	
7.1	Introduction	193

7.2	Signal Model and Problem Statement	195
7.3	Atomic Norm Minimization and Associated Performance Guarantees	199
7.4	Super-Resolution Radar on a Fine Grid	204
7.5	Proof Outline	207
7.6	MIMO Radar	211
7.7	Discussion and Current and Future Research Directions	219
	<i>References</i>	222
<b>8</b>	<b>Adaptive Beamforming via Sparsity-Based Reconstruction of Covariance Matrix</b>	<b>225</b>
	Yujie Gu, Nathan A. Goodman, and Yimin D. Zhang	
8.1	Introduction	225
8.2	Adaptive Beamforming Criterion	228
8.3	Covariance Matrix Reconstruction-Based Adaptive Beamforming	234
8.4	Simulation Results	240
8.5	Conclusion	252
	<i>References</i>	252
<b>9</b>	<b>Spectrum Sensing for Cognitive Radar via Model Sparsity Exploitation</b>	<b>257</b>
	Augusto Aubry, Vincenzo Carotenuto, Antonio De Maio, and Mark A. Govoni	
9.1	Introduction	257
9.2	System Model and Problem Formulation	259
9.3	2-D Radio Environmental Map Recovery Strategies	263
9.4	Performance Analyses	270
9.5	Conclusions	280
	<i>References</i>	280
<b>10</b>	<b>Cooperative Spectrum Sharing between Sparse Sensing-Based Radar and Communication Systems</b>	<b>284</b>
	Bo Li and Athina P. Petropulu	
10.1	Introduction	284
10.2	MIMO Radars Using Sparse Sensing	286
10.3	Coexistence System Model	293
10.4	Cooperative Spectrum Sharing	297
10.5	Numerical Results	309
10.6	Conclusions	315
	<i>References</i>	316
<b>11</b>	<b>Compressed Sensing Methods for Radar Imaging in the Presence of Phase Errors and Moving Objects</b>	<b>321</b>
	Ahmed Shaharyar Khwaja, Naime Ozben Onhon, and Mujdat Cetin	
11.1	Introduction and Outline of the Chapter	321
11.2	Compressed Sensing and Radar Imaging	322

11.3 Synthetic Aperture Radar Autofocus and Compressed Sensing	328
11.4 Synthetic Aperture Radar Moving Target Imaging and Compressed Sensing	333
11.5 Inverse Synthetic Aperture Radar Imaging and Compressed Sensing	341
11.6 Conclusions	349
<i>References</i>	349
<i>Index</i>	355