Index

A
achievable rate region, 74, 595–7, 623, 644–5, 647–50, 680–1
adaptation/reconfiguration efficiency, 39
adaptive coding, 3, 35, 37, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 90
Concatenated codes with interleavers, 51
Continuous valued source, 60
Distributed source coding, 59
filtering, 246, 286, 583
modulation, 32, 86, 87, 90, 91, 205, 372
precombining LMMSE receivers, 246
Punctured convolutional codes/code, 46
reconfigurable block coding, 35
reconfigurable convolutional codes, 40
reconfigurable transmit power allocation, 153
Scalar quantization and trellis-based coset construction, 63
Systematic recursive convolutional codes, 50
The iterative decoding algorithm, 53, 56
Trellis-based quantization and memoryless, 64
Viterbi algorithm, 42
weight adjustment, 299
ADC, 5
addition/deletion, 4, 897
aggregation, 1, 3, 59, 779–82, 784
akogrimo, 27, 29, 33
alamouti scheme, 115, 123, 190, 630
ALOHA, 795, 800
amplify-and-forward, 586, 590–1, 593, 600–2, 604–6, 608, 616–17, 622, 625, 628–9, 654, 660–1, 673, 682
annealing, 4, 284, 784, 799
ant colony, 4, 691, 701, 704
antnet, 4, 688, 691–2, 696–7, 739–40
autocorrelation function, 211, 284, 309, 480, 489, 520
AWGN channel, 40, 87, 185, 231, 354, 366, 608
Bartlett estimate, 256
base station, 95, 98, 149, 179, 182, 220, 397, 403, 539, 556, 558, 563, 593, 653, 719, 723, 730, 739, 744, 762, 767, 900
BCJR algorithm, 69, 71, 201, 381, 446, 454
Bessel function, 100, 167, 304, 408, 410–11, 500
Bezout identity, 523
Bhattacharyya bound, 484
Binary maximal length sequences, 211
Binary shift register sequences, 209
Blind Bayesian multiuser receiver, 455
equalizers, 300–1, 347
least squares receivers, 251
turbo multiuser receiver, 429
built-in time diversity, 159
Bussgang, 340–1, 347, 349

© 2011 John Wiley & Sons, Ltd. Published 2011 by John Wiley & Sons, Ltd.
Index

C
Canonical game, 898–900, 909
CDMA multipath channel, 234
channel estimator, 94, 97, 122, 165, 167, 249, 308, 315, 323, 332, 358, 370, 387, 393, 418, 434, 442
channel sensing, 1, 3, 565–9, 579, 583
cheaters, 580
Chebyshev filter, 304
Chernoff bound, 184
cloud computing, 18–24, 32
cluster, 182, 463–6, 487, 709, 739, 796–8, 897, 902, 905–6, 910–14
coalition, 4, 894, 897–914, 919–20
coding, 1–4, 35, 37, 39, 48, 56, 77, 81, 87, 93, 98, 106, 127, 148, 157, 172, 528, 587, 591, 616, 621, 630, 675
Concatenated codes with interleavers, 51
Continuous valued source, 60
Distributed source coding, 59
Punctured convolutional codes/code, 46
reconfigurable block coding, 35
reconfigurable convolutional codes, 40
Scalar quantization and trellis-based coset construction, 63
Systematic recursive convolutional codes, 50
The iterative decoding algorithm, 53, 56
Trellis-based quantization and memoryless, 64
Viterbi algorithm, 42
Coding gain, 39, 45, 49, 67, 77, 79–80, 87, 127, 172, 187, 189
cognitive networks, 1, 565–7, 569, 571, 573, 575, 577, 579, 581, 583
cognitive radio, 1–3, 565, 568, 578, 632, 893, 900
cognitive wireless networks, 3, 565
collaborative joint detection problem, 575
collaborative optimization, 576
collaborative spectrum sensing, 3, 573, 900, 920
complex orthogonal designs, 116
coding clouds, 879
connectivity, 19, 26, 40, 703–5, 773, 777, 781, 785, 789, 793, 798, 869, 890, 893, 895, 900
collaborative joint detection problem, 575
collaborative optimization, 576
collaborative spectrum sensing, 3, 573, 900, 920
coregional diversity, 109–11, 134, 136, 175
denial of service, 22, 776, 799
definteeleaver, 326, 328
delayed decision feedback sequence estimation (DDFSE), 383
delay diversity, 109–11, 134, 136, 175
denial of service, 22, 776, 799
dFE adaptive algorithms, 338
Index

diamond relay, 586, 640–1, 681
differential decoding, 140, 144–5, 306
differential encoding, 142, 148, 425
dimensioning, 4, 773–5, 777, 779, 784, 897
discrete fourier transform, 201, 423–4, 546, 569
disruptive innovation, 16–17, 19
distributed power control, 586, 652, 655
distributed source coding, 1, 3, 59
distributed space–time coding, 629
diversity gain, 3, 93, 95, 98, 122, 127, 152–3, 172, 174, 201, 384, 386, 395, 397, 586, 594, 601, 603
diversity gain properties, 172
diversity receiver, 358
dominancy, 4, 832, 840–1, 843, 846, 849
dPSK, 133, 141, 225, 226, 361, 364, 365, 453
dynamics, 4, 254, 692, 862, 866, 871, 874, 877, 880, 891, 893, 900, 906, 914, 916, 917, 919
dynamic resource allocation, 586, 592–3, 616, 635, 640, 879, 885
effective length, 158–9
e-healthcare, 29–30, 33
eigenvalues and eigenvectors, 282, 359
e-learning, 24, 27, 29, 33
entropy, 59, 335, 337–9, 341, 807–8, 812
epidemic routing, 4, 710–12, 740
turbo equalization, 72, 286, 324–6, 328, 330, 348–9
zero-forcing equalizers, 291
error rate bound, 158
estimation of MIMO channel, 3, 165
euclidean distance, 58, 78–9, 80, 82, 85, 158–9, 184–5, 382, 449, 474, 698

evolutionary stable strategy, 914
extrinsic information, 271–2, 276, 326–8, 430, 446
extrinsic information ratio (EIR), 271, 276
F
F/B MMSE receiver, 274–5
FFT block, 8, 385, 441
fictitious playing, 4, 832, 840–1, 844, 846, 850
FIR channel estimator, 360–1
fixed-point iteration, 537, 539
formation games, 4, 887, 889, 891, 895, 899, 903, 905, 907, 909, 911, 913, 917, 919–21
forwarding protocol, 589, 592, 616, 626, 629, 635, 637, 640–1, 646–51
frequency selective channel model, 379
frequency selective fading channels, 246, 286, 423–4, 431–2
Frobenius, 542
full spatial diversity, 130, 132–3, 612, 615
G
game theory, 1, 586, 652, 655, 682, 824, 836, 841, 849, 884, 887, 893, 898, 902, 919–20
genetic algorithm, 4, 709, 718–19, 725, 741, 781, 799
gold sequences, 212–13, 229, 412
gold-like and dual-bch sequences, 213
gossip, 4, 813–14, 884
grand coalition, 897–99, 908
Hadamerd sequence, 219
half-duplex relay, 586, 588–90, 592, 616–17, 640–2, 646
hamming weight, 211
HD game, 912, 916, 918
hermitian, 151, 166, 171, 174, 176, 195, 304, 334, 533, 541, 546, 756
heterogeneous channels, 567
HIPERLAN, 9, 30, 556, 563
homogeneous channels, 567
horizontal layered space–time (hlst) architecture, 261
householder transformation, 192
Index

I
IBI, 383, 385, 630, 632
IFFT, 8, 351, 358, 363, 368, 374, 376, 385, 392, 422, 438, 449, 630
IIR, 347
immune system, 683–5, 716, 739
in-home channel, 468
input parameters, 791
integer programming, 4, 699, 783
interarrival times, 466
interference cancellation, 3, 220, 264, 266–8, 274, 276, 285–7, 289, 376, 410, 412, 432, 434, 455, 561
interfering power modeling, 662
inverse fast fourier transform, 438, 449
iterative algorithm, 53, 299, 660, 820, 840, 851
J
Jacobian, 337
Jakes model, 168, 412, 444
joint optimization, 4, 413, 575, 831, 852, 855–6, 860
JPL sequences, 215
K
kalman filter, 288, 330, 332–3, 349, 452
kasami sequences, 214–15
kronecker product, 171, 631
kurtosis-based algorithm, 341
L
lagrange multipliers, 199, 868
lagrangian, 858, 867
layered space–time (LST) architecture, 259
least squares (LS) receiver, 251
linear processing orthogonal designs, 3, 114, 117
link utility, 4, 894–5
LMS algorithm, 248, 251, 299, 314, 318–19, 332, 345
LST architectures, 259, 261
LSTC receivers, 269
Lyapunov drift, 865–7, 873–6
M
MAC game, 578–9
mapping, 61–4, 67, 80, 133, 138–9, 141, 144, 146, 160, 263, 338–9, 348, 424, 568, 606, 792, 811–13
matrix game, 4, 820, 824–7, 830–1, 836, 840–1, 843, 846, 848, 884, 916
max-flow, 4, 588, 803, 805, 884
maximal connected sets of m-sequences, 212
maximum likelihood (ML), 47, 259, 263, 312
MIMO capacity, 206
MIMO channels, 3, 204, 252, 286, 523, 527, 529, 531, 535, 539, 541, 543, 545, 547, 549, 551, 553, 555, 557, 559, 561, 563, 679
MIMO OFDM, 375
min-cut, 4, 588, 803, 805, 884
MIPEG, 28–9, 33
mismatch, 123, 307, 345
ML sequence (block) estimator, 304
MLSE equalization, 3, 306, 345, 347, 454
MLSE receiver, 346–8
mobile agent, 4, 685, 688, 691–2, 708, 710, 739–40
modulation, 77
MoGrid, 27–8
multicasting, 4, 697, 699, 740
multichannel cognitive MAC, 3, 578
multicomodity, 867
multidimensional constellation, 3, 84, 86, 89–90, 136
multipath decorrelation, 233, 235
multiple channel sensing, 567
multiple receive antennas, 96, 146, 242, 442
multiple transmit antenna differential detection from, 142, 203
MUSIC, 73, 258–9
Index

| N | nanonetworks, 4, 718 |
|   | nash equilibrium, 579, 582, 655–9, 825, 840, 889, 915–17 |
|   | network virtualization, 18–19 |
|   | next generation internet, 16, 32 |
|   | non-coherent detector, 224 |
|   | non-linear cubic games, 4, 843 |
|   | non-linear power amplifier model, 408 |
|   | null space, 151, 524, 533 |
|   | Delayed decision feedback sequence estimation (DDFSE), 383 |
|   | Fading channel estimation for OFDM systems, 357 |
|   | Layered space–time coding for MIMO OFDM, 375 |
|   | Robust frequency and timing synchronization for OFDM, 354 |
|   | Space–time coded adaptive modulation for OFDM, 372 |
|   | Space–time coded TDMA/OFDM reconfiguration efficiency, 379 |
|   | Space–time coding with OFDM signals, 367 |
|   | Timing and frequency offset in OFDM, 351 |
|   | Turbo and space–time coded adaptive OFDM, 372 |
|   | Optimum PN sequences, 217 |
|   | Orthogonality, 143 |
| P | parallel multiband channel sensing, 569 |
|   | pareto optimality, 581 |
|   | partitioned, 278, 280 |
|   | path loss modeling, 466 |
|   | payoffs, 579, 848, 852, 887, 889–90 |
|   | penalty mechanism, 581 |
|   | percolation, 791, 794, 796–800 |
|   | performance bounds, 48, 60, 604, 754, 877, 883 |
|   | PIC-STD, 269–70, 273–4, 276 |
|   | pilot symbols, 122, 252, 358, 365, 402–4 |
|   | polynomial, 50, 60, 128, 132, 198, 209, 210, 212, 214, 267, 404, 484, 523–4, 561, 563, 789, 791, 803, 809, 818, 883 |
|   | PPM UWB multiple access, 3, 476 |
|   | preamble, 332, 387 |
|   | precoding, 1, 291, 523–4, 530, 630, 642, 644 |
|   | primary users, 565, 569, 571–2 |
|   | protocol competition, 918 |
|   | pseudorandom sequences, 209 |
| Q | QAM, 3–4, 6, 81–4, 87, 90–1, 110–11, 118, 122, 125, 137, 187, 190, 195, 205, 286, 346, 348, 363–9, 371, 373–4, 437, 441, 447, 453, 546, 657 |
|   | QAM constellation, 82, 84, 87, 110–11, 118, 122, 365, 447 |
|   | QPSK, 4, 6, 81, 130–3, 135–7, 202, 297–8, 318, 332, 361–2, 368, 373–5, 546, 554, 557–60 |
|   | Quasi-static fading, 157, 161–3, 189, 205, 376 |
|   | Queuing, 861–2, 874–5 |
| R | raised cosine window, 353 |
|   | RAKE receiver, 6, 9, 90, 242–3, 247–8, 251, 399, 463, 474, 522 |
|   | random graphs, 791, 884 |
|   | random network coding, 4, 811 |
|   | rate adaptation, 404–5, 455 |
|   | rate-compatible punctured convolutional (RCPC) codes, 404 |
|   | rate-distortion, 59, 74, 679 |
|   | real constellation set, 148 |
|   | receiver signal model of STBC MC CDMA systems, 424 |
|   | recursive least squares (RLS), 252, 314 |
Index

relay channel, 586–8, 590, 593, 617–18, 640–2, 646, 679–81
repetition, 13, 35, 55, 60, 109, 111, 411, 459, 475, 483, 590, 593, 600, 603, 607, 609, 612, 615, 617, 620, 622, 626, 675–6, 681
Rician distributions, 100
robust frequency and timing synchronization, 354
route packing, 4, 820, 822, 824
RS decoder, 361–2, 364, 368
S
sampling space of data, 429
sato function, 301
scheduling, 4, 23, 30, 662, 720–2, 724, 831–3, 836–7, 839, 843–9, 852–6, 862, 865, 867, 869–70, 884
schur product, 246
schur-concave, 540–1, 546, 548–9, 551–2, 555–6
secondary users, 565, 570–3, 578, 900
SEDUMI, 533, 562
selfish player, 578
sensing policies, 566–7
sensor networks, 1–4, 24, 26, 29, 32–3, 59, 708, 740, 753–4, 772
sequential channel sensing, 568
sequential optimization, 576
set partition, 3, 66–7, 82–4, 89, 159, 348
sharing, 4, 23, 24, 29, 32, 345, 587, 897, 900–1, 903, 913, 916, 919
signal and channel parameters, 367, 387
single collision domain, 578
soft graph coloring, 4, 843
Algebraic space–time codes, 128
Channel estimation imperfections, 122
Concatenated space–time block coding, 157
Diagonal algebraic space–time block codes, 187
Differential space–time modulation, 133
Estimation of MIMO channel, 165
Lattice code decoder for space–time codes, 194
Layered space–time coding, 148
MIMO channel capacity, 195
MIMO systems with constellation rotation, 182
Multiple transmit antenna differential detection from generalized orthogonal designs, 142
Optimization of a MIMO system, 174
QR Factorization, 192
Quasi-orthogonal space–time block codes, 123
Space–Time Block Codes from Orthogonal Designs, 112
Space–Time convolutional codes, 127
ST codes for frequency selective channels, 168
space–time trellis code design, 174
spatial processing, 242
spatial reuse, 651–2, 655–6, 682, 795
special codes, 117
spectral efficiency of parallel channels, 180
spectrum, 3–4, 7, 9–11, 73, 197, 212, 284, 286–8, 351, 357, 444, 454, 459, 471–2, 478, 480, 483–4, 489, 520–1, 561–2, 565, 569, 571, 573, 583, 585, 682, 771, 798, 800, 897, 900–1, 919–20
square root filtering, 333
standard iterative receiver, 269
static CSMA/CA game, 581
static resource allocation, 586, 592–3, 600, 616, 622, 629, 636, 647, 651
statistical description of the received sequence, 304
statistics of mobile radio channels, 357
stochastic geometry, 791–2, 794, 799
superadditivity, 898
survivable networks, 798
Index

survivor, 48, 312, 319, 332, 348–9, 684
swarm intelligence, 4, 687–8, 703–5, 739
switching, 4, 18–19, 31–2, 91, 205, 372, 374,
   620, 773, 785, 787, 799, 820, 822–8,
   830–1, 833, 836, 843–4, 875, 884
synchronous CDMA channels, 220
system model, 98, 157, 165, 182, 187, 225, 238,
   300–2, 307, 311, 375, 448, 578, 719, 832,
   844, 893, 902, 906
systematic convolutional codes, 50

T
Tarakh, Seshadri, and Calderbank (TSC), 135
TCSQ, 63–6, 68
the case of low SNR, 159
the received signal model, 424, 462
threaded layered space–time (TLST) structure, 262
TIA (telecommunications industry association), 5
Timing, 3, 257, 260, 288, 349, 351–2, 354–5,
   423, 452, 522, 744, 754, 771, 808
TLST architectures, 261
tracking the fading processes, 415
transmission strategy, 600, 645, 647, 650
transmit diversity, 1, 3–4, 95–6, 98, 142, 159,
   160, 189–90, 200, 203, 263, 384, 454,
   604–5, 674
transversal filter equalizer, 294–5, 297
Turbo equalization, 324
two-way relay, 586–7, 590, 593, 646, 650,
   681
TWRC, 586, 590, 593, 646–51
Type of traffic, 590, 593

U
Ultra Wide Band Radio, 3, 459
Universal Wireless Communications (UWC), 5
Utility, 20, 22, 24, 28, 569, 579–80, 656–7, 659,
   697, 725, 728, 730, 733, 738, 857, 860,
   867–8, 871, 874, 876, 879, 887, 890, 893,
   895, 897, 900, 916, 918
UWB, 1–3, 5, 11, 15–16, 459, 462–3, 466, 468,
   470–1, 473–6, 483, 486–7, 491–2, 519–22
UWB channel, 3, 459, 462, 519, 522
UWB radio, 3, 486, 492
vertical Bell laboratories layered space–time
   (VBLAST), 259
vertical layered space–time (VLST), 259
Viterbi algorithm, 3, 47–8, 58, 60, 65, 71–2, 74,
   105, 231, 263, 308, 325–6, 332, 484

W
Walsh functions, 216
water-filling, 199, 549–51, 553
Wiener solution, 309, 414, 416, 418–19
Wireless grids, 24–9, 32

Z
Zero-forcing equalizers, 291
ZF strategy, 264