

Index

- (u,v) code construction, 46
- a-posteriori probability, 22
- acknowledgement, 150
- active distances, 122, 202
 - active burst distance, 123, 202
 - active column distance, 124
 - active reverse column distance, 124
 - active segment distance, 124
- addition table, 303
- Alamouti, 257
- algebraic decoding algorithm, 84
- Amplitude Shift Keying, *see* ASK
- angular spread, 231
- APP decoding, 140, 145, 186
- ARQ, 68
- ASK, 218
- automatic repeat request, 68
- AWGN channel, 6, 57

- Bahl, 140
- basis, 27
- Bayes' rule, 22
- BCH bound, 78
- BCH code, 80
- BCJR algorithm, 140, 181, 186
- beamforming, 257
- BEC, binary erasure channel, 168
- belief propagation algorithm, 168, 174
- Benedetto, 184, 196, 212
- Berger's channel diagram, 4
- Berlekamp–Massey algorithm, 89
- Berrou, 163
- Bhattacharyya bound, 132
- Bhattacharyya parameter, 132

- binary symmetric channel, 5
- binomial coefficient, 18
- bit energy, 7
- bit error probability, 5, 134
- bit interleaving, 149
- BLAST detection, 275
- block check sequence, 153
- block code, 13
 - (n, k) , 14
- Bluetooth, 47, 51
- Boolean functions, 58
- bottleneck region, 194
- bound, 37
 - asymptotic, 40
 - Bhattacharyya, 132, 134
 - Gilbert–Varshamov, 40
 - Griesmer, 40
 - Hamming, 37
 - Plotkin, 40
 - Singleton, 37
 - sphere packing, 37
 - Viterbi, 134, 135
- boxplus operation, 172, 173
- BSC, 5, 114
- burst, 202
- burst error probability, 134

- cardinality, 299
- catastrophic generator matrix, 110
- channel
 - capacity, 4, 248
 - code, 2
 - coding, 1
 - decoder, 2
 - decoding, 2
 - encoder, 2

- check nodes, 165
- CIRC, 83
- Cocke, 140
- code
 - block, 13
 - extension, 43
 - interleaving, 44
 - parameter, 16
 - polynomial, 63
 - puncturing, 43
 - rate, 17
 - shortening, 42
 - space, 18
 - space–time, 215
 - termination, 104, 148, 153
 - word, 14
- commutative group, 295
- commutative ring with identity, 296
- commutativity, 295
- compact disc, 83
- complementary error function, 7
- concatenated codes, 177, 182
- concatenated convolutional codes, 182
- conditional entropy, 4
- conditional probability, 4
- conjugate root, 76, 304
- constraint length, 100
- controller canonical form, 100
- convolutional codes, 98–101, 121, 147, 182, 198
- convolutional encoder, 98–101, 103, 106
- correction ball, 25
- correlated channels, 236
- correlation matrix, 238
- coset, 34
- coset leader, 35
- CRC, 66
- cross-interleaved Reed–Solomon code, 83
- cyclic code, 62
- cyclic group, 295
- cyclic redundancy check, 66
- cyclotomic coset, 77
- decision region, 20
- decoding strategy, 19
- demodulation, 2
- demodulator, 2
- design distance, 80
- DFT, 82, 305
- differential entropy, 6
- digital video broadcasting, 83
- dimension, 300
- discrete convolution, 69
- discrete Fourier transform, 82, 305
- distance, 17
- diversity, 256
 - frequency diversity, 223
 - polarization diversity, 223
 - space diversity, 223
 - time diversity, 223
- diversity combining, 158
- division with remainder, 296
- divisor, 296
- DoA, direction of arrival, 230
- DoD, direction of departure, 230, 237
- Doppler delay-angle scattering function, 230
- DRAM, 29
- dual code, 36
- dual cyclic code, 71
- DVB, 83
- dynamic programming, 117
- ECSD, 152
- EDGE, 152
- effective length, 204
- EGPRS, 152
- eigenvalue decomposition, 314
- elementary symmetric polynomial, 89
- Elias, 160
- encoder state, 103
- encoder state space, 103
- entropy, 4
- equidistant code, 40
- equivalent encoders, 110
- equivalent generator matrices, 110
- erasure, 93
- error
 - burst, 44, 66
 - covariance matrix, 275
 - detection, 34
 - evaluator polynomial, 89

- locator, 86
- locator polynomial, 88
- polynomial, 66, 86
- position, 86
- value, 86
- error event, 121, 134
- Euclid's algorithm, 89, 296
- Euclidean metric, 136
- EXIT charts, 188, 190, 192–196
- EXIT, extrinsic information transfer, 188
- expected weight distribution, 196
- extended code, 43
- extended Hamming code, 51
- extension field, 75, 302
- extrinsic log-likelihood ratio, 173
- factorial ring, 63, 301
- Fano, 160
- fast Fourier transform, 82
- fast Hadamard transform, 57
- FDD, 239
- FFT, 82
- FHT, 57
- field, 298
- finite field, 299
- finite geometric series, 91
- finite group, 295
- first event error probability, 134
- Forney, 160
- Forney's formula, 93
- fractional rate loss, 105
- free distance, 121, 122
- frequency division duplex, *see* FDD
- frequency hopping, 149
- Frobenius norm, 312
- Gallager, 163, 165, 167, 168
- Galois field, 299
- generating length, 203
- generating tuples, 203
- generator matrix, 29
- generator polynomial, 64
- girth, 177
- Glavieux, 163
- GMSK, 152
- Golay code, 50
- GPRS, 152
- group, 295
- GSM, 147, 152, 163
- Hadamard matrix, 53
- Hagenauer, 140, 169
- Hamming code, 29, 49
- Hamming distance, 17
- hard output, 140
- hard-decision decoding, 7
- header check sequence, 153
- Höher, 140
- Höst, 212
- HSCSD, 152
- hybrid ARQ, 150
 - type-I, 151, 156
 - type-II, 151, 157
- identity element, 295
- incremental redundancy, 152, 158
- independence assumption, 176
- information polynomial, 65
- information source, 3
- information word, 14
- inner code, 163
- input–output path enumerator, 136
- interleaved code, 44
- interleaving, 153
- interleaving depth, 44
- inverse element, 295
- IOPEF, 131
- IOWEF, 128
- irregular code, 167
- Jacobian logarithm, 146, 172
- Jelinek, 140, 160
- Johannesson, 212
- key equation, 89, 91
- L*-value, 169
- latency, 46
- LDPC codes, 163, 165, 168, 174
- linear block code, 27
- linear dispersion codes, 265
- linear feedback shift register, 72
- linear independency, 300

- linear multilayer detection, 272
- linearity, 27
- link adaptation, 152, 156
- log-likelihood algebra, 169
- log-likelihood ratio, 141, 169, 171, 188
- LoS, line-of-sight, 230
- macrocell, 231
- MacWilliams identity, 37
- majority decision, 10
- majority decoding, 47
- majority logic decoding, 56
- MAP, 22
- MAP decoding, 112
- Mariner, 58
- Massey, 161
- matched filter, 6
- Mattson–Solomon polynomial, 309
- max-log approximation, 147, 172
- maximum a-posteriori, 22
- maximum distance separable, 37
- maximum likelihood decoding, 23, 112, 113, 116, 134, 196
- maximum ratio combining, 159, 224
- McAdam, 140
- McEliece, 161
- MCS, 152–155
- MDS code, 37, 81
- MED, 22
- memory, 100
- memoryless channel, 5
- message nodes, 165
- message passing, 174
- message-passing algorithms, 168
- MIMO channel
 - frequency-selective, 234
 - modelling, 237
- minimal polynomial, 76, 304
- minimum constraint length, 100
- minimum distance decoding, 24, 113–115, 136
- minimum error probability decoding, 22
- minimum Hamming distance, 17
- minimum length, 210, 211
- minimum weight, 17
- MISO channel, Multiple-Input Single-Output channel, 235
- MLD, 23
- modulation, 1
- modulator, 2
- Montorsi, 196, 212
- Moore–Penrose inverse, 276
- multilayer transmission, 266
- multiplication table, 303
- multiplicative inverse, 299
- mutual information, 4
- narrow-sense BCH code, 80, 84
- NLoS, 230
- node metric, 117
- noise power, 6
- noise vector, 57
- normal burst, 149
- not acknowledgement, 150
- octal notation, 109
- odd/even interleaver, 210
- OFD codes, 122
- optimal code, 37
- optimum free distance codes, 122
- order, 295, 303
- orthogonal
 - matrix, 313
 - space–time block codes, 257
- orthogonal code, 36
- orthogonality, 30, 56
- outer code, 163
- overall constraint length, 100
- pairwise error probability, 131, 134
- parallel concatenation, 182, 185
- parity
 - bit, 28
 - check code, 27, 48
 - check condition, 31
 - check equations, 31
 - check matrix, 30
 - check polynomial, 67
 - check symbol, 29, 48
 - frequency, 83
- partial concatenation, 185
- partial distance, 205
- partial rate, 185
- partial weights, 196

- path enumerator, 129
- path enumerator function, 134
- PEF, 131
- perfect code, 39
- Phase shift keying, *see* PSK
- pinch-off region, 194
- pit, 85
- polling, 155
- polynomial, 63, 300
 - irreducible, 301
- polynomial channel model, 72, 86
- polynomial generator matrix, 110
- polynomial ring, 300
- power spectral density, 7
- prime number, 296
- primitive BCH code, 80
- primitive element, 296
- primitive polynomial, 303
- primitive root, 303
- primitive root of unity, 75
- product code, 163, 177–179
- PSK, 219
- punctured code, 43
- puncturing, 106, 137, 153–155, 159
- pure code combining, 159

- QAM, 218
- QL decomposition, 278
- Quadrature Amplitude Modulation, *see* QAM

- rank criterion, 256
- rank of a matrix, 312
- rate-compatible punctured convolutional codes, 160
- Raviv, 140
- received polynomial, 66
- received word, 14
- Reed–Solomon code, 81
- Reed–Muller code, 55
- regular code, 167
- repetition code, 47
- residue class ring, 297
- ring, 296
- RLC, 152, 153
- root, 302

- SCCC, 184
- SDMA, 216
- selective repeat ARQ, 155
- self-dual code, 36
- sequence estimation, 112, 116
- serial concatenation, 184, 185
- Shannon, 163
- Shannon function, 4
- shortened code, 42
- signal, 2
- signal power, 6
- signal-to-noise ratio, 6
- SIMO channel, Single-Input Multiple-Output channel, 235
- simplex code, 51
- singular value decomposition, 314
- SISO, 192
- SISO decoder, 181
- SISO decoding, 186
- SISO, soft-in/soft-out, 181
- soft output, 140
- soft-decision decoding, 7, 57
- soft-input, 136
- soft-output decoding, 140
- sorted QL decomposition, *see* SQLD
- source coding, 1
- source decoder, 2
- source decoding, 2
- source encoder, 2
- space–time code, 215
- sparse graphs, 165
- spatial multiplexing, 265
- spectral encoding, 82
- spectral norm, 312
- spectral polynomial, 82
- spectral sequence, 305
- sphere detection, 289
- SQLD, 285
- squared Euclidean distance, 137
- state diagram, 103
- subspace, 27, 300
- superposition, 27
- survivor, 118
- symbol error probability, 19

- symbol-by-symbol decoding, 112
- syndrome, 33, 86
- syndrome polynomial, 72, 89
- systematic block code, 29
- systematic encoding, 70, 111
- systematic generator matrix, 111

- tail-biting, 104, 153
- tail-biting code, 104
- Tanner graph, 164, 165
- TDD, 239
- termination of a convolutional code, 104
- TFCI, 58
- Thitimasjshima, 163
- time division duplex, *see* TDD
- transmission, 1
- trellis diagram, 95, 112, 115
- triple repetition code, 9
- truncation of a convolutional code, 104
- turbo codes, 163, 182, 183
- turbo decoding, 163, 186, 188
- turbo decoding algorithm, 180
- twiddle factor, 305

- UART, 49
- UMTS, 58, 147, 183
- unitary matrix, 313

- V-BLAST, 266
- Vandermonde matrix, 79
- vector, 299
- vector space, 18, 299
- Viterbi, 97, 160
- Viterbi algorithm, 112, 116, 136
- Viterbi bound, 134
- Voyager, 50

- waterfall region, 193
- Weber, 140
- WEF, 126
- weight, 17
- weight distribution, 17, 126, 196
- weight enumerator, 126
- Welch, 140
- wide-open region, 195
- Wiener solution, 274
- word error probability, 19
- woven convolutional codes, 177, 198–200, 202, 203, 205
- woven turbo codes, 201
- Wozencraft, 160

- zero, 75
- zero element, 296
- zero padding, 46
- zero-forcing, 273
- Zigangirov, 160
- Zyablov, 212