

Subject index

- Adler competition field, 423
- aggregation, 372
 - see also clustering
- aggregation recipes, 261
- aggregation index, 196
 - bivariate, 313
- Akaike information criterion, 450
- alignment of points, 383
- amacrine cells, 5
 - mark probabilities, 310
 - independence of types, 462–463
 - indices, 315
 - mark connection functions, 332
 - partial pair correlation functions, 326
 - reconstruction, 415
- angle count sampling, 308
- angular marks, 355
- anisotropy, 250, 355
- area-interaction process, 157
- atomic pair correlation function, 243

- bandwidth, 115, 230, 482
 - choice, 115, 235, 237
- Bartlett spectrum, 33
- basaltic formations, 112, 116
- Bayesian approach, 106, 340, 471
- beeches, 315, 327, 334, 465
- bias, 480

- binomial
 - distribution, 104
 - point process, 59
 - periodic, 62
 - simulation, 63
- birth-and-death algorithm, 144, 146
- birth-and-death process, 144, 427, 429
- Bitterlich field, 308
- bivariate, 5, 295, 313, 326
- black spots on maple leaves, 133
- blood particles, 12
- Boolean model, 44
- bootstrap, 121
 - variance estimation, 453
 - intensity, 454
 - pair correlation function, 455
- border
 - method, 185
 - estimator, 209
- box kernel, 230, 482
- bronze particles, 288
- burn-in, 152, 154, 401

- Campbell Theorem, 29, 175, 302
- Campbell–Mecke formula, 179
 - for marked point process, 305
- carbide particle, 250
- central limit theorem, 40

- centre of herd, 21, 269
- centred process, 114
- chemical activity, 148, 399
- circular cluster, 268
- Clark–Evans index, 196
- Clark–Evans test, 92
- cluster analysis, 274
- cluster process, 371
- clustering, 368
- clusters
 - detection of, 373
- coefficient of segregation, 314, 418
- collective rearrangement algorithm, 397
- competition load, 46, 425
- complete spatial randomness (CSR), 58
- completely stationary, 431
- compound distribution, 107
- computerised tomography, 122, 329
- concrete, 10
 - mark connection functions, 335
 - mark correlation functions, 347
 - partial pair correlation functions, 328
- conditional probability density
 - function, 146
- conditional reconstruction, 417
- conditional simulation, 56, 153, 378
 - outside of window, 185
- conditioning, 69
- configuration space, 104
- configurational partition function, 140
- connectivity function, 248
- constructed Cox points, 438, 443
- constructed mark, 297, 311
- contact d.f.
 - with respect to B , 68
- copper deposits and lineaments, 443
- correlation
 - of point locations, 214, 272
 - of points and marks, 294, 341, 460
 - of marks, 341, 460
 - with covariates, 44, 438, 444
- correlation coefficient, 30
- counting measure, 24
- counting birds, 25, 34, 176, 303
- covariance, 479
 - of numbers of points, 30
- covariance function, 233, 367, 384
- covariate, 19, 479
- coverage, 441
- Cox process
 - fibre-process-generated, 383
 - finite, 123
 - Poisson-gamma random field, 381
 - random-set-generated, 382, 385
 - shot noise, 382
 - simulation, 325
 - stationary, 379
 - statistics, 386
- critical value
 - of L -test, 95
- cross-variogram, 439
- CSR, 58
 - recommendations, 97
 - test, 83
 - general idea, 84
- cusp-point method, 161, 402
- data files for examples, xiii
- dbh, 368
- dead leaves model, 391
- degree
 - of colocalisation, 196
 - of hexagonality, 197
 - of short-range order, 241
- Delaunay tessellation, 48, 50, 247
- dendrogram, 275, 278
- design approach, 35
- deviation test, 457
- dilation function, 127
- discrepancy test, 93
- disease spread, 437
- disk graph, 50
- dislocation density, 117
- distance method, 80
 - CSR test, 89
- distance sampling, 20, 192, 307
- distance, 10
 - to 2nd, . . . neighbour, 76, 199
- dominance competition model, 390
- earthquake data
 - statistics, 434
- earthquakes in central Japan, 432
- edge-correction, 180
 - isotropic, 188
 - rotational, 188

- stationary, 188
- translational, 188
- empty-space d.f., 42, 176, 199
- entropy, 140
- envelope test, 455
- Epanechnikov kernel, 482
- ergodicity, 39
- error probability
 - of envelope test, 456
- estimation variance, 480
- ETAS model, 434
- Euler number, 44, 201
- evaluation of summary characteristics, 417
- event process, 427
- exponential energy marks, 400

- factorial moment measure, 31
 - second-order, 33
- fast Fourier transform, 233
- fibre process, 442
- field methods, 20
- finite K -function, 129
- finite Cox process
 - explanation of, 123
 - statistics for, 125
- finite nearest neighbour distance d.f., 126
- finite point process, 36, 99
 - types, 101
- force-biased algorithm, 395
- forest, 10, 257, 315, 367, 404, 463
- Fourier approach, 233
- 4-neighbour graph, 257
- fractionator counting, 190
- frost shake, 463
- fruit dispersal, 122, 472
- functional summary characteristics, 42

- galaxy, 15
- gap detection, 257
- Gaussian, 40, 71, 112
- Georgii–Nguyen–Zessin formula, 399
- geostatistical marking, 297, 420
- geostatistics, 489
- germ-grain model, 43
- Geyer–Thompson algorithm, 164
- Gibbs hard-core process, 141, 401
 - simulation, 144
- Gibbs process
 - ecological applications of, 159
 - finite, 160
 - simulation, 137, 143
 - statistical inference, 160
 - inhomogeneous, 156
 - second-order characteristics, 154
 - stationary, 398
 - simulation, 402
 - statistical inference, 402
 - with fixed number of points, 139
 - with random number of points, 148
- glacier buttercup, 439
- gold particles, 6
 - connectivity function, 249
 - constructed marks, 298
 - CSR test, 86, 98
 - hard-core model, 391
 - index-of-dispersion test, 88
 - intensity, 82
 - intensity RVE, 266
 - J -function, 213
 - L -function, 218
 - mark correlation function, 342, 349
 - mark p.d.f., 310
 - nearest-neighbour-distance characteristics, 211
 - pair correlation function, 221
 - pair correlation function RVE, 267
 - spherical contact d.f., 204
 - testing geostatistical marking, 468
 - testing independence, 467
- goodness-of-fit test, 54, 455
- graph, 49
- graph-theoretic statistics, 129
- Greig-Smith method, 88

- hard-core
 - distance, 58, 201
 - Gibbs process, 141, 401
 - point process, 387
 - Strauss process, 142, 162
 - hard sphere, 101, 394
- Hegyi index, 318
- homogeneous, 38
- homogenisation
 - vertical, 290
- Horvitz–Thomson weighting, 229

- i.i.d. cluster, 111
- image analysis, 4, 22, 233
- impulse function, 45, 423
- independent marks, 296
 - summary characteristics for, 418
- independent scattering, 69, 118
- index, 41, 155, 311
- index of dispersion, 87, 195
- index-of-dispersion test, 87
- index of mark-sum-dispersion, 312
- indicator function, 26
- intensity, 37, 174
 - explanation, 70
 - estimation, 82, 189–195
 - adapted, 193
 - standard estimator, 189
- intensity field, 380
- intensity function, 28, 35
 - estimation, 110, 475
 - by means of Voronoi tessellation, 116
 - for marked point process, 35
 - non-parametric estimation, 114
 - parametric, 120
- intensity measure, 28
- intensity reweighting, 281
- intensity-weighted log Gaussian Cox, 421
- intensity-weighted marks, 421
- interaction function, 143
- isotropised set covariance, 485
- isotropy, 38

- J*-function, 213, 321
- J*-test
 - CSR test, 91

- k*-neighbour graph, 51, 257
- K*-function
 - estimation, 231
 - explanation, 214
- kernel estimator, 481
- Kolmogorov–Smirnov test, 54, 455

- L*-function
 - estimation, 232
 - explanation, 216
- L*-test, 95
- large mark, 309
- large window trick, 127

- likelihood function
 - of inhomogeneous Poisson process, 121
- linear transformation of Poisson process, 67
- line transect sampling, 192, 307
- local
 - rescaling, 282
 - minus-sampling, 309
 - parallel alignment, 359
 - plus-sampling, 309
- location density functions, 103
- log Gaussian Cox process, 381, 384
- lognormal, 122

- mapping, 21
- mangrove tree, 436
- mark
 - mean, 302
 - qualitative, 295, 320
 - quantitative, 295, 322
 - variance, 302
- mark connection function, 331
- mark correlation function, 341, 346, 354, 418
- mark d.f., 300, 309
- mark dominance
 - distribution, 322
 - index, 318
- mark p.d.f., 302, 410
- mark probability, 300, 310, 313
- mark variogram, 344
- mark-sum intensity, 304, 306
- mark-sum measure, 304
- mark-weighted
 - K*-function, 350
 - L*-function, 352
- marked Gibbs processes, 158
- marked point processes, 33, 293
- Markov chain Monte Carlo, 144
- Markov point process, 159
- master
 - d.f., 284
 - pair correlation function, 284
- Matérn cluster process, 237, 376, 381
- Matérn hard-core process, 238, 287, 388
 - generalisation, 389
- maximum likelihood method, 161, 448, 481

- MCMC, 144
- mean, 479
- mean direction index, 197
- mean-direction test, 92
- mean squared error, 480
- Medvedev's shape parameters, 247
- metallic glass, 242
- method of moments, 450
- Metropolis–Hastings simulation
 - algorithm, 149
- $M/G/\infty$, 430
- mingling
 - distribution, 321
 - index, 41, 314, 418
- minimum contrast method, 228, 451
- minimum inter-point distance, 207
- Minkowski addition, 483
- minus sampling, 185
- mixing, 40
- model approach, 35
- model choice, 445
- modified Thomas process, 377
- molecular dynamics, 398
- moment measures, 31
 - second-order, 223
- Monte Carlo integration, 164
- Monte Carlo maximum likelihood, 163, 165
- Monte Carlo method, 52
- Monte Carlo test, 54, 455
 - of CSR, 96
- Moran's I -statistics, 344
- Moravie index, 318
- morphological function
 - explanation, 201
 - estimation, 204
- mse, 480
- multiplicatively-weighted pair correlation function, 348
- multivariate
 - K -function, 323
 - L -function, 325
 - process, 295
- multivariate analysis, 271
- nearest neighbour
 - k th, 76, 314
- nearest-neighbour distance d.f., 206
 - estimation, 208
 - explanation, 126, 206
 - for marked point process, 321
- nearest-neighbour
 - correlation index, 317, 418
 - probability, 313
- negative binomial distribution, 108
- neighbour network, 49
 - network, 49
- Neyman–Scott process, 16, 374
 - non-stationary, 378
- no-edge-correction, 187
- nearest-neighbour-correlation index, 317
- nearest-neighbour-edge-correction, 187
- nearest-neighbour-estimator, 309
- non-stationary case, 279
- normalised K -function, 131
- number distribution, 26, 104
- numerical summary characteristics, 41
- O-ring, 220
- oaks
 - indices, 315
 - mark connection functions, 334
 - partial correlation functions, 327
 - testing randomness, 463, 465
- observation window, 18
 - choice of, 264, 465
- orientation analysis, 250, 355, 357
- orientation correlation function, 357
- orientation distribution
 - nearest-neighbour, 252
 - second-order, 254
- outlier
 - detection, 256
 - model-based, 257
- overlap model, 141
- P -value, 481
 - of deviation test, 458
- packing of spheres, 242, 394
- pair correlation function
 - estimation, 232
 - explanation, 218
 - interpretation, 239
 - multiplicatively weighted, 348
- pair potential, 140, 399

- Palm distribution, 74, 177
 - for marked point process, 304
- Palm intensity function, 220
- Papangelou conditional intensity, 28
- parameter estimation, 448
- parametric bootstrap, 455
- partial pair correlation function, 325, 354
- partition process, 475
- perfect simulation, 154
 - dead leaves, 393
- periodic edge-correction, 184
- Phlebocarya, 7
 - CSR, 86
 - Delaunay tessellation, 48
 - fitting
 - Matérn cluster process, 452
 - Cox process, 386
 - nearest-neighbour-distance d.f., 212
 - pair correlation function, 221
 - Voronoi tessellation, 47
- photogrammetry, 22
- Pielou's index, 196
- pilot study, 265
- plant community, 13, 272, 423, 435
- plus sampling, 183
 - estimator, 198
- point density d.f., 29
 - estimation, 117
- point network, 21
- point process and fibre process
 - correlations, 442
- point process and random field
 - correlations, 437
- point process
 - distribution, 27
 - number distribution, 26
 - sum, 25
- point quarter method, 80
- Poisson convergence, 70
- Poisson cluster process, 368
- Poisson distribution, 66, 106
- Poisson process
 - Bayesian estimation of intensity
 - function, 475
 - conditioning, 69
 - doubly stochastic, 380
 - homogeneous, 66
 - confidence interval for intensity, 81
 - distance method, 80, 89
 - estimation of the intensity, 79
 - formulas for Voronoi tessellation, 79
 - functional summary characteristics, 78
 - intensity, 66
 - K -function, 76
 - L -function, 77
 - linear transformation, 67
 - moment measures, 71
 - nearest neighbour distance d.f., 75
 - numerical summary characteristics, 79
 - pair correlation function, 77
 - Palm distribution, 75
 - product density, 74
 - properties, 67
 - simulation, 70
 - spherical contact d.f., 68
- inhomogeneous, 118, 285
 - properties, 118
 - simulation, 119
 - statistics, 121, 289
- space-time, 428
- posterior distribution, 471
- power law
 - for pair correlation function, 15
- prior distribution, 471
- probability density function
 - with respect to Poisson process, 104, 147
- product density, 32
 - k th order, 74
 - second-order, 224
- profile likelihood method, 167
- protein, 250
- pseudo-likelihood method, 167
- quadrat counting, 20
 - CSR test, 86
- qualitative marks, 295, 313, 320, 323, 460
- quantitative marks, 295, 317, 322, 341, 466
- quasi-homogeneous patterns, 102
- r -close triplets, 245
- r -mark correlation function, 346
- radial spanning tree, 51, 114
- random competition model, 389
- random field, 44, 489

- random field model, 297, 420
 - correlation characteristics, 420
- random labelling, 326, 461
- random number generation, 56
- random pair distance d.f., 132
- random reallocation, 462
- random set, 24, 43
- random shift, 462
- random superposition, 297, 326, 461
- randomly labelled, 296
- range
 - of correlation, 220, 347, 490
 - of interaction, 140, 161
- ratio-unbiased, 480
- reconstruction
 - algorithm, 408
 - practical application, 415
 - conditional, 417
 - of cluster centres, 339
 - of marked point pattern, 416
 - of Neyman–Scott process, 410
 - of point patterns, 407
 - of Voronoi cells, 476
- reduced second-order moment measure, 223
- reflection method, 482
- regionalisation, 110, 438
- rejection sampling, 64, 148
- relative intensity, 300
- remote sensing, 22
- replicated patterns, 260
 - aggregation recipes, 261
- representative volume element, 265
- residuals, 259, 400
- ring, 216
- Ripley's K function, 214
- r -mark correlation function, 346
- RSA process, 132, 393
- sea anemone, 360
- second-order
 - characteristic, 129, 154, 214, 323, 352
 - orientation density function, 255
 - factorial moment measure, 223
 - product density, 224, 431
- sedimentation algorithm, 394
- seed density, 25, 34, 45, 176, 303
- segregation 314, 315
- self-thinning, 435
- set covariance, 485
- short-sighted, 207, 214, 253
- shot-noise field, 45, 423
- silicon, 117
- simplicity, 24, 69
- simple sequential inhibition, 393
- Simpson index, 330
- simulation, 52
- simulation test, 54
- single cluster, 101
- Sitka spruce, 257, 367
- Slivnyak–Mecke theorem, 78
- small pattern, 101
- soft-core process, 241
- space–time point process, 425
 - completely stationary, 431
- Spanish town, 168, 459
- sparse data, 155, 161
- spatgraphs, 52
- spatstat, xii, 95, 170, 227, 281, 485
- sphere graph, 50
- spherical contact d.f., 27, 68, 176, 200
 - estimation, 204
 - explanation, 203
 - for marked point process, 320
- spruce, 404
 - nearest-neighbour-correlation indices, 419
 - mark variogram, 419
 - pair potential, 404
 - testing geostatistical marking, 469
 - testing independence, 468
- stable tessellation, 49
- stationarity
 - explanation, 37, 174
 - of marked point process, 299
 - of Poisson process, 67
- stationary, 37, 69
- statistically homogeneous, 38
- Strauss process, 141, 147
 - Monte Carlo maximum likelihood, 165
 - simulation, 146, 152

- stoniness, 440
- summary characteristic
 - functional, 42
 - numerical, 41
 - non-stationary case, 279
- summary process, 427
- superposition, 370
- t*-snapshot, 427
- (T_1, T_2) -summary process, 427
- Takacs–Fiksel method, 402
- tar spots, 133
- termites and palms, 335
- tessellation, 46
- testing
 - CSR hypothesis, 83
 - homogeneity, 82
 - independent marking, 460
 - mark hypotheses, 460
- thinning, 365
 - p*-thinning, 227, 365, 367, 429
 - p*(*x*)-thinning, 282, 365
 - P*(*x*)-thinning, 365, 367
- third-order product density, 244
- total energy, 140
- trial-and-error estimation, 452
- triangulation, 21, 48
- triplets
 - number of *r*-close, 245
- typical point, 178
- unbiased, 480
- uniformly distributed, 59
- variance, 479
 - of number of points, 30, 226, 266
- variogram, 490
 - cross, 439
- vertical homogenisation, 290
- Viola tricolor, 14
- void-probability, 27, 69, 200, 384
- volume fraction, 385, 394
- volume integral, 28
- Voronoi
 - cell weighting, 191, 307
 - tessellation, 47, 116, 476
- waterstriders, 8, 138
- Weibull distribution, 118, 122, 208
- window
 - adaption, 265, 268
 - choosing, 264, 465
- wireless communication, 46