

Index

- aftershocks, 74
 - Báth's law, 76
 - hazard analysis, 313
 - nonhomogenous Poisson process, 142
 - Omori's law, 75
- aleatory variability, 14, 333
 - empirical ground-motion model, 168
 - ground-motion simulation, 239
 - seismic hazard, 271
 - source model, 44
 - validation, 490
- anelastic attenuation
 - empirical evidence, 173
 - near-surface, 229
 - simplified ground-motion simulation, 227
 - theory, 215
- apparent aleatory variability. *See* aleatory variability
- area source, 41
 - discretization, 127
 - rupture scenarios, 126
- Arias intensity, 157
- aseismic deformation, 89
- attenuation relation. *See* ground-motion model
- average annual loss, 388
- background source, 43
- Bayes's rule, 507
- Bernoulli sequence, 517
- beta distribution, 375
- beta function, 375
- binomial distribution, 517
- bivariate normal distribution, 515
- body wave, 206
- bracketed duration, 155
- Brownian passage time distribution, 133
- Brune stress parameter, 226
- causal parameters, for ground-motion selection, 424
- characteristic distribution, 100, 133
- coda, 216
- coherency, 473
- collectively exhaustive, 505
- collision margin, 23
- conditional probability, 506
- conditional spectrum, 307
 - use in ground-motion selection, 406
- confidence interval
 - mean, 519
 - standard deviation, 519
- consequences, 373
 - correlation in, 477
- convergent margin, 23
- corner frequency, 226
- coseismic deformation, 82, 89
- crust
 - continental, 23
 - oceanic, 23
- crustal model, 219
- cumulative absolute velocity, 157
- cumulative distribution function, 509, 510
 - inverse, 510
- deaggregation. *See* disaggregation
- depth to top-of-rupture, 26
- deterministic seismic hazard analysis, 2, 282
- dip angle, 26
- Dirac delta function, 511
- directionality, 159
- directivity, 178
- disaggregation, 287, 289
 - binning, 292
 - occurrence versus exceedance, 293
- discrete Fourier transform, 153, 474
- dispersion
 - fragility distribution, 371
 - of seismic waves, 207
- divergent margin, 23
- duration
 - bracketed, 155
 - significant, 155
 - uniform, 155
- earth structure, 21
- earthquake rupture forecast, 59
- EEPAS model, 142
- efficiency, of ground-motion intensity measures, 409
- elastic rebound theory, 31, 133
- empirical ground-motion model, 147
- epicenter, 28
- epistemic uncertainty, 13
 - empirical ground-motion modeling, 186
 - fragility and vulnerability, 393
 - ground-motion selection, 419
 - ground-motion simulation, 239
 - risk, 398
 - seismic hazard, 271
 - source model, 44

- SRSS, 394
- validation, 490
- epsilon, 167
- equivalent body forces, 204
- ergodic assumption, 95, 135, 319
- ETAS model, 142
- exceedance probability curve, 386
- expectation, 513
- failure rate, 382
- fault, 25
 - creep, 87, 89
 - slip rate, 87, 92
- fault source, 38
 - dynamic rupture, 205
 - kinematic rupture, 202
 - rupture scenarios, 120
 - time-dependence, 138
- first-order second-moment analysis, 513
- focal mechanism solution, 29
- foot wall, 27
- foreshocks, 74
- Fourier spectra, 153
- fragility function, 370
 - analytical, 380
 - empirical, 379
 - expert opinion, 381
 - fitting, 530
 - validation, 501
- frequency, of seismic waves, 206
- Gaussian distribution, 514
- generalized conditional intensity measure, for ground-motion
 - selection, 414
- geometric spreading
 - empirical evidence, 173
 - simplified ground-motion simulation, 227
 - theory, 214
- grand inversion, 113
- Green's function, 198
- ground-motion hazard curve, 249
 - validation, 491
- ground-motion instrument array, 474
- ground-motion model, 148
 - empirical, 147
 - physics-based, 198
- ground-motion prediction equation. *See* ground-motion model
- ground-motion simulation, 196
 - comprehensive physics-based method, 220
 - hybrid broadband, 223
 - simplified physics-based method, 225
- Gutenberg–Richter distribution, 90
- hanging wall, 27
 - effect on ground motion, 178
- hazard analysis, 1
- hazard curve, 5, 249
 - derivative, 264
 - mean, 276, 398
 - slope, 264
- hazard map, 306
 - limitations of, 448
- hazard-consistent ground motions, 404
- hybrid broadband ground-motion simulation, 223
- hypocenter, 28
- hypothesis testing, 521
- impedance, quarter-wavelength theory, 229
- impedance ratio, 209
- incremental dynamic analysis, 411, 530
- independence, 506
- intensity measure, 149
 - multi-component, 158
 - RotD50, 158
 - RotD100, 158
- inverse transform method, 518
- Joyner–Boore distance, 130
- kappa, 229
- kinematic rupture generator, 203
- logarithmic interpolation, 262
- logic tree, 272
 - fragility, 394
 - pruning, 281
- lognormal distribution, 517
- loss exceedance curve, 385
- Love wave, 206
- magnitude
 - conversion, 69
 - maximum, 94
 - moment magnitude, 36
 - scales, 37, 70
- magnitude-frequency distribution, 89
 - characteristic distribution, 100
 - Gutenberg–Richter distribution, 90
 - moment release rate, 91
- Markovian dependence, 391
 - earthquake processes, 142
- maximum likelihood estimation, of seismicity
 - parameters, 525
- maximum magnitude
 - from source-scaling relations, 52
 - from statistical estimation, 94, 523, 524
- maximum usable period, 165
- mean, 512
- mixed effects, 332
- mixed-effects regression, 527
- modeling uncertainty
 - analytical fragility, 381
 - physics-based ground-motion modeling, 234, 237
- moment magnitude, 36
- moment release rate, 91, 100
- moment tensor, 29, 198
 - use in ground-motion simulation, 204

- Monte Carlo simulation, 279, 392, 477, 518
- multivariate normal distribution, 515
- mutually exclusive, 505
- non-ergodic
 - concepts, 322
 - ground-motion selection, 420
 - hazard analysis, 319
- nonlinear site response
 - amplification factor, 347
 - empirical ground-motion modeling, 174
 - ground-motion simulation, 216
 - non-ergodic consideration, 343
- normal distribution, 514
- ontological uncertainty, 15
- paleoseismology, 67, 117
- parametric uncertainty
 - empirical ground-motion modeling, 190
 - ground-motion simulation, 235
 - physics-based ground-motion modeling, 234
 - source model, 44
- peak ground acceleration, 150
- peak ground displacement, 150
- peak ground velocity, 150
- PEER framework, 391
- physics-based ground-motion models, 198
- plate tectonics, 20, 22
 - divergent margins, 23
- point source
 - moment tensor, 201
 - source model, 42
- Poisson distribution, 518
- Poisson process, 74, 133, 253, 518
 - with random selection, 255
- primary hazards, 1
- primary wave, 206
- probabilistic seismic hazard analysis, 5, 249
- probability density function, 509
 - discretization, 510
- probability mass function, 508
- pseudo-dynamic rupture generator, 205
- PSHA calculation, 250
- quality factor, 215
- radiation pattern, 226
- rake angle, 27
 - variation over rupture area, 202
- random effects, 182, 332, 527
- random number generator, 518
- random variable, 508
- rate-and-state friction, 34
- Rayleigh wave, 206
- reflection, of seismic waves, 209
- refraction, 210
- renewal model, 142
- response-history analysis, ground-motion selection for, 404
- response spectra, 150
- return period, 253
- risk analysis, 1, 369
- risk metrics, 382
 - average annual loss, 388
 - exceedance probability curve, 386
 - expected annual loss, 388
 - loss exceedance, 385
- risk-targeted ground motion, 399
- rupture, geometry, 26
- rupture depth, effect on ground motion, 178
- rupture distance, 130
- rupture scenarios, 120
- rupture velocity, 202
- scattering, of seismic waves, 216
- secondary hazards, 1
- secondary wave, 206
- seismic moment, 36
- seismic source, 38
 - area source, 41
 - background source, 43
 - fault source, 38
 - moment balancing, 93
 - moment release rate, 91
 - point source, 42
- seismic velocity, 206
- seismic waves, 205
- seismicity, 22, 60, 65
- seismogenic thickness, 20
- semivariogram, 456
- significance level. *See* hypothesis testing
- significant duration, 155
- single-degree-of-freedom system, 150
- site response, 348
 - convolution integral, 347
 - embedded site effects, 348
 - site-specific, 348
- slip-predictable model, 142
- slip rate, 116
- slip vector, 27
- Snell's law, 210
- source inversion, 202
- source-scaling relations, 46
 - variability components, 358
- spatial intensity measure distribution, 452
- spectral matching, 427
 - of ground motions, 429
- standard deviation, 513
- statistically significant. *See* hypothesis testing
- stick-slip models, 31
- stochastic event set, 280
- stochastic method, 225
- strain energy, 32
- stress drop
 - Brune stress parameter, 226
 - static and dynamic, 46

- stress triggering, 35, 142
- strike angle, 26
- strike distance, 130
- style of faulting, 27
 - effect on ground motion, 178
- subduction zone, 23
 - in-slab event, 24
 - interface event, 24
- sufficiency, of ground-motion intensity measures, 391, 410
- surface wave, 206
- synthetic earthquake catalog, 280
- tectonic type, effect on ground motion, 177
- time dependence
 - long term, 133
 - Poisson process, 133
- time-history analysis. *See* response-history analysis
- time-predictable model, 142
- total internal reflection, 212
- total probability theorem, 507
- total residual, 182, 528
- transform margin, 23
- transmission, of seismic waves, 209
- travel time curve, 68
- uniform duration, 155
- uniform hazard spectrum, 301
- validation, 485
 - common pitfalls, 486
 - ground-motion simulation, 237
 - prospective, 485
 - pseudo-prospective, 486
 - PSHA methodology, 501
 - retrospective, 485
- variance, 512
- vector PSHA, 312
- velocity, of seismic waves, 207
- velocity model, 219
 - non-ergodic corrections for, 350
- verification, 484
- vulnerability function, 373
- wave equation
 - numerical solution, 221
 - one dimension, 206
 - three dimensions, 220
- waveguide, 214
- wavelength, 206
- wavenumber, 206