

Index

A

Absorption, 94, 118
Accelerated Characterization Tests, 495
Acid modification, 191
Active fillers, 203, 205, 222, 239, 241, 243, 244, 247
Adhesion promoting agents, 200, 201
Adhesive failure, 125, 140, 147, 179
Aging, 32, 33, 46, 49, 51–53, 65, 68, 70
Air voids, 261, 271–275, 277–280
Alligator cracking, 14, 19
Analytic solution methods, 439
Ancient aqueducts, 7, 12
Ancient asphalt, 12, 13, 15, 18, 20, 21
Ancient concrete, 2, 4, 11, 12
Angularity, 104–107, 109, 111–114, 116
Anisotropic material, 427, 428
Anisotropy, 105, 106
Asphalt binder, 27–33, 36–40, 42, 45, 47–51, 54, 59, 60, 63, 65, 66, 68, 70, 72

B

Binder microstructure, 40, 42, 45, 47, 48
Bitumen, 27, 40–42, 45
Bleeding, 15, 283, 300, 301
Boundary conditions, 422–424, 435, 437, 438, 452
Boundary value problem, 420, 422, 423, 435–437, 439–441, 443, 445, 448–451
Bulk density, 271–273, 279, 280

C

Cap yield criterion, 548
Carson transforms, 348
Chemical bonding, 130, 178
Cohesive failure, 140, 141, 172, 173
Cohesive zone model, 583, 584, 586
Collocation Method, 484
Combined hardening, 562, 564, 565

Complex modulus, 304–306, 313, 332, 496, 497, 501, 503, 511–513
Composite modeling, 252
Computational fracture mechanics, 619
Computational methods, 598
Computational micromechanics, 637
Computational modeling, 637
Computational plasticity, 634
Computational solution methods, 440
Computational viscoelasticity, 634
Conservation laws, 375, 382
Constant strain triangle, 635
Constitutive experiments, 391
Constitutive theory, 389, 391, 394
Continuum, 341, 342, 352, 354–358, 375
Continuum mechanics, 341, 342, 356
Contracting multi-scaling, 660, 670, 679
Convolution integral, 348–350
Correspondence principle, 473, 476, 483
Cracking, 578, 580, 581, 586
Crack pinning, 241–243
Creep tests, 464, 485–490, 493, 506, 520

D

Damage mechanics, 580
Detachment, 123, 124, 139
Deviatoric stresses, 362
Dirac delta function, 350
Direct analytic method, 473, 474, 476
Direct method, 483
Dirichlet problem, 437
Displacement, 123, 124, 132, 133, 139
Divergence theorem, 351, 377, 379, 381, 384
Drucker's postulate, 552–555, 559
Durability, 79, 89, 101, 102, 111, 118

E

Effective binder content, 271, 272
Eiffel tower, 9

- Elasticity, 419, 435, 437–439, 443, 446
 Elastic material model, 394
 Elastomers, 223–225
 Elasto-plastic material model, 409
 Element eq. , 613
 Element equations, 604, 610, 613, 614, 616
 Expanding multi-scaling, 643, 648
 Extenders, 187, 196
- F**
 Failure mechanisms, 285
 Fatigue cracking, 14, 283, 290–292, 299, 315, 317, 318, 320, 321, 325–327, 335
 Filler particles, 238–241, 243–245, 257
 Fine aggregate matrix, 237, 247, 253–256
 Finite element, 605, 609
 Finite element computational platform, 598
 Finite element method, 594, 596, 597, 598, 600–602, 605, 606, 608, 611, 616, 622, 626, 637
 Finite element platforms, 600
 Flow rule, 534, 548, 549, 551, 552, 554–557, 559, 561, 562, 564–566, 574
 Form, 80, 84, 91–93, 100, 104, 106, 113, 114
 Fracture, 531, 532, 555, 582, 585, 586
 Fracture mechanic, 580–582
 Frequency sweeps, 485, 495, 498, 499, 503, 508, 509, 511, 512, 523
 Functional groups, 33–36, 38
- G**
 Gradation types, 82
- H**
 Hardness, 96–99, 101, 103
 Heat transfer, 599, 600, 602, 604, 609
 Heaviside step function, 348, 350
 Historical introduction, 1
 Hydrated lime, 194, 203, 204, 211, 216, 218, 219, 222
 Hydraulic scour, 123, 126, 139
 Hygro-material model, 411, 413, 414
- I**
 Index notation, 342–344
 Initial boundary value problem, 462, 464, 466, 471, 473, 474, 476, 479, 482, 483, 485, 486, 495, 504, 515, 518, 566, 574
 Isotropic hardening, 557, 558
 Isotropic material, 430–432, 434
- K**
 Kelvin model
 for creep compliances, 504
- Kinematic hardening, 559, 561, 562
 Kinematics, 352, 353
 Kinetics, 355
- L**
 Laboratory compaction, 263, 265, 268
 Laplace transforms, 346–348, 383
 Linear elasticity, 419, 439–441
 Linearity, 346, 349, 383
 Longitudinal cracking, 15, 16
- M**
 Marshall mix design method, 264, 274, 276, 279
 Master curve, 61–64
 Mastics, 237, 238, 241, 247, 256
 Material property characterization, 432
 Material symmetry, 426, 431
 Mathematical dimensional, 435
 Maximum specific gravity, 271, 274, 277, 279, 280
 Mechanical analogs, 503, 504, 505
 Mechanics, 341, 352, 357, 375
 Mechanistic methods to evaluate damage, 311, 319, 321
 Micromechanics, 440, 442, 445
 Mineralogy, 119
 Modeling evolving cracks, 658
 Modeling pavement, 594
 Modifiers, 187, 226
 Mohr-coulomb yield criterion, 546
 Mohr's circle, 364, 367–372, 386
 Moisture diffusion, 600
 Moisture effects, 454
 Moisture induced damage, 283, 296, 298, 299, 331–335
 Mortars, 237, 238, 247, 253
 Multi-dimensional, 419, 445, 462, 513, 533, 567, 570
 Multi-scaling, 644, 648, 657, 666, 671, 672, 681, 684, 689
- N**
 Neumann Problem, 438
 Newton iteration, 615
 Nonlinear viscoelasticity, 520
- O**
 Optimum binder content, 262, 263, 270, 272, 274–278, 280
 Orthotropic material, 428–430
- P**
 Palierne model, 192, 195, 229

Pavement history, 12, 14, 17, 20, 21
 Performance grading, 52, 74
 PH instability, 123, 127, 139
 Physico-chemical interaction, 238, 241, 243, 244, 246
 Plasticity, 533, 534, 549, 554, 567
 Plastomers, 223, 224
 Polymers, 192, 194, 195, 224, 227
 Pore pressure, 123, 125, 126, 139, 178
 Potholing, 17, 18
 Power law model, 508
 Prandtl–reuss equations, 549
 Principal stresses, 360–364, 370, 371, 386
 Prony series, 484, 490, 505, 506–508, 510, 512
 Pushing, 15, 16

R

Ramp tests, 485, 490–493
 Raveling, 17
 Reflective cracking, 15, 16
 Relaxation tests, 485, 487, 494, 495, 502, 506
 Resilient modulus test, 640, 642–644
 Reynolds transport theorem, 351, 377, 380, 381
 Rheological properties, 32, 33, 36, 37, 47, 65, 68, 70
 Rigden voids, 240, 241, 243, 246, 247, 257
 Roadway materials, 14, 20
 Roadway performance, 454
 Roman roads, 2, 3, 8
 Rutting, 17–19, 283, 286, 287, 290, 296, 299, 300, 309, 311, 314, 315, 329, 335

S

SARA fractions, 40, 41, 47
 Self-healing, 283, 324–327
 Simplistic or torture tests, 309, 328, 332
 Spontaneous emulsification, 123, 125, 139
 Steric hardening, 49–51
 Strain, 352, 357, 364
 Strain hardening, 125, 147, 313
 Stress tensor, 356–358, 360–363, 378, 385
 Stress transformations, 358, 365
 Stripping, 17, 18
 Superpave mix design method, 276, 277
 Surface aging, 15
 Surface energy, 286, 287, 290, 293, 296, 297, 300, 325, 326, 332, 334, 335
 Surface free energy, 123, 134, 153, 158
 Surface wear, 18, 19
 Suspension bridges, 9

T

Tensors, 344, 346
 Textbook roadmap, 21–23
 Texture, 81, 90, 97–99, 101, 105, 106, 109, 111, 113, 114
 Thermal cracking, 17
 Thermodynamic constraints, 424, 446, 447, 448, 466, 472, 473, 515, 516, 518, 572, 574
 Thermoelasticity, 445, 446, 450, 452, 453, 457
 Thermo-material model, 411, 412
 Thermoviscoelasticity, 513, 515, 518
 Thermoviscoplasticity, 570, 571, 575, 577
 Time-temperature superposition, 485, 502, 511, 527
 Tire loading, 595
 Toughness, 87, 88, 96, 97, 101
 Traction vector, 355, 360, 377, 382
 Transverse cracking, 293–295, 328, 329
 Transversely isotropic material, 430
 Two-way coupled multi-scaling, 668, 671, 678–681, 686, 688

V

Variational methods, 601, 605, 606, 608, 610
 Vectors, 343–345, 359, 361, 386
 Viscoelasticity, 461, 462, 474, 515
 Viscoelastic material model, 399, 403, 408–413
 Viscoelastic media, 485
 Viscoplasticity, 567, 571
 Viscoplastic material model, 411
 Viscosity, 38, 39, 51, 55, 64, 70–72, 75
 Viscous material model, 397, 399, 400
 Voids filled with asphalt (VFA), 277
 Voids in mineral aggregate (VMA), 277

W

Wiechert model
 for relaxation moduli, 505
 Wohler curve, 319, 320, 327
 Workhardening rules, 534, 555, 560, 564, 566

Y

Yield criterion, 533, 536, 539–544, 546–548, 554, 555, 557–559, 561–566
 Yielding, 536, 537, 539–542, 544–548, 555, 582