

Subject Index

A

- ADINA computer program, 619
- Aircraft structures
 - fatigue cracks
 - in fastener holes, 45
- Alloys
 - aluminum, 45, 281, 467
 - iron, 328
 - nickel-base, 167
 - steel, 214, 238, 281, 381, 467
 - HSLA, 131
 - HY-80, 45, 578
 - manganese aluminum, 597
 - manganese chromium, 149, 597
 - manganese silicon, 597
 - titanium, 281, 392
 - tungsten, 554
 - uranium, 554
- Aluminum alloys
 - 6061-T651, 281
 - 7075-T651, 45, 467
 - 7075-T7351, 281
- Angle, crack opening, 453
- ANSYS finite element code, 242
- Arc-shaped tension specimen, 27, 106
- Arrest, crack (*see also* Propagation, crack)
 - in aluminum alloy, 467
 - table, 476
 - in welded HY-80 steel, 451
- ASTM Standards
 - A 289: 150
 - D 638: 494
 - E 23: 579

- E 208: 579
- E 399: 27, 107, 214, 239, 253, 310, 566, 579
- E 647: 387
- E 813: 294, 319, 328
- Axial flaws
 - in steel pipelines, 632
 - in zirconium pressure tubes, 308

B

- Beam specimen, 239
- Bending specimen (*see also* Three-point bend specimen) 27, 102, 197
- British Standard BS 5762(1979): 214
- Burst pressures
 - experimental versus theoretical values, table, 612
 - nuclear reactor vessels, 597

C

- CANABC computer program, 356
- Cathodic charging, 135
- Central Electricity Generating Board
 - R6 analysis
 - stress prediction in pipelines
 - initiation loading, table, 644
 - maximum loading, table, 644
- Charpy transition tests
 - in carbon steel, 238
 - in pipelines, table, 635
 - in pressure vessels, 598
- Charpy V-notch specimens, 281, 582
 - ASTM Standard E 23: 582

- Clip gage displacement (*see Displacement, crack opening*)
- Closure, crack, 350, 361, 381
- COD (*see Displacement, crack opening*)
- Compact tension specimens
boundary collation analysis, 113
displacement of crack opening
zirconium pressure tube, 308
- elastoplastic analysis, 251
- equations for displacement, 27
- Hutchinson-Rice-Rosengren analysis, 197, 409
- HY-80 steel, 579
- Inconel 718, 168
- Conic section
edge crack shape approximation, 95
- Corrosion
in generator end rings, 149
in HSLA steel, 131
- Crack
axial, 183, 308, 632
beam specimen, 238
center, 239
ductile tearing, 238
hole corner, 45, 65
nozzle corner, 45, 65
rapid tearing, 431
rectangular, 521
ring segment, 106, 149
semi-elliptical, 521, 617
single edge on panel, 197
single edge on strip, 95
small type, 347, 361
stationary, 409
straight, 535
surface, 521
triangular, 521
twin, 521
- Crack advancement (*see Propagation, crack*)
- Crack front
in aluminum alloys, 474
profile, 535
- straight versus curved, 251, 544
and stress distribution, 251, 617
- Crack initiation (*see Initiation, crack*)
- Crack interaction, 521
- Crack length
as function of crack opening displacement
arc tension specimens, table, 42
compact tension specimens, table, 41
- Crack opening displacement (*see Displacement, crack opening*)
- Critical load assessment method, 183
- CTOA (*see Angle, crack opening*)
- CTOD (*see Displacement, crack opening*)

D

- Disk-shaped tension specimen, 27
- Displacement, crack opening
in aluminum alloys, 467
in bending specimens, 33, 197
load-line displacement, table, 37
in cast iron alloy, 328
in compact specimens, 113, 197, 251, 308
table, 38
constant amplitude loading, table, 388
in disk-shaped tension specimen, table, 38
in ductile steel pipelines, 632
equations for standard specimens, 27
as function of crack length
arc tension specimens, table, 42
compact tension specimens, table, 41
- initiation loading, table, 640
maximum loading, table, 640
in pressure vessels, 214, 308, 597, 617
table, 600
in ring segments, 106

- in side-grooved specimens, table, 268
- single edge on panel, 197
- single edge on strip, 95
- in steels, 214, 361, 381, 409, 431, 617
- three-point bend specimens, 27, 214
 - load-line displacement, table, 37
- in zirconium pressure tubes, 308
- Ductile/brittle transition
 - steel, 569
- Ductile tearing, 238
- Dugdale model, 113, 361, 431

- E**
- Elastoplastic fracture analysis
 - of aluminum, 281
 - of cast iron alloys, 328
 - of pipelines, 632
 - of pressure vessels, 214, 597, 617
 - of projectiles, 554
 - of steels, 281, 293, 381, 409, 431, 451, 632
 - three-dimensional specimens, 251
 - of titanium alloy, 281
 - of zirconium, 308
- Electric generators
 - rotor end rings, 149
- Electron microscope, 328, 367, 493
- Energy release rate, 535, 617
- Equations
 - Barson-Rolfe-Novak, 246
 - boundary collocation, 106, 113
 - Bowie, 75
 - Budansky and Hutchinson, 365
 - Buekner, 95
 - Castigilliano, 28
 - Clark, 262
 - crack length as function of displacement
 - standard specimens, 27
 - displacement as function of crack length
 - standard specimens, 27
- Eigenfunction, 197
- Gauss-Chebyscher, 7
- Hutchinson-Rice-Rosengren, 204, 409, 617
- eigenmodes, 197
- Keer and Freedman, 97
- Kiefner, 648
- Liu, 45
- Neuber's rule, 352
- Newman and Raju, 45, 75
- Paris, 28, 46, 606, 651
- Park, 551
- Rice, 86, 95, 382, 412
- Shah, 45
- Stallybrass, 97
- Walker, 48
- Westergaard, 67
- Explosions
 - effect on welded steel, 451

- F**
- Fastener hole, 45
- Fatigue crack propagation, 27, 45, 131, 347, 361, 381
 - ASTM Standard E 399: 27
 - ASTM Standard E 647: 387
 - ASTM Standard E 813: 387
 - and cyclic *J* relation, 381
 - and creep interaction
 - nickel superalloy, 167
 - in side-grooved compact tension specimens, 251
 - and surface roughness, 392
- Finite element analysis
 - bending specimen model, 197
 - compact tension model, 197, 409
 - table, 420
 - line spring model, 521
 - projectile model, 554
 - three-dimensional model, 238, 251, 535, 617
 - three-point bend model, 214, 451
- Flaw growth (*see* Propagation, crack)

- Fractography
of steel, illus., 136, 140, 141
- Fracture (*see* Crack)
- Fracture toughness (*see* Resistance, crack)
- Frozen stress analysis, 504
- G**
- Glass fiber
as plastic reinforcement, 493
- H**
- Hoop stress
in pressure vessels, 612
- Hot rolling
austenitic steel plate, 293
HSLA steel, 133
- Hydrogen
in 18Mn-4Cr steel, 149
and steel mechanical properties, table, 137
- Hysteresis loop, 385
- I**
- Inclusion in smooth steel plate, 376
- Inconel 718 (*see* Nickel-base superalloy)
- Infinite strip, 7
- Initiation, crack (*see also* Resistance, crack)
in electric generator end rings, 149
in HY-80 steel, 451, 569
in pressure vessels, 274
in steel end rings
hydrogen environment, table, 158
- Instability point, crack, 183
- Iron alloys
GGG-4 (nodular), 328
S-45 (ductile), 328
- Isochromatics, 65, 431
steel, illus., 441, 443, 444
- J**
- J*- Δa curves, 308
- J-R* curves
aluminum alloys, 281
austenitic stainless steel, table, 300
center-cracked panel, 183
pressure vessel, 183
steel, A723, 281
titanium alloy, 281
- J*-integrals
aluminum alloys, 281
table, 289
biaxial load, table, 92
cast iron alloy, 328
critical load assessment method, 183
ductile materials, 197
net versus effective thickness, 251
pressure vessel tests, 214, 597, 617
steels, 281, 409
effect of fatigue cycling, 381
table, 289
titanium alloys, 281
table, 289
zirconium pressure tube, 308
- K**
- Kieffner analyses
stress predictions, pipelines, table, 648
- L**
- Launch simulation tests
tungsten alloy, 554
uranium alloy, 554
- LEFM (*see* Linear elastic analysis)
- Ligament activity
in aluminum alloys, 467
in pressure vessels, 617

Linear elastic analysis
 ASTM Standard E 399 specimens,
 27
 bending specimen, 27
 boundary collocation method, 106,
 113
 in edge-cracked strip, 95
 in infinite strip, 7
 in plate with through crack, 535
 theory development, 7, 27, 45, 65,
 95
 in thick shell/plate, 521
 Line spring model, 521
 Literature review
 ductile/brittle transition of steel, 569
 stress intensity factor analysis
 corner cracks at holes, 45
 Load-drop method (*see also* Unloading)
 aluminum alloys, 281
 steel alloys, 281
 titanium alloys, 281
 Loading
 biaxial, 65, 89
 blast, 451
 concentrated force, 113
 constant amplitude, 45, 381, 392
 table, 387
 cyclic, 113, 167, 293, 361
 dynamic, 409, 431, 451
 inertialess, 409
 instability point determination, 183
 maximum in pipelines, 632
 monotonic, 113, 472
 pin-type, 113, 310
 projectile launch simulation, illus.,
 560
 and small crack behavior, illus., 370
 three-point radial, 106
 triangular waveform, 170
 uniform pressure, 24, 113
 unsymmetric triangular waveform,
 170

Long-rod penetrator, 554
 Lug root stress, 554
M
 Microcracks
 in thermoplastics, illus., 498, 499
 Microstructure
 heat-treated steel, illus., 305
 heat-treated steel, table, 579
 iron alloy, illus., 332, 338, 339
 titanium alloy, 402
 Widmanstätten, 398
 Moiré interferometry, 504

N
 Nickel-base superalloy, 167
 Nil ductility temperature
 specimen, 569
 test, 598
 Nonlinear fractures, 597
 Nuclear reactors, 183, 308, 597

O
 Optical analysis techniques
 Cranz-Schardin camera, 436
 electron microscopy, 493
 interferometry, 504
 Oxygen, interstitial
 in titanium alloys, 392

P
 Paris tearing instability analysis
 in pipelines, 651
 Pearlite
 cast iron alloys, 328
 Penalty function, 197
 Photoelasticity, 431, 504
 Pipelines, 521
 API 5LX, 56, 632

- Plastic deformation, 113, 347, 386
 Plastic hinge formation, 233
Plastics
 glass fiber reinforced, 493
 polyamide, 66, 493
 polymeric material, 504
 polymethyl methacrylate, 45
 tensile properties
 ASTM Standard D 638: 494
 Plastic zones, 214, 349, 409, 431
 Polariscope, 436
POLO-FINITE structural mechanics system, 219
 Power-hardening material, 197
 Power law analysis
 of pressure vessels, 617
 of stationary cracks, 409
 Pressure vessels, 183, 214, 308, 521, 597, 617
 K values, table, 605
 Profile, crack front (*see* Crack front)
 Projectile, cannon-launched, 554
 Propagation, crack (*see also* Fatigue crack propagation)
 in blunt- and sharp-notched plates, 361
 in center-cracked panel, 183
 crack-shape predictions
 for aluminum, table, 60
 for polymethyl methacrylate, table, 59
 in generator end rings, 149, 167
 in nickel-base superalloys, 167
 in nuclear reactor pressure vessels, 183
 in polymeric materials, 45, 493, 504
 in side-grooved compact tension specimens, 251
 in steel, 281, 409
 austenitic, 293
 HY-80, 451, 578
 hydrogenated, 131
 polycarbonate, 431
 stainless, 293
 in three-dimensional specimen, 251
- R**
- Radius, notch root, 392
 Residual stress, 247, 434, 451
 Resistance, crack
 aluminum, titanium, and steel alloys, table, 291
 ASTM Standard E 813: 328
 in austenitic stainless steel, 293
 in ductile steel pipeline, 632
 in HY-80 steel plates, 451
 in iron alloys, 328
 table, 343
 in normalized/as-rolled steel, 238
 in titanium alloys, 392
 in zirconium pressure tubes, 308
- Ring segment
 external cracking, 106
 hydrogen-assisted cracking, 149
- S**
- SEM (*see* Electron microscope)
 Similitude parameters, 347
 Slip (*see* Plastic deformation)
 Steel
 A36: 238
 A131: 214
 A508: 214
 A516: 214, 238
 A517: 214
 A533: 214, 381, 467
 A723: 281
 AISI 1018: 467
 AISI 4340: 453
 austenitic stainless, 293
 in bridges, 569
 high-carbon, 361
 HSLA, 131

- hydrogenated, 131, 149
 HY-80 alloy, 451, 578
 manganese aluminum alloys, 597
 manganese chromium alloys, 149,
 597
 manganese silicon alloys, 597
 microstructure of, 579
 pipeline, 632
 polycarbonate, 431
 1020: 361
 1070: 361
 welded, 451, 597
- Strain hardening**
 of austenitic stainless steel, 293
- Strain-rate effects** (*see Loading*)
- Stress** (*see Loading; Residual stress; Stress intensity factor analysis*)
- Stress intensity factor analysis**
 correlations of four solutions
 aluminum, table, 57, 61
 polymethyl methacrylate, table,
 59, 61
 edge-cracked strip, 95
 HSLA steel, 131
 inappropriate use of, 347
 infinite strip, 7
 nondimensionalized
 biaxial loading of hole crack, ta-
 ble, 71, 76, 77
 normal/shear components, 17
 plates, 361, 551
 polymeric materials, 504
 polymethyl methacrylate, 45
 pressure vessel tests, 597, 617
 projectiles, 554
 ring segment, 106
 standard specimens, 27
 thick shells, 521
 titanium alloys, 392
 uranium projectile, table, 557
- Stress ratios**
 7075-T651 aluminum, table, 51
- Strip yield model** (*see Dugdale model*)
- Surface roughness**
 crack initiation
 titanium alloys, 392
- T**
- Tearing instability theory**
 crack propagation, table, 193, 195
- Temperature**
 lowered
 effect on cast iron, 328
 effect on nickel alloy, 167
 effect on pipelines, 635
 effect on steel, 113, 569
 effect on steel, table, 143, 241
 effect on uranium alloy, table,
 558
 elevated
 effect on polymeric material,
 504
 effect on pressure vessels, 597
 effect on steel, table, 293, 580,
 584
- Tensile tests**
 ductile cast iron alloys, 328
 tungsten alloy, table, 565
- Three-dimensional fractures**
 finite element analysis, 535
- Three-point bend specimens**, 37, 214,
 453
 initiation/maximum loading, table,
 636
 K values, table, 605
 R-curve data, 636
 radial loading, 106
- Thermoplastic composite** (*see Plastics*)
- Titanium alloys**
 Ti-6Al-4V, 281, 392
- Tubular products**, 106
- Tungsten alloys**, 554
- Tunneling effects**
 and crack propagation, 251

U

Unloading (*see also* Loading)
compliance method, 281, 308
and crack behavior, 167, 349
table, 316
Uranium alloys, 554

W

Weight function (*see* Loading)
Weldments
HY-80 steel, 451

V

Vertex (*see* Crack front)

Z

Zirconium, 308