
References

1. A.J. Durelli, E.A. Phillips, C.H. Tsao, *Introduction to the Theoretical and Experimental Analysis of Stress and Strain*, McGRAW-HILL BOOK COMPANY, INC., 1958.
2. Y.C. Fung, *Foundations of Solid Mechanics*, PRENTICE-HALL, INC., Englewood Cliffs, New Jersey, 1965.
3. Ch. Massonnet, S. Cescotto, *Mécanique des Matériaux*, EYROLLES, Paris, 1980.
4. S.P. Timoshenko, J.N. Goodier, *Theory of Elasticity*, third edition, McGraw-Hill Book Company, 1970.
5. Bronstein, Semendjajew, *Taschenbuch der Mathematik*, 24th edition, Verlag Harri Deutsch Thun und Frankfurt/Main, 1989.
6. D.R.J. Owen, E. Hinton, *Finite Elements in Plasticity - Theory and Practice*, Pineridge Press Limited, Swansea, U.K., 1980.
7. Odone Belluzzi, *Ciencia de la Construcción*, Aguilar s a de ediciones, 1973.
8. Charles Massonnet, *Résistance des Matériaux*, II volume, DUNOD, Paris, 1965.
9. J.S. Farinha, A. Correia dos Reis, *Tabelas Técnicas*, edição P.O.B., Setúbal, 1993 (in Portuguese).
10. prEN 1993-3: 20xx, *Eurocode 3: Design of steel structures: Part 1-1: General structural rules*, 2001.
11. S.P. Timoshenko, J.M. Gere, *Theory of Elastic Stability*, second edition, McGraw-Hill Book Company, 1961.
12. Curt F. Kollbrunner, Konrad Basler, *Torsion*, Springer-Verlag, Berlin and Heidelberg, 1966.
13. W.T. Koiter, General theorems for elastic-plastic solids, in *Progress in Soild Mechanics*, Vol. 1, I.N. Snedon and R. Hill (Eds.), Chapter 4, North- -Holland, Amesterdam, 1960.
14. V. Dias da Silva, *Introdução à Análise Não-Linear de Estruturas*, Departamento de Engenharia Civil, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, 2002 (in Portuguese).
15. Ted Belytschko, Wing Kam Liu, Brian Moran, *Nonlinear Finite Elements for Continua and Structures*, John Wiley & Sons Ltd., 2000.

Index

- action 3
- action axis 192
 - of the bending moment 192
 - of the shear force 193
- analogy
 - hydrodynamical 364
 - membrane 364
 - physical 364
- anticlastic 206
- axial force 141
- axial stiffness 143

- behaviour models 67
- bending 189
 - composed 190, 202
 - in elasto-plastic regime 221
 - inclined 197, 199
 - non-uniform 189
 - nonlinear 219
 - of composite members 213
 - plane 192
 - pure or circular 189
- bending moment 189
- bending stiffness 195
- Bernoulli's hypothesis 139
- Betti's theorem 473
- boundary balance equations 16
- Bredt's formulas 376
- buckling modes 442, 445, 454, 457
- bulk modulus 79

- Castigliano's theorem 469
- Cauchy equations 16
- centroid 142

- characteristic equation 19, 20
 - of the stress state 19
- characteristic values 135
- Clapeyron's theorem 468
- coefficient
 - buckling 415
 - dynamic 490
 - homogenizing 154, 216
 - of thermal expansion 132
 - Poisson's 76, 124
 - retardation 73
 - safety 137, 406
 - stiffness 452
- collapse mechanism 320
- compatibility of deformations 144
- composite material 3
- conjugate beam method 302
- conservation
 - of energy 80, 309, 359, 468
 - of plane sections 138
- constitutive law 7
- continuity conditions 299
- Continuum Mechanics 4
- core of a cross section 201
- creep 69
- creep modulus 73
- critical phase 390
- curvature 189
- curvature equation 298

- deflection curve 193
- deflection plane 193
- deformation 5

- compatible 51
- elastic 68
- homogeneous 43
- plastic 68
- pure 49
- visco-elastic 71
- visco-plastic 69
- viscous 68
- deformation energy 86, 126
- degree of connection 53
- degree of indeterminacy
 - kinematic 143, 153
- deviatoric tensor 26
- differential equations
 - of equilibrium 14
- dimensional tolerance 134
- direction cosines 16
- displacement method 144
- displacement-strain relations 6
- distortion 46
- Drucker-Prager's criterion 104

- effective length 404
- elastic limit stress 129
- elastic phase 93
- elasto-plastic analysis 145, 223
 - bending 223
- elasto-plastic phase 147
- energy
 - deformation 86
 - dissipated 88, 113, 127
 - elastic potential 80, 126
 - kinetic 511
 - potential 80, 390
 - total potential 485
- equation of three moments 317
- equation of two moments 317
- equations of compatibility
 - integral 54
 - local 54
 - of the strain 44
- equilibrium conditions 9
- Euler's hyperbola 408
- Euler's problem 410
- Eulerian formulation 300
- execution imperfections 134
- external forces 5
 - of mass 5
 - of surface 5
 - virtual 484
- external friction 465

- fatigue failure 128
- fatigue limit stress 129
- fibre 193
- first area moment 192, 253
- flow lines 364, 365
- Fluid Mechanics 85
- force method 144
- force-stress relations 6
- framed structures 138

- generalized displacements 469
- generalized forces 469
- generalized Maxwell model 74
- geometrical stiffness 442

- hardening 122
 - natural hardening 128
 - strain hardening 127
- homogenization 215, 377, 378
- Hooke's law 67, 75, 105
- hyperstatic unknowns 153
- hypothesis of continuity 4

- imperfections (effect of) 396
- inertial forces 5, 14
- influence lines 475
- instability 389
 - by divergence 433
 - by equilibrium bifurcation 398
 - in axial compression 414
 - in composed bending 411
- interaction formula 415
- internal forces 5, 6
- internal friction 88, 466
- intrinsic strength curve 101
- invariants 19
 - of the strain tensor 49
 - of the stress tensor 20
- irradiation poles 31
- isotropic tensor 24

- Johnson's parabola 407

- Kelvin chain 74, 83
- Kelvin's solid 71
- kinematic coordinates 454
- kinematic method 321
- kinematic unknowns 144

- Lagrangian formulation 300, 413
- Lamé's constant 79
- Lamé's ellipsoid 22
- level curves 365
- limit states 133
 - of serviceability 133
 - ultimate 133
- linear visco-elasticity 74, 83
- liquid 69
- load
 - collapse 321
 - critical 414
 - elasticity limit 122
 - Euler 413
 - proportionality limit 131
 - yielding 131
- longitudinal modulus of
 - elasticity 76, 124
- longitudinal shear flow 254
- longitudinal shear force 252, 310
- longitudinal strain 44

- Müller-Breslau's principle 476
- material
 - brittle 69, 121
 - composite 3
 - continuous 5
 - ductile 69, 121
 - elastic 87
 - isotropic 68
 - monotropic 68
 - orthotropic 68
- material stiffness 442
- mathematical models 3, 67
- Maxwell's model 73
- Maxwell's theorem 477
- mean rotation 50
- Mechanics of Materials 3
- Menabrea's theorem 473
- method of integration
 - of the curvature equation 298
- minimum energy theorem 473
- minimum loads 153
- Mohr's circle 30
- Mohr's criterion 104
- Mohr's representation 58
 - three-dimensional 34
- moment of inertia 195, 218
- moment-area method 304

- multiply connected body 53

- neutral axis 193
- neutral equilibrium 390, 403
- neutral surface 193, 206
- Newtonian liquid 84
- nominal values 135
- normal stress 11

- octahedral stress 24

- partial factors 136
- perfect liquid 84, 364
- physical models 68, 150
- plane of actions 193
- plane strain 59
- plane stress state 39
- plastic hinge 225
- plastic moment 223
- plastic section modulus 224
- polar decomposition theorem 50
- post-critical behaviour 393
 - stable 395
 - symmetrical 395
 - unstable 398
- pressure centre 201
- prestressing technique 150
- principal axis of inertia 198
- principal directions
 - of the stress state 19
- principal strains 58
- principal stress trajectories 276, 352
- principal stresses 19
- principle
 - conservation 80, 309, 359, 468, 479
 - of energy 80
 - of Müller-Breslau 476
 - of Saint-Venant 130
 - of stationarity of the 485
 - of superposition 76, 131
 - potential energy 485
- probabilistic approach 134
- probabilistic density curve 134
- product of inertia 198, 239
- proportionality limit stress 131, 407

- quantiles 136

- reciprocity of shearing stresses 12

- redistribution of internal forces 152
- redistribution of stresses 161
- reduced area 310
- reinforced concrete 3
- relaxation 69
- relaxation modulus 74
- resilience 126, 127
- retardation time 73
- rheological behaviour 3, 7
 - elastic 143
 - elasto-visco-plastic 69
- rigid body motion 5

- safety stresses 136
- Saint-Venant's hypothesis 252
- Saint-Venant's principle 130
- secant formula 411
- second-order theories 391
- section modulus 195
- semi-normal of the facet 10
- semi-probabilistic approach 135
- shape factor 223
- shear centre 270, 493
- shear flow 265, 358
- shear force 254
- shear modulus 77
- shearing strain 44, 77
- simplifying
 - hypotheses 120, 134, 257, 361
- simply connected body 53
- slender members 138
 - cross-section 138, 222, 274
 - non-prismatic 157, 209, 273
 - prismatic 138
 - with curved axis 157, 212, 273
- slenderness ratio 403
- solid 69
- Solid Mechanics 7, 37, 120, 121, 466
- stability 389
- stable equilibrium 390, 395
- state of deformation 43
 - around a point 49
 - isotropic 58
- state of stress 17
 - around a point 17
 - axisymmetric 24
 - isotropic 22
 - three-dimensional 92
- static method 321
- statically determinate structures 143
- statically indeterminate
 - structures 143, 315
- statistical dispersion 134
- stiffness 123
- stiffness matrix 441
 - of a compressed bar 445
 - of a tensioned bar 451
- strain 5
- strain tensor 6, 40
- Strength of Materials 120
- stress 5, 10
- stress concentration 161, 364
- stress tensor 6, 17, 20
- support conditions 303

- tangent elasticity modulus 124
- tangential 11
- tenacity 126, 134
- tensor 9
- tensorial quantities 9
- Tetmeyer's line 406, 407
- theorem of virtual displacements 479
- theorem of virtual forces 482
- theory of elasticity 119
- theory of strain 6
- theory of stress 6
- torque 347
- torsion 346
 - of circular cross-sections 347
 - of thin-walled cross-sections 356, 360
- torsion centre 271, 370
- torsion modulus 351
- torsional moment 347
- torsional stiffness 351, 359, 368, 369
- transversal modulus of elasticity 77
- transversal strain 75
- twisting moment 347

- uncertainties 133
- unstable equilibrium 390, 442

- virtual displacements 479
- virtual stress 482
- viscosity modulus 85, 86
- volumetric modulus of elasticity 79
- von Karman convention 36

- yielding bending moment 223

yielding criteria 93, 96
 Beltrami 98, 106
 Rankine 106
 Saint-Venant 106
 Tresca 98

 Von Mises 95
yielding stress 68, 92, 125
yielding surface 99, 100
yielding zone 121
Young's modulus 124