
Index

- P*-th order accurate 135
- local truncation error 205
- θ -methods 279
- 0-stability 136
- 2h backward Euler method 166
- 2h trapezoidal method 166
- absolute stability 136, 284
- Adams-Bashforth 274
- Adams-Moulton 275
- aliasing 202
- amplification factor 138, 205, 212
- Analytic ODE 32, 33
- analytical solution 138
- A-stable 160, 289
- Asymptotic Stability Theorem 47
- asymptotically stable 47
- autonomous 12
- backward difference formula 274
- backward Euler Method 164
- Banach Contraction Principle 225–229
- Banach space 218
- Butcher tableau 257
- Butterfly 25–31
- Calculus of Variations 63, 64, 68
- canonical coordinates 64
- canonical lifting 65
- Cartesian 240
- CFL condition 197
- Chaos 25–31
- characteristic polynomial 155–282
- characteristics 195, 203
- Classical 4th-order Runge-Kutta (Classical RK4) 172
- clock 21
- closed orbit 20
- closed system 91
- configuration space 96
- conjugate momentum 73
- Conservation Laws 73
- Conservation of Angular Momentum 120
- Conservation of Energy 74
- Conservation of Linear Momentum 118
- consistency 277
- constant method 293
- constant of the motion 34
- Continuity of solutions w.r.t. V 24
- Continuity With Respect to Initial Conditions 22
- continuous extension 208, 213
- convergent 280
- convergent algorithm 17
- Coriolis force 104
- corrector 292
- coupled harmonic oscillators 50
- critical point 19
- Dahlquist root condition 169

-
- Dahlquist's equivalence theorem 286
 - defect 213
 - dense output 213
 - differential equation 1, 5
 - discretization methods 133
 - discretization parameter 133
 - dynamical systems theory 15
 - E. Noether's Principle 81
 - Ecological Models 56
 - eigenvalue 252
 - elementary differentials 260
 - embedded 163
 - embedded methods 176
 - Equation of Exponential Growth 37
 - Equation of Simple Harmonic Motion 37
 - equations of evolution 1
 - equilibrium point 20
 - Euler-Lagrange Equations 68, 70
 - exercises 2
 - Existence Theorem 8
 - explicit method 134, 157
 - Exponential Growth 15
 - extrapolation 149
 - extremal 72
 - fixed point 20
 - fixed point iteration 158
 - flow 14
 - flow-box coordinates 244
 - forced harmonic oscillator 55
 - Foucault Pendulum 103
 - geodesics 86
 - global error 17, 144, 211
 - Gram-Schmidt Procedure 223
 - Green's Operator 56
 - Gronwall's Inequality 22
 - Hamilton's Equations 86
 - Harmonic Oscillator 15, 112, 177
 - Heat Equation 184
 - Heun's Method 2160, 57
 - homoclinic tangle 31
 - Hooke's Law 38
 - horseshoe map 31
 - hyperbolic 46
 - ignorable coordinate 73
 - implicit method 134, 157
 - implicit midpoint method 166
 - improved Euler method 160
 - infinite order accuracy 138
 - inhomogeneous linear ODE 52
 - initial value problem 1, 7
 - inner-product space 220
 - Invariance Properties of Flows 34–36
 - isolated system 91
 - IVP 7
 - Jordan canonical form 44
 - Lagrange's Equations 86
 - law of evolution 1
 - Leapfrog Method 152
 - linear m-step method 134
 - linearized KdV equation 194
 - local constant of the motion 245
 - local error 144, 206
 - local truncation error 144, 207, 276
 - Logistic Equation 6, 59
 - Lorenz Attractor 28
 - Lyapounov Exponent 31
 - Maximal Solution Theorem 13
 - method of small vibrations 128
 - Method of Successive Approximations 10
 - metric space 217
 - midpoint 257
 - midpoint method 148
 - Milne device 175
 - Milne's corrector 280
 - model parameter 137
 - modified trapezoidal method 160
 - m-step method 134
 - multistage 134

-
- multistep 134
 - Newton's Equations 86
 - Newton's Laws of Motion 92
 - Newton's method 158
 - No Bounded Escape Theorem 14
 - non-autonomous 12
 - norm 218
 - normed vector space 218
 - Numerical Methods 133
 - orbit 14
 - order of accuracy 135
 - ordinary differential equation (ODE) 1
 - parasitic 285
 - partial differential equations (PDE) 1
 - Pendulum 113
 - Pendulum Equation 111
 - period 20
 - periodic solution 20
 - Pierre Simon de Laplace 25
 - potential function 106
 - precession 121
 - Predator-Prey Model 60
 - predictor 292
 - predictor-corrector 161
 - prerequisites 2
 - prime period 20
 - propagator 49
 - Ralston's method 270
 - region of absolute stability 146, 284
 - relative stability 286
 - residual 206, 208, 213
 - resonant 56
 - rest point 20
 - Rikitake Two-Disk Dynamo 29
 - root condition 169, 285
 - rooted trees 259
 - r-stage one-step method 134
 - Runge-Kutta 134
 - Second Order ODE 66
 - sensitive dependence on initial conditions 27
 - singularity 20
 - Small Oscillations About Equilibrium 126–132
 - smoke particle 6
 - Smoothness w.r.t. Initial Conditions 23
 - Smoothness w.r.t. Parameters 24
 - solution (of an IVP) 8
 - spectral 138
 - spectral accuracy 138
 - Spectral Theorem 251
 - splitting method 200
 - stability 136
 - stable equilibrium 47
 - stable multistep method 281
 - stable Runge-Kutta method 270
 - stable subspace 45
 - stationary point 20
 - step-size 133
 - stiff 139
 - Straightening Theorem 244
 - Strang splitting 201
 - strange attractor 27, 31
 - strong root condition 286
 - successive approximations 39
 - Taylor methods 255
 - The Inverse Function Theorem 232
 - Theorem on Smoothness w.r.t. Initial Conditions 250
 - total energy function 73
 - trapezoidal method 157
 - Uniqueness Theorem 8
 - unstable subspace 45
 - Variation of Parameters 52
 - variational equation 249
 - vector field 5
 - visual aids 3
 - Volterra-Lotka Equations 60
 - weak stability 286
 - Web Companion 3

well-posed 26
y-midpoint method 166