

Index

- adjoint equation, 116
- asymptotic series, 100
- asymptotically stable, 143
- autonomous system, 141

- backward characteristic, 190
- Brachistochrone problem, 197

- canonical form, 238
- canonical transformation, 148
- catenary, 198
- Cauchy problem, 185
 - characteristic, 187, 203
 - non-characteristic, 187
- characteristic curve, 241
- characteristic equations, 186
- characteristic form, 242, 247
- characteristic parallelogram property, 312
- characteristic set, 242
- characteristic variety, 242
- coercive, 189
- complete integral, 188
- complex potential function, 150
- conservation law, 190
- control problem, 54
- controllability, 53
- controllability Grammian matrix, 55
- cost
 - optimal, 189
- cycloid, 221

- density, 261
- Dirichlet principle, 198
- domain of dependence, 308
- domain of determinacy, 309
- double layer potential, 261

- eigenfunction
 - boundary value problem, 111
- eigenvalue
 - boundary value problem, 111
- ellipsoid, 238

- energy functional, 148
- entropy condition, 192
- entropy solution, 192
- envelope, 9
- equation
 - Bernoulli, 15
 - Bessel's, 91, 96–98, 101
 - Chebyshev, 92
 - Darboux, 330
 - diffusion, 235
 - Duffing, 14
 - Duffing's, 164
 - elliptic, 235, 239
 - Euler, 101
 - exact, 4
 - Hamilton-Jacobi, 188
 - Hamilton-Jacobi-Bellman, 188
 - heat, 235
 - Hermite, 89
 - hyperbolic, 235, 239
 - hypergeometric, 92
 - Jacobi, 15
 - Klein-Gordon, 338
 - Klein-Gordon-Fock, 338
 - Laplace, 248
 - Laplace, 235
 - maximum principle, 247
 - mean value formula, 247, 249
 - Legendre, 91, 101
 - parabolic, 235, 239
 - Poisson, 248, 251
 - Riccati, 15
 - telegraph, 314, 332
 - Tricomi, 239
 - van der Pol, 14
 - wave, 235
 - multi-dimensional, 329
 - one-dimensional, 307
 - three-dimensional, 330
 - two-dimensional, 331
- equations
 - Euler-Lagrange, 189, 198

358 | Index

- equiangular spiral, 42
- equilibrium point, 141, 143
 - hyperbolic, 145
 - isolated, 143
 - non-isolated, 143
- equipotential lines, 150
- escape velocity, 19
- exactly controllable, 54
- exit time, 196
- formula
 - D'Alembert's, 307
 - Fourier-Poisson, 285
 - Green's, 117
 - Green's representation, 252
 - Hopf-Lax, 189
 - Kirchhoff's, 330
 - Lax-Oleinik, 192
 - Picone, 120
 - Poisson
 - ball, 253
 - upper half-space, 253
- Frobenius series, 95
- Frobenius theory, 85
- function
 - Hölder continuous, 254
 - harmonic, 248
 - sub-harmonic, 248
 - super-harmonic, 248
- fundamental solution, 236, 247
- general solution, 188
- generalized solution, 192
- Gevrey class, 87
- Green's function, 113
 - dihedral angle, 257
 - first octant, 257
 - quarter-ball, 257
 - strip, 257
 - upper-half ball, 257
- Green's identities, 255
- Gronwall's inequality, 5, 16
- Hamiltonian, 148, 188
- Hamiltonian system, 148, 152, 154, 218
- Harnack's inequality, 250
- heat equation
 - Dirichlet problem, 287
 - Duhamel's principle, 286
 - fundamental solution, 285
 - inhomogeneous, 286
 - mixed problem, 287
 - Neumann problem, 287
- heat kernel, 285
- Hermite polynomial, 90
- Hopf's lemma, 250
- Huyghens principle, 332
- hyperboloid, 238
- hypoelliptic, 236
- indicial equation, 94
- initial value problem, 185
- integrating factor, 3, 4
- irregular singular point, 92
- isogonal trajectory, 11
- Joukowski airfoil, 153
- Joukowski transformation, 153
- jump condition, 192
- Kalman's rank condition, 55
- Kelvin transform, 259
- Lagrange identity, 117
- Lagrangian, 188
- Legendre polynomial, 106
- Legendre transformation, 189, 190
- Liapunov
 - function, 146
 - instability theorem, 146
 - stability, 143
 - stability theorem, 146
- Liapunov function, 145
- limit cycle, 142, 171
- linear stability analysis, 144
- linear theory, 47
- linearised system, 144
- Lipschitz continuity, 6
- Lipschitz continuous, 254
- logarithmic spiral, 42
- loss of regularity, 312
- matrix
 - diagonal, 48
 - fundamental, 52
 - nilpotent, 51
 - transition, 48, 52
- maximal interval of existence, 8
- maximum principle
 - strong, 249
 - weak, 249, 254

- method of characteristics, 185
- method of descent, 331
- minimum principle
 - strong, 249
 - weak, 249, 254
- non-autonomous system, 141
- non-hypoelliptic, 236
- null controllable, 55
- numerical range, 10
- oblique trajectory, 11
- observability, 53
- observability inequality, 58
- observable system, 56
- operator
 - Laplace, 247
- orbit, 141
 - closed, 142
 - homoclinic, 164, 167, 181
 - periodic, 142
- ordinary point, 90
- orthogonal trajectory, 11
- paraboloid, 239
- path, 142
- periodic boundary condition, 112
- Perron's method, 248
- point
 - characteristic, 236
- Poisson kernel, 253
- potential flow, 149
- potential function, 150
- potential theory
 - local version, 261
- Prüfer substitution, 120, 124
- Prüfer substitution, 118
- prey-predator system, 15
- principal part, 242
- principal symbol, 242, 247
- propagation of singularities, 310
- qualitative theory, 141
- range of influence, 308
- Rankine-Hugoniot condition, 192, 200
- rarefaction, 209
- rarefaction wave, 191, 226, 229, 231
- real analytic function, 86
- regular singular point, 92
- self-adjoint system, 118
- semi-concavity, 190
- shock, 191, 192, 209
- shooting method, 113
- single layer potential, 261
- singular point, 10, 87
- singular point of first kind, 92
- singular point of second kind, 92
- singular solution, 216
- solution
 - optimal, 189
 - periodic, 142
- speed of propagation, 307
- spherical mean function, 329
- stream function, 150
- streamline, 150
- strip condition, 186
- Sturm–Liouville problem
 - regular, 111
 - singular, 111
- Sturm–Liouville theory, 111
- subspace
 - invariant, 50
- surface
 - characteristic, 236
 - non-characteristic, 236
- Sylvester's law of inertia, 238
- symplectic matrix, 148
- theorem
 - Cauchy–Peano, 7
 - center manifold, 145
 - Chetaev, 146
 - continuous dependence, 8
 - Hartman–Grobman, 145
 - Liouville's
 - stronger form, 257
 - Perron's, 144, 146
 - Picard, 7
 - Widder, 291
- trajectory, 142
- transversality condition, 187
- uniformly elliptic, 247
- unique continuation principle, 58
- value function, 189
- value function, 188
- weakly hyperbolic, 241