

Index

In this index *italics* is used to specify page numbers for major references such as definitions or sections on the topic.

- addition formula, *see under* pfaffian
- antisymmetric matrix, 62
- atom, 192
- auxiliary variable, 56, 57, 127
- Bäcklund transformation, 32, 157
 - BKP equation, 175
 - KdV-type equation, 161
 - KP equation, 169
 - Toda molecule equation, 188
 - two-dimensional Toda lattice equation, 179
- bi-directional wronskian, *see under* wronskian
- bilinear equation, 23
- bilinear expression, 20
- bilinear form, 24
 - indefiniteness of solution, 32
- bilinear method, *see* direct method
- bilinear operator, *see* *D*-operator
- bilinearization, 37–46, 120, 194
- BKP equation, 128, 175
 - Bäcklund transformation, 175
 - $\tau_{\text{KP}} = \tau_{\text{BKP}}^2$, 90, 130
- BKP hierarchy, 128
- BKP-type equations, 128
 - pfaffian solutions, 127–132
- bordered determinant, *see under* determinant
- Boussinesq equation, 57
 - Bäcklund transformation, 168
- bright soliton, *see under* soliton solution
- Burgers equation, 13
- Casorati determinant, 144
- chaotic behaviour, 193
- characteristic polynomial, 120
- cofactor
 - determinant, 77
 - pfaffian, 77
- Cole–Hopf transformation, 14
- commutation relation, 64, 164
- compatibility condition, 163, 164
- computer algebra, 22, 38, 54, 80, 83, 191
 - REDUCE, 30
- conserved density, 158
- coupled KdV equation, 138
- coupled KP equation, 133, 137
 - solutions, 134, 139
- creation–annihilation operators, 66
- D*-operator, 23
 - D_{xy}^n , 37
 - $D_{m,n,x}$, 35
 - properties, 27–37
- dark soliton, *see under* soliton solution
- Davey–Stewartson equation, 192
- decoupling, 22, 35, 39, 40, 45
- dependent variable transformation, 13, 15, 18, 24, 37–46, 164
 - bi-logarithmic, 43
 - logarithmic, 41
 - rational, 37
- derivative formulae, *see under* pfaffian
- determinant
 - bordered, 87–92, 104, 106
 - Jacobi identity, 77
 - Laplace expansion, 70
 - perfect square formulae, 84

- Plücker relation, 61, 73, 76, 97, 110, 119, 172
 wronskian, *see* wronskian
- difference equation, 61, 193
- differential-difference equation, 14, 15
- direct method, 8, 12, 19–26
- dispersion, 4
- dispersion relation
 linear, 3
 nonlinear, 112, 113, 129
- double wronskian, *see under* wronskian
- dromion, 157, 192
- envelope soliton, *see under* soliton solution
- exchange formula, 31, 32, 161, 176, 180
- fermion, 75, 116
- fifth-order KdV equation, 127
 Bäcklund transformation, 167
- Gel'fand–Levitan integral equation, 128
- Ginzburg–Landau equation, 35
- grammian, 123
 solution, 130, 142
- Grassmanian manifold, 110
- group velocity, 4
- Hessian, 37
- Hirota bilinear form, *see* bilinear form
- Hirota condition, 55, 84
- Hirota derivative, *see* D -operator
- Hirota's method, *see* direct method
- hole solution, 35
- hybrid mode solution, 142
- inverse scattering method, 12, 20, 128, 160, 166
- Jacobi identity, *see under* determinant
- Kač–Moody algebra, 29, 138
- Kadomtsev–Petviashvili equation, *see* KP equation
- Kaup–Kuperschmidt equation, 36
- KdV equation, 12, 20, 111, 112, 164
 Bäcklund transformation, 162
- KdV-type equation, 50, 55
 Bäcklund transformation, 161
 extension, 52
- Korteweg–de Vries, *see* KdV equation
- KP equation, 57, 111
 Bäcklund transformation, 168, 169
 bilinear form, 57, 76, 111
 first modified, 170
 grammian solution, 122
 N -soliton solution, 112
 second modified, 137
 $\tau_{KP} = \tau_{BKP}^2$, 90, 130
 wronskian solution, 115
- KP hierarchy, 120, 138
- Laplace expansion, *see under* determinant
- Lax fifth-order KdV equation, *see* fifth-order KdV equation
- Lax pair, 164, 165, 180
- Leibniz rule, 27
- Lie algebra, 29, 32, 60, 138
- Lie group, 32
- linearization, 12–15
- Liouville equation, 15, 18, 153, 159
- Maya diagram, 73, 116
- Miura transformation, xi, 158, 163, 166, 183
- mKdV equation, 14, 166
 dispersionless, 157
- model equations for shallow water waves, 127
 Bäcklund transformation, 168
- modified BKP equation, 177
- modified Kaup–Kuperschmidt equation, 36
- modified KdV equation, *see* mKdV equation
- modified KP equation, *see under* KP equation
- modified Toda equation, 181
- nondispersive wave
 linear, 2
 nonlinear, 4
- nonlinear Schrödinger equation, 41, 192
- nonlinearity, 4–12
- numerical simulation, 50, 193
- one-form, 64
- Padé approximation, 8, 21
- parameters p_i, q_i , 112, 129
- perturbation method, 7, 20, 21, 25, 38, 47, 112
- perturbed system, 193
- Pfaff (J. F. Pfaff), 64
- pfaffian, 61–66
 addition formula, 99, 174
 cofactor, 77

- pfaffian (*cont.*)
 derivative formulae, 101–109
 entry, 63
 expansion formulae, 62–64
 Gramm-type, 139
 identities, 92–97
 orthogonality relation, 77
 Wronski-type, 133
 phase constant, 114
 phase shift, 49, 52, 55, 112, 113, 129
 phase velocity, 3
 Plücker relation, *see under*
 determinant
 plane wave solution, 6
 Poisson bracket, 37
 predator–prey model, 17–18

 quadratic form, 20
 quasi-periodic solution, 51

 recurrence relation, 85
 Riccati equation, 12

 Sato theory, 61
 Sawada–Kotera equation
 Bäcklund transformation, 168
 scaling transformation, 9
 Schrödinger equation, 31
 shock wave solution, 35
 similarity transformation, 9
 sine–Gordon equation, 45, 159
 Snake’s legs, 22
 solitary wave, 1, 4, 7
 amplitude, 9, 11
 exact solution, 11
 velocity, 10, 11
 solitary wave solution, 4, 8, 22, 35
 soliton, 1, 3, 12

 soliton solution
 bright soliton, 41
 dark soliton, 41
 envelope soliton, 41
 four-soliton, 56
 head-on interaction, 110
 N -soliton, 55, 129
 one-soliton, 1, 25, 47
 overtaking interaction, 60
 three-soliton, 53, 56
 two-soliton, 26, 47, 49, 52
 special functions, 193
 superposition principle, 12, 26

 Taylor expansion, 59
 Toda lattice equation, 57, 143
 Bäcklund transformation, 169
 trilinear form, 53
 triple wronskian, *see under* wronskian
 truncation, 25, 26
 two-dimensional KdV equation, 111
 two-dimensional modified Toda equation, 184
 two-dimensional Toda lattice equation, 74,
 142–148
 two-dimensional Toda molecule equation,
 149–156
 two-form, 65
 two-wave interaction, 17
 equation, 153, 182

 vertex operator, 194

 wronskian, 67, 74, 111
 bi-directional, 150, 188
 double, 154
 triple, 155

 Young diagram, 75, 120