

Subject Index

- Addition theorem, 35, 37, 57, 176, 202
Adjoint representation, 12, 20, 41, 59, 77, 107, 124, 163, 243
Airy function, 89, 138
Angular momentum operator, 243
Anharmonic oscillator function, 127, 138, 147
Appell transform, 94, 146, 154
- Bargmann—Segal Hilbert space, 142, 232
Basis, 26, 263
Bessel equation, 10, 28, 43, 62, 270
Bessel function, 10, 56, 62, 119, 136, 152, 165, 194, 216, 237, 239, 243, 269–271
modified, 201, 221
of second kind, 72
spherical, 175, 190
Bessel polynomials, 72
Bilinear expansion, 39, 71, 159, 193, 222
Binomial coefficient, 266
Bipolar coordinates, 212
- Cartesian coordinates, 9, 17, 43, 50, 177, 207, 234
Casimir operator, 86, 110, 213, 236, 239, 243
Cauchy problem, 96, 151, 159
Cauchy-Riemann equations, 14
Cherry's thoerem, 89
Class I equation, 8, 41, 157, 162
Class II equation, 8, 157
Clebsch-Gordan coefficient, 175
Commutator, 261, 263
matrix, 5, 261
Confluent hypergeometric function, 119, 140, 152, 153, 155, 167, 258, 268, 269
Conformal algebra, 224, 240, 242
Conformal group, 205, 228, 230, 233, 242
Conical coordinates, 190, 192, 208
Continuous spectrum, 30
Cyclide, 208, 209, 212
Cylindrical coordinates, 165, 177, 192, 196, 207, 212, 221
Cylindrical wave, 36, 177, 202, 216
- Deficiency indices, 51, 53, 54
Dirac delta function, 22, 29
- Eigenvalue, 25
Eigenvector, 25
Ellipsoidal coordinates, 163, 182, 192, 208
Ellipsoidal harmonic, 208
Ellipsoidal wave equation, 168, 182
Ellipsoidal wave function, 168, 182, 183
Elliptic coordinates, 18, 134, 182, 185, 186, 190, 234
Elliptic cylinder coordinates, 178, 179, 192, 207
Elliptic function, 168, 182, 211, 274, 275
Equivalent coordinates, 12, 230
Euclidean group, 2, 161
complex, 59
in the plane, 2–6, 59, 234
in three space, 161, 212
Euler angles, 161, 172
Euler-Poisson-Darboux equation, 239–241, 243
Exponential mapping, 219, 261, 263
Extension of operator, 26
- Fourier series, 27
Fourier transform, 50, 225
- Galilei group, 75, 79, 128, 147
Gamma function, 88, 265
Gegenbauer polynomial, 199, 219, 220, 222, 239, 241, 243, 267
Generalized eigenfunction, 29
Generalized hypergeometric function ${}_pF_q$, 156, 258, 259, 271, 272
Generating function, 63, 115, 154, 155, 199, 220, 222, 256, 257, 259
continuous, 90, 112, 159
Graf's addition theorem, 68, 71
- Hankel function, 57, 195
Hankel transform, 112

- Heat equation, 92
 complex, 97, 151, 222
 in three variables, 145
 in two variables, 92
Heat group, 93, 146
 complex, 151
Heat polynomials, 94
Helmholtz equation, 1, 22, 151, 160, 165, 171, 191, 222, 234
 complex, 58
Hermite function, 98, 102, 156, 159
Hermite polynomial, 84, 98, 99, 131, 270
Hilbert space, 22, 23, 47, 51, 80, 128, 169, 171, 226, 231, 235, 236, 238, 240, 242
Hille-Hardy formula, 110, 121, 159
Hypergeometric function ${}_2F_1$, 222, 241, 245, 250, 252, 266–268
- Ince polynomial**, 135, 142, 190
Inversion symmetry, 205, 225
- Jacobi polynomial**, 241, 243, 268
- Kepler problem**, 231, 242
Klein-Gordon equation, 39, 235, 242
- Laguerre function**, 104, 113
Laguerre polynomial, 101, 109, 119, 134, 149, 152, 198, 231, 257, 269
Lamé equation, 169, 186, 188, 208, 211, 218, 233
Lamé polynomial, 169, 184, 187–190, 208, 237
Lamé-Wangerin function, 237, 239
Laplace equation, 204, 219, 222
Laplace operator, 11
 on the hyperboloid, 236, 242
 on the sphere, 174, 184, 230, 233, 242, 243
Lauricella function, 245–258, 272
Lebedev transform, 53
Legendre function, 165, 166, 173, 179, 195, 212, 237, 239, 267, 268
Lie algebra, 3, 4, 58, 261
Lie derivative, 262
Lie group, 260
Limit in the mean, 47, 49
Local group representation, 65, 262
Lorentz group, 242
Lorentz transformation, 223
- Macdonald function**, 51, 53, 56, 57, 237
Mathieu equation, 19, 33, 46, 178, 272
Mathieu function, 19, 44, 45, 137, 143, 192, 208, 272, 273
 modified, 34, 137, 179
Matrix elements, 35, 56, 66, 91, 100, 103, 117, 173, 175, 198, 200, 252
 mixed-basis, 36, 91, 112, 237
Mehler's theorem, 102, 103
Mellin transform, 88
Multiplicity of spectrum, 30
Multiplier, 262
 representation, 262
- Nonsplit coordinates**, 230, 241
- Oblate spheroidal coordinates**, 166, 180, 192, 207, 216
Operational identity, 202
Orbit, in Lie algebra, 12, 21, 41, 59, 78, 79, 82, 93, 97, 107, 109, 113, 124, 163, 222
Orthogonal group O(3), 185
Orthogonal vectors, 25
Orthonormal set, 26
Overlap functions, 35, 55, 90, 112, 142, 190, 191
- Parabolic coordinates**, 17, 33, 69, 137, 167, 180, 191, 197, 203, 208, 215
Parabolic cylinder coordinates, 178, 192, 207, 222, 234
Parabolic cylinder equation, 17, 33, 270
Parabolic cylinder function, 17, 33, 43, 69, 88, 98, 139, 269, 270
Paraboloidal coordinates, 167, 181, 208
Parseval's equality, 50
Planck's constant, 73
Plane wave, 36, 177
Pochhammer's symbol, 266
Poincaré group, 39, 40, 59, 224, 235, 242
 extended, 42, 55
Polar coordinates, 10, 18, 62, 63, 136, 137, 153, 234
Potential function, 73, 121, 157
Prolate spheroidal coordinates, 166, 179, 192, 207, 222
- Raising operator**, 158
Real forms of Lie algebra, 59
Recurrence formulas, 115, 153, 159, 189, 192, 200, 201, 219, 220, 241, 244, 246, 247, 258, 259, 267, 269–271
Representation, 118

- Rotation group, 161, 185, 230
full, 185
- R—separable coordinates, 78, 125, 130, 204, 230, 259
for heat equation, 94, 97, 146–149, 151
for Laplace equation, 209, 210
for radial free particle Schrödinger equation, 107, 113
for three-variable Schrödinger equation, 126
for two-variable Schrödinger equation, 79
for wave equation, 230, 232–240
- Schrödinger algebra, 75, 122, 238
- Schrödinger equation, 73, 121, 145, 157
free particle, 74, 121, 125, 237, 242
harmonic oscillator, 81, 125, 130, 158
linear potential, 82, 125, 130, 158
radial free particle, 106, 109, 112, 113
radial harmonic oscillator, 106, 108
radial repulsive oscillator, 106, 109, 111
repulsive oscillator, 82, 87, 125, 130, 158
time dependent, 73, 158
time-independent, 157
- Schrödinger group, 77, 86, 122
covering group of, 86
- Self-adjoint operator, 26, 171
- Semisplit coordinates, 230, 241
- Separable coordinates, 9–11, 13–19, 163, 259
for complex Helmholtz equation, 61
for Klein-Gordon equation, 47
for Laplace equation, 207
for Laplace operator on sphere, 184
for three-space Helmholtz equation, 164
for time-independent Schrödinger equation, 157
for two-space Helmholtz equation, 22
- Separable solutions, 9–11, 209
- Separation constant, 9
- Separation of variables, 9, 11, 39
- Skew-Hermitian operator, 24
- Solid spherical harmonic, 214, 216–218
- Solution space, 1, 171, 204, 206
- Space inversion, 60, 185, 205
- Special conformal transformation, 204, 205, 223, 225
- Special linear group, 75, 84, 93, 106, 123, 146, 213, 229, 236, 239, 240
complex 97, 113, 115, 222, 247, 250
universal covering of, 85, 108, 240
- Special orthogonal group, $SO(2,1)$, 228, 236, 243
- $SO(3)$, 161, 172, 174, 184, 185, 228, 230
 $SO(3,1)$, 242
 $SO(3,2)$, 228, 230, 233
 $SO(4)$, 242
 $SO(4,1)$, 205
 $SO(4,2)$, 242
- Spectral decomposition, 27, 83, 131, 133, 172, 187, 237
- Sphere S_2 , 170, 184
- Spherical coordinates, 106, 165, 170, 172, 176, 191, 192, 198, 201, 203, 207, 212, 214, 218, 219, 222, 233
- Spherical harmonic, 173, 186, 188, 216, 232
- Spherical wave, 176, 195, 202
- Spheroidal wave equation, 166
- Spheroidal wave function, 166
- Split coordinates, 230
- Subgroup coordinates, 13
- Symmetric operator, 25
- Symmetry algebra, 3, 39, 74, 113, 145, 160, 184, 204, 223, 250, 258
- Symmetry group, 2, 205
- Symmetry operator, 2
first order, 2–4, 6, 125, 147, 157
second order, 6–8, 20, 40, 60, 125, 147, 157, 162, 184, 206, 213, 230, 239
trivial, 7, 162
- Time translation, 129
- Toroidal coordinates, 212, 217
- Transformation formula, 155, 203, 222, 241, 253, 267, 269
- Transformation group, 4, 39, 161, 205, 224, 250, 262
- Unitary representation, 49
- Unitary transformation, 23, 25, 171, 187
- Vandermonde's theorem, 255
- Virial theorem, 231
- Wave equation, 222, 223, 241, 250
- Weisner's method, 62, 98, 105, 113, 118, 152, 155, 198, 202, 213, 218, 254, 259
- Weyl group, 76, 92, 122
- Weyl's theorem, 108
- Whittaker function, 181
- Whittaker-Hill equation, 135, 141, 167, 181, 218
- Wigner D function, 173