

# Index

- acoustic scattering, 148
- Alessandrini's identity, 227
- anisotropic conductivity, 183
  
- Beltrami equation, 216, 266
- Beurling transform, 217–219
- blurring, 8, 13
- Born approximation, 151, 255, 260, 261, 283, 284
- boundary data
  - Dirichlet, 164, 166, 188, 229, 277
  - Neumann, 164, 170, 189
  - Robin, 173, 192
- boundary integral equation, 228, 234, 257, 266, 268, 271, 274
- breast cancer, 161, 181
- Brownian motion, 14
  
- calculus of  $\bar{\partial}$  operator, 204
- Calderón, 159, 180, 182, 201, 262, 264, 285
- camera
  - digital, 132
- Cauchy integral formula
  - generalized, 204
- central slice theorem, 25
- circulant matrix, 11
- cloaking, 183, 184
- complex-linear, 237, 240
- condition number, 51
- conductivity equation, 147, 164, 188, 200, 206, 216, 229
- conjugate direction method, 79
- conjugate gradient method, 79, 81
- contact impedance, 172, 192
- convection-diffusion equation, 134
- convolution, 7, 51, 146, 207, 211, 212, 218, 230, 238, 240, 263
  
- matrix, 11, 58
- operator, 207
- current pattern, 173
  - adjacent, 174, 175
  - Fourier, 173
  - optimal, 160, 179
  - pairwise, 174, 178, 254
  - skip 3, 176
  - trigonometric, 173–175, 254
  - Walsh, 174
- cutoff
  - frequency, 223, 232, 274
  - function, 238, 264, 265
  
- data
  - noise-free, 144
- deconvolution
  - blind, 146
- degree of ill-posedness, 45, 53
- density, 151–153
- diffusion, 14
  - coefficient, 16
- diffusion equation, 156
- dispersion coefficient, 147
- drum
  - determining the shape of, 151
  
- ECG, 161
- EEG, 161
- eigenfunction
  - Dirichlet-to-Neumann (DN) map, 186, 284
  - Neumann-to-Dirichlet (ND) map, 178, 179
- eigenvalue
  - Dirichlet-to-Neumann (DN) map, 186, 284
  - Neumann-to-Dirichlet (ND) map, 178, 179

- problem, 152, 153
- electrode model
  - complete, 173, 191
  - continuum, 163, 170, 185
  - gap, 170
  - shunt, 172
- exceptional points, 207
- existence
  - lack of, 142
- far field pattern, 150, 287
- fast Fourier transform (FFT), 11, 212, 213, 219, 240, 241
- flowchart
  - idealized D-bar reconstruction method, 225
  - regularized D-bar reconstruction method, 233
- Fourier symbol, 208
- Fréchet differential, 201
- Fredholm equation
  - first kind, 37, 41, 42, 44
  - second kind, 207, 230, 289
- Fredholm operator, 207
- fundamental solution, 17, 205–207, 209, 287
- Galerkin method, 38, 46
- GMRES, 213, 217, 218, 240, 241, 271, 285, 289, 307
- Green's function, 205
  - Faddeev, 208, 210, 228, 231, 235, 259
  - for the Laplacian, 207, 209, 210, 234
- heat equation
  - backward, 133
- indicator function, 277, 282
- inverse crime, 7, 12, 13, 19, 20, 32, 131, 145
- kernel
  - Hilbert–Schmidt, 41
  - weakly singular, 42
- L-curve method, 63, 72, 73, 89, 105, 106
- Laplace
  - equation, generalized, 163, 166
  - transform, 133
- least-squares, 32, 53, 68, 84, 134
- linear operators, 40, 234
  - compact, 40, 41, 43
  - injective and bounded, 48
  - unbounded, 40
- linearized problem, 259
  - EIT, 201, 285
- Lippmann–Schwinger equation, 150, 151, 206, 210, 228, 230, 237, 238
- low-pass filter, 223, 255, 265, 272
  - nonlinear regularization, 245
- low-pass transport matrix, 266, 272
- minimization
  - least-squares, 134
- minimization problem, 66, 70, 81, 82, 84, 89, 90, 99, 100, 104, 119, 135, 144, 145
  - nonlinear, 144, 223
  - quadratic, 81, 99
- minimum
  - global, 145
  - local, 145
- mollifier, 262
- Morozov discrepancy principle, 72
- Neumann problem, 170, 189
- nonuniqueness, 36, 50, 55, 140
- optical tomography, 154
- optimization, 144
- panoramic (dental) imaging, 123, 124, 126
- parabolic problem
  - backward, 134, 146
- parallelization, 145
- perfusion, 254, 256, 257, 262
- permittivity, 159, 163, 181, 184, 263
- photograph, 7, 117, 119, 132
- Picard condition, 45
- point spread function, 8, 13, 132
  - discrete, 10
- power, 165
- power method, 179
- preconditioning, 82
- pseudoinverse, 55

- pulmonary imaging, 161, 181
- quadratic
  - form, 200, 201
  - functional, 67, 91
  - problem, 79, 81
  - programming, 83, 86, 89, 99, 116, 119
- reaction-diffusion equation, 146
- real-linear, 237, 238, 240, 270
- refractive index, 149
- regularization, 47
  - admissible parameter, 47, 143, 232, 233
  - direct, 145
  - iterative, 144
  - nonlinear, 231
  - nonlinear low-pass filter, 244
  - parameter, 63, 223, 283
  - strategy, 47, 140, 143–145, 232
  - Tikhonov, xi, xii, 6, 63, 83, 84, 104, 106, 111, 113, 114, 116, 120, 121, 129, 144
- regularization method
  - nonlinear, 278
- regularized inversion, 47, 53, 143, 231
- relative error, 56
- S-curve method, 89, 119
- scattered field, 149
- Schrödinger equation, 206, 224, 283
- shunting, 172
- signal-to-noise ratio, 177
- singular
  - functions, 44
  - values, 44, 49, 51, 53, 58, 65
  - vectors, 56, 58, 60, 61, 65
- singular values
  - generalized, 75
- sinogram, 3, 31, 32, 111, 114
- solute transport, 146, 147
- Sommerfeld radiation condition, 149
- sound speed, 148, 151
- sound-hard object, 286
- sound-hard, object, 149
- sound-soft, object, 149
- space
  - Banach, 40
  - Besov, xii, 95, 98, 99, 108, 114, 117, 120
  - Hilbert, 40
  - Sobolev, 164, 176, 187, 189, 206, 297, 299, 301, 302
  - sparsity, xi, 72, 88, 95, 99, 101, 108, 117, 120
  - stability, 36, 250
    - conditional, 48, 141, 142
    - criterion, 18
    - final time, 134
    - numerical, 55
  - stacked form, 68
  - Sturm–Liouville problem, 153
- tangential derivative map, 270
- transformation optics, 183
- transport equation, 156
- transport matrix, 268
- ultrasound, 148
- variational form, 192
- vocal tract, 146, 152
- wave equation, 148, 151
- weak form
  - of Dirichlet-to-Neumann (DN) map, 165
- wedge product, 204
- well-posed, 35, 40