## Index

Abel integral equation, 25, 27
inversion formula, 27
analytic continuation, 112
anharmonic function, 121
approximation error, 2, 3, $14-16,35,53,65,72,88$
arbitrarily slow convergence, 3 , 17

Banach-Steinhaus theorem, 6, 15, 54, 87, 89
band-limited, 111, 112
essentially, 116
Bessel function, 70, 72
biharmonic equation, 122
blur, 67
motion, 67
out of focus, 67, 70-72

Cauchy problem, 33, 40, 77, 81, 97, 109, 124, 141
numerical solution, 34,81 , 97, 109
unique solvability, 43, 44, 97, 100, 121, 124, 141
Cauchy-Kovalevsky theorem, 34, 141
CGLS (Conjugate Gradient iteration for Least Squares problems), see conjugate gradient method
CGNE, 103
CGNR, 103
computerized tomography, see tomography
conductivity, 31, 40
conjugate gradient method, 101-103, 113, 117, 119, 125, 151
convolution, 67, 71
convolution theorem, 68, 71, 150
data error, propagated, 2, 3, 7, 14, 15, 54, 88
data fit, 15, 55, 89
deconvolution, 67
differentiation
half order, 27
numerical, 1, 5, 12, 14, 20, 28, 63, 76, 80
Dirichlet problem, 140
as an ill-posed problem, 76, 80
exterior, 122
discrepancy principle, 58,91 , 108
distributional Laplacian, 136
distributional solution, 124, 135
EIT (Electric Impedence Tomography), 39
embedding, 5, 78
compact, 18, 120, 133, 135
extremal sequence, 50,130
flux, see Neumann derivative heat, 123
Fourier series, 32
Fourier transform, 68, 70, 73, 111, 147
fast, 73
inverse, 68, 148
functional
Lagrange, 53
quadratic, 51, 73, 151
Tikhonov, 53, 73
ghost, 28, 121
Gibbs effect, 73
gravimetry, 121
gravitational potential, 122

Green's formula, 125, 136
second formula, 43, 99, 120
harmonic function, 44, 76, 120, 123, 137, 141, 143
harmonic part, 122, 123
Hausdorff-Tikhonov lemma, 17, 34, 35
heat equation, 123
Holmgren theorem, 40, 97, 141
identifiability, 11, 29, 120
IHCP (Inverse Heat Conduction Problem), 123
ill-posed problem, 11
mildly, 13, 14, 27, 122
severely, 13, 33, 112, 120, 124
imaging, 23, 67
impedance tomography, 39
insulating inclusion, 40
inverse heat conduction problem, see IHCP
inverse mapping theorem, 52
isometry, 68, 148
Kozlov-Maz'ya iteration, 77, 97
L-curve, 57, 59
L-curve criterion, 59
Lagrange functional, 53
Lagrange parameter, 53
Landweber iteration, 85-87, 91, 94, 97, 101-103, 105, 107, 112, 119
Laplace equation, 31, 76, 77, 97, 124
Lipschitz domain, 133
low-pass filter, 111
mixed boundary value problem, 124, 141
motion blur, see blur
Neumann derivative, 123, 135, 141
weak sense, 136, 137
Neumann problem, 40, 139
Neumann series, 86
normal equation, 103
normal vector, $31,40,80,97$, 134
operator
Abel integral, 25, 27
adjoint, 11, 78
band-limiting, 111
bounded, 5
bounded from below, 75
closed, 75
compact, $11,12,18,19,25$, 33, 42, 69, 108, 112, 120, 129, 130, 132, 133, 135
convolution, 68, 71, 149
embedding, see embedding
Fredholm integral, 12, 26, 112, 113
Hilbert-Schmidt, 114
Neumann-Dirichlet, 40, 81
Poincaré-Steklov, 81
trace, 41, 42, 134, 135
trace class, 114
unbounded, 75
order optimal, $20,59,95,108$, 119
out of focus blur, see blur
parallelogram identity, 50
Parseval identity, 12, 32, 35
Picard criterion, 12, 41, 45
Plancherel theorem, 68, 112, 148

Poincaré inequality, $76,77,134$, 139, 140
point spread function, 67,71
Poisson equation, 119, 121, 122, 139
quadratic functional, 51, 151
Radon transform, 24, 25, 27, 28
regularization parameter, 16 , $53,55,58,59,70,71,78$, 87
a posteriori choice, 58, 59, 63
a priori choice, 59
residual, $55,89,91,98,102,108$, 151
normal equation, 103, 151
Riemann-Lebesgue lemma, 68, 69, 147, 150
ringing artefacts, 72
Robin problem, 81, 101
semiconvergence, 88,108
seminorm of $H^{1}, 134$
Shannon sampling theorem, 116
signal processing, 111
singular value decomposition, $12,14,33,34,45,108$, $113,117,119,129,132$
truncated, 20, 22, 34, 119
Sobolev space, 4, 5, 27, 81, 121, 133, 143, 149
source condition, $19,20,58,93$, 108, 119
source problem, 119, 123
parabolic, 123
spline
linear, 62,65
natural cubic, 62
smoothing, 62, 63
square integrable function, 4, 133
steepest descent, 151
support, compact, 133
Tikhonov functional, 53, 73
Tikhonov lemma, see Hausdorff-Tikhonov lemma
Tikhonov regularization, 53 , 71, 119
Tikhonov's variational method, $49,53,58,59,62,77,119$
tomography, 23, 39, 121
impedance, 39
local, 28
total variation, 73
trace, $40,97,124,134,135,141$, 143
operator, 41, 42, 134, 135
TSVD (Truncated Singular Value Decomposition), 20, 22, 34, 119
unique continuation principle, 125
variational equation, 135 , 139-141
variational problem, 52, 53
weak convergence, 15
weak derivative, $4,6,133$
weak solution, 122, 139-141
Weierstrass theorem, 6
Weyl lemma, 121

