Index

active variable, 42
algorithmic differentiation, xi
  adjoint model, 54
    fourth-order, 142
    second-order, 104
    third-order, 133
forward mode, 40
forward-over-forward mode, 99
forward-over-reverse mode, 105
reverse mode
  incremental, 60
  nonincremental, 56
reverse-over-forward mode, 106
reverse-over-reverse mode, 108
tangent-linear model, 39
  fourth-order, 142
  second-order, 98
  third-order, 133
aliasing, 44
basic block, 44
call tree, 80
  reversal problem, 81
Cartesian basis vector, 3
CG (conjugate gradient), 5
Chomsky normal form, 164
classified model, 3
control flow stack, 65
CYK-algorithm, 164
dependent output, 24
derivative code
  adjoint, 57
    fourth-order, 143
    second-order, 110
    third-order, 137
tangent-linear, 42
    fourth-order, 142
    second-order, 100
  third-order, 134
derivative tensor, 91
  projection
    first-order, 93, 132
    second-order, 95, 132
direct linear solver, 5
  Cholesky factorization, 5
  Gaussian factorization, 5
directed acyclic graph, 24
  linearized, 24
    adjoint extension, 54
tangent-linear extension, 40
  reversal problem, 80
elemental function, 24
finite differences, 3
  backward, 3, 28
  central, 28
  forward, 3, 28
  second-order, 15
gradient, 10, 37
Hessian, 2, 92
  compression, 129
IEEE 754 standard, 30
  cancellation, 31
  floating-point number
    double precision, 31
    single precision, 31
  rounding, 31
independent input, 24
iterative linear solver, 6
  conjugate gradient (CG), 6, 18
  Krylov subspace method, 6
  preconditioner, 6
Jacobian, 2, 38
  compression, 52
  symmetric positive definite, 9

Karush–Kuhn–Tucker (KKT) system, 19

Lagrangian, 20
local partial derivative, 24

Newton algorithm, 2, 15
Newton step, 2, 15
Newton system, 2, 15

overloading
  forward mode, 48
  forward-over-forward mode, 102
  forward-over-reverse mode, 121
  reverse mode, 71
  reverse-over-forward mode, 124
  reverse-over-reverse mode, 128
  vector forward mode, 50
  vector reverse mode, 76

passive variable, 43

required data stack, 62
result checkpoint, 62

seed matrix, 52
single assignment code (SAC), 24
  assignment-level, 64
  incomplete, 64
source transformation
  forward mode, 42
  reverse mode, 57

sparsity, 51

steepest descent algorithm, 10
subroutine argument checkpoint, 78

tape, 71, 121, 125