

Index

- access, 1
- access paths, 99
- `__add__()`, 69
- ANSI C, 24, 121
- Arnoldi, 117
- `arnoldi()`, 119
- Arnoldi method, 31
- Arnoldi routine, 119

- back substitution, 84
- `bisvd()`, 91
- `BKPfactor()`, 71, 112
- `BKPsolve()`, 71, 112
- BSD Unix, 121
- Bunch–Kaufmann–Parlett factorisation
 - sparse, 112

- C, 125
- C++, 129, 143
- `catch()`, 34
- catchall, 136
- `catchall()`, 34
- `catch_FPE()`, 34
- `cg_numiters`, 113
- CGS, 31, 113
- `cgs()`, 113
- `cg_set_maxiter()`, 113
- `CHfactor()`, 27, 73
- Cholesky factorisation, 13, 22, 27, 73
 - incomplete, 15, 23
 - modified, 73
 - sparse, 108
- `CHsolve()`, 27, 73
- columns, 20, 46, 63
- comment, 3, 40
- comments, 135
- compact form, 10
- companion matrix, 141
- compilation, 8, 11
- componentwise operations, 65
- condition number, 26, 27, 29, 31, 78
 - estimator, 26, 75
 - least squares, 27

- conjugate gradients, 22, 113
 - pre-conditioner, 109
- contiguous allocation, 17
- copy, 130
- copy routines, 36
- copying, 133
 - sparse matrices, 96
- copyright, 123
- copyright, 123
- core routines, 69
- `cp_ivec()`, 36
- `cp_mat()`, 4, 36
- `cp_perm()`, 36
- `cp_vec()`, 2, 36
- create object, 45

- data structures, 1, 16, 42, 129
- debugging, 135, 142
- deep copy, 133
- dimension, 2
- `d_save()`, 55
- `Dsolve()`, 84
- `dump_mat()`, 42
- `dump_perm()`, 42
- `dump_vec()`, 42

- efficiency, 135
- eigenvalues, 14, 29, 88, 90
 - sparse matrices, 116
- eigenvectors, 14, 29, 88, 90, 142
- entries, 1
 - sparse matrix, 97
- `ERRABORT()`, 39
- `ERREXIT()`, 39
- `error()`, 34, 37, 142
- error handling, 9, 34, 37, 39, 136
- `ev_err()`, 37, 136

- factorisation, 3
 - BKP
 - sparse, 112
 - Bunch–Kaufman–Parlett, 71
 - Cholesky, 13, 21, 27, 73, 108
 - incomplete, 15, 32
 - incomplete, 21, 22, 108

- indefinite, 71
- LDL, 86
- LU, 14, 75
 - incomplete, 32
 - sparse, 110
- modified, 22
- positive definite, 73
- QR, 14, 27, 28, 77, 79, 82, 86
- Schur, 88
- sparse, 21
- SVD, 91
- symbolic, 21, 108
- symmetric, 71, 73, 86
- Fast Fourier Transform, 93
- fft(), 93
- files, 2, 40, 42, 55
- fill-in, 19, 21, 31, 108, 110
- fin_mat(), 40
- fin_perm(), 40
- finput(), 43
- fin_vec(), 40
- forward substitution, 84
- fout_mat(), 42
- fout_perm(), 42
- fout_row(), 106
- fout_vec(), 42
- fprompter(), 43
- freeivec(), 44
- freemat(), 4, 44
- freeperm(), 44
- freevec(), 44
- functional representation, 15, 22, 31, 114, 117, 139
- Gauss–Seidel, 31
- Gaussian elimination, 75, 110
- get object, 45
- get_col(), 46
- get_ivec(), 17, 45
- get_mat(), 1, 45
- get_perm(), 1, 45
- get_row(), 46
- get_vec(), 1, 45
- givens(), 80
- Givens' rotations, 28, 80
- Hadamard product, 65
- hhtrcols(), 28, 82
- hhtrrows(), 28, 82
- hhtrvec(), 28, 82
- hhvec(), 28, 82
- Householder transformations, 28, 77, 82
- identity matrix, 47
- id_mat(), 47, 91
- ifft(), 93
- ill conditioning, 24
- ill-conditioned problem, 26, 141
- incremental testing, 141, 142
- indexing, 2
- initialisation, 2, 13, 47, 101
- in_mat(), 40
- inner product, 49
- in_perm(), 40
- in_prod(), 49
- input(), 43
- input routines, 40
- input/output, 2, 8, 9, 42, 43, 132, 133
 - interactive, 133
 - sparse, 102, 104
- installation, 120
- integer vectors, 17
- in_vec(), 40
- inverse
 - matrix, 75, 142
 - permutation, 60
- __ip__(), 69
- iterative methods, 31, 113
- iv_add(), 50
- iv_free(), 17
- iv_resize(), 17, 51
- iv_sub(), 50
- Jordan Normal form, 30
- lanczos(), 116
- Lanczos method, 22, 31, 116
- Lanczos routines, 23, 142
- Lanczos-type solver(CGS), 114
- lanczos2(), 116
- LDLfactor(), 73
- LDLsolve(), 73
- LDLupdate(), 86
- least squares, 14, 23, 26, 77, 114
- linear combinations, 67
- linear equations, 14
- loop unrolling, 122
- Lsolve(), 84
- LSQR, 31, 113
- lsqr(), 113
- LTsolve(), 84
- LU factorisation, 14, 75, 110
- LUconddest(), 26, 75
- LUfactor(), 14, 75
- LUsolve(), 14, 75
- LUTsolve(), 75

- MACHEPS, 24, 28, 53, 110
- machine dependent routines, 69
- machine epsilon, 24, 28, 53, 121, 141
- `m_add()`, 54
- `makeQ()`, 79
- `makeR()`, 79
- Markowitz, 110
- MATLAB, 55
- matrix
 - columns, 63
 - data structure, 17
 - dense, 31
 - diagonal, 65, 66
 - Hilbert, 26
 - inverse, 75
 - multiplication, 57
 - norms, 58
 - operations, 2, 19, 54
 - orthogonal, 10, 77, 80, 82, 88, 91
 - random, 47
 - row, 63
 - scalar multiplication, 54
 - sparse, 18, 31
 - structure, 19
 - symmetric, 29, 88
 - transpose, 57, 59, 98
 - tridiagonal, 88
 - unitary, 30
- matrix norm, 25
- matrix–vector multiplication, 59, 98
- maximum, 65
- `MCHfactor()`, 73
- `mem_copy()`, 69
- memory management, 4, 17, 18, 31, 36, 44, 45, 51, 94, 130, 135, 136, 142
- memory thresholding, 137
- `mem_zero()`, 123
- minimum, 65
- `m_inverse()`, 75
- `m_load()`, 55
- `__mltadd__()`, 69
- `m_mlt()`, 54
- `mmtr_mlt()`, 57
- `m_norm1()`, 25, 58
- `m_norm_frob()`, 25, 58
- `m_norm_inf()`, 25, 58
- `mrnd()`, 47
- `mrndlist()`, 47
- `m_resize()`, 51
- `m_save()`, 55
- `m_sub()`, 54
- `m_transp()`, 57
- `mtrm_mlt()`, 27, 57
- `mv_mlt()`, 59
- `mv_mltadd()`, 59
- norm, 25
 - Euclidean, 25
 - Frobenius, 25
 - matrix, 25
- normal equations, 27
- norms
 - Frobenius, 58
 - matrix, 58
 - vector, 68
- NULL, 2, 5, 7, 19
- numerical integration, 139
- `ON_ERROR()`, 39
- `ones_mat()`, 47
- `ones_vec()`, 47
- ordinary differential equations, 5
- orthogonal matrices, 10, 77, 80, 82, 88
- overdetermined system, 26
- partial pivoting, 21, 75, 110
- `pccg()`, 15, 109, 113
- permutation
 - data structure, 18
 - identity, 1
 - matrices, 61
 - operations, 2, 60
 - vectors, 61
- perturbation theorem, 26, 29
- pointer, 127
- pointers, 1, 18, 130, 139
- polynomials, 141
- preconditioner, 22
- preconditioning, 15, 66
- `prompter()`, 43
- pseudo-inverse, 27
- `px_cols()`, 61
- `px_id()`, 60
- `px_inv()`, 60
- `px_invvec()`, 61
- `px_mlt()`, 60
- `px_resize()`, 51
- `px_rows()`, 61
- `px_vec()`, 61
- QR factorisation, 14, 27, 28, 77, 79
- `QRCPfactor()`, 77
- `QRfactor()`, 10, 14, 77
- `QRsolve()`, 14, 77
- `QRTsolve()`, 77

- QRupdate(), 86
- raise an error, 37
- rand_mat(), 47, 121
- random entries, 47
- rand_vec(), 47, 121
- rank deficient, 27, 28
- rank estimation, 28, 78, 91
- rational functions, 141
- resizing, 94, 139
- resizing data structures, 51
- reverse communication, 140
- rot_cols(), 80
- rot_rows(), 80
- rot_vec(), 80
- rotations, 80
- rot_cols(), 28
- rot_vec(), 28
- roundoff error, 141
- _row_mltadd(), 106
- rows, 20, 46, 63
- row_set_val(), 106
- row_xpd(), 97, 106
- Runge–Kutta ODE solver, 5
- scalar multiplication, 54, 64
- schur(), 14, 30, 88, 90
- Schur decomposition, 14, 29, 88, 90
 - real, 29
- schur_evals(), 14, 90
- schur_vals(), 30
- schur_vecs(), 14, 30, 90
- setbuf(), 142
- set_col(), 63
- set_err_flag(), 37
- set_row(), 63
- shallow copy, 130
- Singular Value Decomposition, 91
- singular values, 27, 91
- singular vectors, 27
- size, 2
- SmallTalk, 129
- __smlt__(), 69
- sm_mlt(), 54
- smrand(), 47
- solving equations, 84
- SOR, 31
- sorting, 65
- sp_arnoldi(), 119
- sparse matrix, 15, 31
- sparse rows, 106
- spBKPfactor(), 112
- spBKPsolve(), 112
- sp_cgs(), 113
- spCHfactor(), 21, 22, 108
- spCHsolve(), 21, 22, 108
- spCHsymb(), 21, 96, 108
- sp_col_access(), 99
- sp_compact(), 94
- sp_cp_mat(), 13, 96
- sp_cp_mat2(), 96
- sp_diag_access(), 99
- sp_dump_mat(), 19
- sp_fin_mat(), 102, 104
- sp_fout_mat(), 102
- sp_free_mat(), 94
- sp_get_idx(), 106
- sp_get_mat(), 13, 94
- sp_get_row(), 106
- sp_get_val(), 97
- spICHfactor(), 13, 15, 23, 96, 108
- sp_in_mat(), 104
- sp_lsqr(), 113
- spLUfactor(), 22, 110
- spLUsolve(), 110
- spLUTsolve(), 110
- sp_mv_mlt(), 98
- sp_out_mat(), 102
- sp_pccg(), 13, 15, 113
- sp_resize(), 94
- sp_row_merge(), 106
- sp_set_val(), 13, 97
- sp_vm_mlt(), 98
- sp_zero_mat(), 101
- stability, 24
 - backward, 24
 - forward, 24
- __sub__(), 69
- SVD, 25, 27, 91
- svd(), 91
- sv_mlt(), 64
- symmeig(), 14, 29, 88
- tracecatch(), 34, 136
- transpose, 57, 59, 98
- triangular matrices, 84
- trieig(), 88
- unit roundoff, 24, 53, 121
- unitary matrix, 30
- Unix
 - BSD, 121
- update routines, 86
- Usolve(), 84

`UTsolve()`, 84

vector

- data structure, 16
- linear combinations, 67
- norms, 68
- operations, 2, 64, 65
- random, 47
- sorting, 65

vector processors, 122

`v_lincomb()`, 67

`v_linlist()`, 67

`v_map()`, 65

`v_max()`, 65

`v_min()`, 65

`v_mltadd()`, 7, 64

`vm_mlt()`, 59

`vm_mltadd()`, 59

`v_norm1()`, 25, 68

`v_norm2()`, 25, 68

`v_norm_inf()`, 68

`v_norm_inf()`, 25

`v_resize()`, 5, 51

`v_save()`, 55

`v_slash()`, 65

`v_sort()`, 65

`v_star()`, 65

`v_sum()`, 65

workspace, 136

`__zero__()`, 69, 123

`zero_mat()`, 47

`zero_vec()`, 47

Contents