

Appendix A

Function Categories

Complex Arithmetic Functions

<code>Cadd</code>	Add two complex numbers
<code>Cdiv</code>	Divide two complex numbers
<code>Cmag</code>	Compute the magnitude of a complex number
<code>Cmul</code>	Multiply two complex numbers
<code>Complex</code>	Form a complex number from its imaginary and real parts
<code>Conjg</code>	Conjugate a complex number
<code>CscalR</code>	Multiply a complex number by a real number
<code>Csqrt</code>	Compute the principal square root of a complex number
<code>Csub</code>	Subtract two complex numbers

Real Matrix and Vector Functions

levinson	Levinson's recursion to solve a Toeplitz system of equations
lineq	Solve system of simultaneous linear equations
mxadd	Add two matrices
mxcentro	Centroid a unimodal 2-D array of data
mxcopy	Copy one matrix to another
mxdeterm	Compute the determinant of a matrix
mxdup	Duplicate and allocate a matrix
mxegen	Compute the eigenvalues and eigenvectors of a real symmetric matrix
mxhisto	Compute the histogram of 2-D data to any resolution
mxident	Create the identity matrix of specified size
mxinit	Initialize a matrix to a floating point value
mxinv	Invert a matrix of any size with LU decomposition
mxinv22	Invert a two by two matrix
mxinv33	Invert a three by three matrix
mxmaxval	Find the max value of a matrix and the indices where it occurs
mxminval	Find the min value of a matrix and the indices where it occurs
mxmul	Multiply two matrices
mxmul1	Multiply the transpose of a matrix by another matrix
mxmul2	Multiply a matrix by the transpose of another matrix
mxscale	Multiply a matrix by a floating point scalar
mxsub	Subtract two matrices
mxtrace	Compute the trace of a matrix
mxtransp	Transpose a general matrix (in place, if square, and if desired)
pseudinv	Solve an overconstrained system of simultaneous linear equations
vadd	Add two vectors
v_centro	Centroid a unimodal vector of data
vcopy	Copy one vector to another
vcross	Form the cross product between two vectors
vdot	Compute the dot product between two vectors
vdup	Duplicate and allocate a vector
vectomat	Multiply two vectors into a matrix
vinit	Initialize a vector to a floating point value
vmag	Compute the magnitude of a real vector
vmaxval	Find the max value of a vector and the index where it occurs
vminval	Find the min value of a vector and the index where it occurs
vmxm	Multiply a matrix by a vector to form another vector
vmxm1	Multiply the transpose of a matrix by a vector into another vector
vscale	Multiply a vector by a floating point scalar
vsub	Subtract two vectors

Complex Matrix and Vector Functions

Clineqn	Solve system of simultaneous linear equations
Cmxadd	Add two matrices
Cmxconjg	Conjugate a complex matrix
Cmxcopy	Copy one matrix to another
CmxEigen	Compute the eigenvalues and eigenvectors of a Hermitian matrix
Cmxdeter	Compute the determinant of a matrix
Cmxdup	Duplicate and allocate a matrix
Cmxinit	Initialize a matrix to a complex value
Cmxinv	Invert a matrix of any size with LU decomposition
Cmxinv22	Invert a two by two matrix
Cmxinv33	Invert a three by three matrix
Cmxmag	Compute the magnitude of a complex matrix
Cmxmaxvl	Find the max value of a matrix and the indices where it occurs
Cmxminvl	Find the min value of a matrix and the indices where it occurs
Cmxmul	Multiply two matrices
Cmxmul1	Multiply the transpose of a matrix by another matrix
Cmxmul2	Multiply a matrix by the transpose of another matrix
CmxscalC	Multiply a matrix by a complex scalar
CmxscalR	Multiply a matrix by a real scalar
Cmxsub	Subtract two matrices
Cmxtrace	Compute the trace of a matrix
Cmxtrans	Transpose a general matrix (in place, if square, and if desired)
Cvadd	Add two vectors
Cvconjg	Conjugate a complex vector
Cvcopy	Copy one vector to another
Cvdot	Compute the dot product between two vectors
Cvdup	Duplicate and allocate a vector
Cvectomx	Multiply two vectors into a matrix
Cvinit	Initialize a vector to a complex value
Cvmag	Compute the magnitude of a complex vector
Cvmaxval	Find the max value of a vector and the index where it occurs
Cvminval	Find the min value of a vector and the index where it occurs
Cvmxmul	Multiply a matrix by a vector to form another vector
Cvmxmul1	Multiply the transpose of a matrix by a vector into another vector
CvscalC	Multiply a vector by a complex scalar
CvscalR	Multiply a vector by a real scalar
Cvsub	Subtract two vectors

 Probability and Statistics Functions

binomdst	Cumulative Binomial distribution function; given k_0 , find $P(k < k_0)$
curvreg	Polynomial regression routine, $y(x) = a + b*x + c*x^2 + d*x^3 + \dots$
hyperdst	Cumulative Hypergeometric distrib. function; given k_0 , find $P(k < k_0)$
invprob	Inverse cumulative normal distribution funct; given $P(x)$, find x
least_sq	Generalized least-squares regression, $y(x) = a*f_0(x) + b*f_1(x) + \dots$
linreg	Linear regression routine, $y(x) = m*x + b$
normal	Normal (Gaussian) random number of specified mean and variance
nprob	Cumulative normal distribution function; given x_0 , find $P(x < x_0)$
poissdst	Cumulative Poisson distribution function; given k_0 , find $P(k < k_0)$
poisson	Poisson random number of specified mean and variance
stats	Compute the mean and variance of an array of data
urand	Uniform random number generator (0...1)

 Numerical Analysis Functions

conjgrad	Minimize n-dimensional differentiable function $f(x_1, x_2, \dots, x_n)$
deriv	Derivative of equidistant data array with differentiating filter
deriv1	Differentiate a user-defined (analytic) function $f(x)$ at $x = x_0$.
integrat	Integrate equidistant array of data with Simpson's rule
interp	Interpolate equidistant array with 5th degree Lagrange polynomial
p_roots	Compute real and imaginary roots of polynomials with real coefficients
interp1	Interpolate data with nth degree Lagrange polynomial, $0 < n < 10$
newton	Find the zeros of the 1-dimensional function; i.e. x , where $f(x) = 0$
romberg	Romberg integration of a user-defined function $f(x)$ over $[x_0, x_1]$
spline	Interpolate data with a natural cubic spline

 Signal Processing Functions

auto2dft	2D-autocorrelation of an array via 2D-FFT
autocor	Autocorrelation of a real-time series
autofft	Fast autocorrelation of a real-time series via FFT
bandpass	Design a (FIR) bandpass filter with a Kaiser-Bessel window
bilinear	Bi-linear transformation of general s-plane function to z-plane
conv2dft	2-D convolution of two real arrays via 2-D FFT
convofft	Fast convolution of two time real series via FFT
convolve	Implement a finite impulse response (FIR) filter with convolution
Cpowspec	Frequency analysis via Welch modified periodogram power spectrum
cros2dft	Fast 2D cross correlation of two real arrays via 2D-FFT

Signal Processing Functions (Continued)

crosscor	Cross correlation of two real-time series
crossfft	Fast cross correlation of two time real series via FFT
dct	1-dimensional discrete cosine transform
dct2d	2D-discrete cosine transform via fast block matrix approach
downsamp	Lower the sampling rate of (i.e., decimate) an equidistant array
fft2d	2-D fft generalized for complex data
fft2d_r	Forward 2-D fft optimized for real data
fft42	Cooley-Tukey radix-"4 + 2" Fast Fourier Transform
fftrad2	Cooley-Tukey radix-2 Fast Fourier Transform
fftreall	Forward fft optimized for real data
fftr_inv	Inverse fft optimized for real data
highpass	Design a (FIR) highpass filter with a Kaiser-Bessel window
iirfiltr	Filter real data with an IIR type filter
lmsadapt	Least-mean-square algorithm (for line-enhancement and noise cancelling)
lowpass	Design a (FIR) lowpass filter with a Kaiser-Bessel window
median	Remove shot-noise or noise from digital drop-out with a median filter
powspec	Frequency analysis via Welch modified periodogram power spectrum
resample	Resample a digital signal to any new integral rate
smooth	Smooth equidistant array of data with a lowpass filter
tdwindow	9 spectral windows: Hanning, Hamming, Blackman, etc.
whitnois	White noise generator

Input/Output Functions

Cvread	Read a complex vector from a binary disk file
Cvwrite	Write a complex vector to a binary disk file
hwfclose	Close a Hypersignal Waveform Data file
hwdcreate	Create a new Hypersignal Waveform Data file
hwddopen	Open an existing Hypersignal Waveform Data file
hwddread	Read data from a Hypersignal Waveform Data file
hwddwrite	Write data to a Hypersignal Waveform Data file
iir_read	Read coefficients from a Hypersignal IIR or FIR data file
vread	Read a real vector from a binary disk file
vwrite	Write a real vector to a binary disk file
xyinfo	Read the header information of a binary or ASCII (LOTUS) disk file
xyread	Read data from a binary or ASCII (LOTUS) disk file
xywrite	Write data to a binary or ASCII (LOTUS) disk file

Miscellaneous Functions

acosh	Inverse hyperbolic cosine function
asinh	Inverse hyperbolic sine function
atanh	Inverse hyperbolic tangent function
besi0	Modified Bessel function of zeroth order, $I_0(x)$
besi1	Modified Bessel function of first order, $I_1(x)$
besin	Modified Bessel function of nth order, $I_n(x)$
besk0	Modified Bessel function of zeroth order, $K_0(x)$
besk1	Modified Bessel function of first order, $K_1(x)$
beskn	Modified Bessel function of nth order, $K_n(x)$
besj0	Bessel function of first kind and zeroth order, $J_0(x)$
besj1	Bessel function of first kind and first order, $J_1(x)$
besjn	Bessel function of first kind and nth order, $J_n(x)$
besy0	Bessel function of second kind and zeroth order, $Y_0(x)$
besy1	Bessel function of second kind and first order, $Y_1(x)$
besyn	Bessel function of second kind and nth order, $Y_n(x)$
chebser	Evaluate a Chebyshev series with finite coefficients
combin	Combinations function, $N!/(r!(N - r)!)$
fact	Factorial function, $N!$
logn	Logarithm function of general base, n
permut	Permutations function, $N!/(N - r)!$
pseries	Evaluate a power series with finite coefficients
