PROGRAM CC COMMAND LIST

CONVERSIONS

Analog to digital to wplane:

bilinear	bilinear transformation
convert	9 different ways
zoh	zero-order-hold equivalance
wplane	convert to wplane

State space to transfer function:

cnum	returns a regular or coupling numerator
fadeeva	Fadeeva's algorithm
gep	using generalized eigenvalue problem
gepper	gep with more options
numerator	displays regular and coupling numerator

TRANSFER FUNCTION TO STATE SPACE:

ccf	controllable canonical form
ocf	observable canonical form
dcf	diagonal canonical form

Matrices to and from state space:

pack	pack a,b,c,d into a quadruple
unpack	go the other way

Change how transfer function coefficients are stored:

chpzf	change to pole-zero-form
chtcf	change to time-constant-form
chsingle	change to single polynomials
chunitary	change to unitary polynomials

Substitute for s or z:

substitute	substitute any transfer function for s
scale	substitute alpha*s for s
shift	substitute s-alpha for s

DISPLAY FUNCTIONS

To display any variable:

display	display the variable
disp	same thing, different name.
format	change the format
ridf	displays real, imag, damping, and frequency
stdisplay	display all the structure members

To display transfer functions:

pzf	pole-zero-form
tcf	time-constant-form
sho	shorthand form (damping ratios and natural frequencies)
single	single polynomials
unitary	unitary polynomials
pfe	partial fraction expansion
ilt	inverse Laplace transform

To display an error or warning message from within a function:

error	display error message and stop execution
warning	display warning message and continue execution

STRING FUNCTIONS

To compute string operations:

char	converts ASCII numbers to a string
findstr	finds one string within another
lower	convert to lower case
strcat	concatenates strings
strvcat	vertically concatenates strings
strcmp	compares strings
strncmp	compares first n characters of strings
strcmpi	compares strings ignoring case
strncmpi	compares first n characters of strings ignoring case
strjust	justifies string vector
strmatch	finds possible matches for string
strrep	replaces string with another
strtok	finds token in string
upper	convert to upper case

To create formatted strings:

printf	mimics C printf function
sprintf	same but returns a string

ELEMENTARY MATH FUNCTIONS

Trigonometry:

acos	inverse cosine
acosh	inverse hyperbolic cosine
acot	inverse cotangent
acoth	inverse hyperbolic cotangent
acsc	inverse cosecant
acsch	inverse hyperbolic cosecant
asec	inverse secant
asech	inverse hyperbolic secant
asin	inverse sine
asinh	inverse hyperboloic sine
atan	inverse tangent
atanh	inverse hyperbolic tangent
atan2	four quadrant inverse tangent
atn	same as atan
cos	cosine
cosh	hyperbolic cosine
cot	cotangent
coth	hyperbolic cotangent
csc	cosecant
csch	hyperbolic cosecant
sec	secant
sech	hyperbolic secant
sin	sine
sinh	hyperbolic sine
tan	tangent
tanh	hyperbolic tangent

Exponential:

dB	20*log10(abs())
exp	exponential
log	natural logarithm
log10	log base 10
sqrt	square root

Complex:

abs	absolute value
angle	same as phase
conj	complex conjugate
imag	imaginary part
mag	same as abs
phase	phase angle
real	real part

Integer:

ceil	round towards positive infinity
fix	round towards zero
floor	round towards minus infinity
int	same as fix
rem	remainder after division
round	round towards nearest integer
sign	Signum function

Factors (integers, gcd and lcm also work with transfer functions):

gcd	greatest command divisor
lcm	least common multiple
primefactors	prime factors

FILTERS

The following functions create Laplace transform filters:

bessel(omega,order)
butterworth(omega,order)
butter(omega,order)
chebyshev(omega,ripple,order)
integrator
itae(omega,order)
leadlag(omega,phi)
notch(omega,zeta_n,zeta_d)
onepole(a)
onezero(a)
pade(tau,order)
pid(a,b,c)
twopoles(zeta,omega)
twozeros(zeta,omega)

FFT FUNCTIONS

To compute the digital Fourier transform using the fast Fourier transform (fft) algorithm:

fft	the fast Fourier transform
fftr	version of fft for real inputs
fft2	2-dimensional fft
ifft	the inverse fft
ifftr	opposite of fftr
iff2	2-dimensional inverse fft

To directly compute the digital Fourier transform:

dft	the digitial Fourier transform at selected frequencies

To change the time series before computing the fft:

fftwin	various windows applied to the fft input

To change the resulting frequency response:

fftshift	shifts the fft result
fftshift2	2-dimensional shift
logbin	used for logarithmic bin averaging
binavg	compute bin averaging

To estimate the frequency response of a system using ffts of the input and output time series:

tfest	transfer function estimation

INFORMATION FUNCTIONS

Information functions:

help	help echoed to command window
list	many different lists (use also Alt+x)
what	list of functions
who	list of variables
whos	list of variables with more detail
winhelp	windows help

Functions in place of structure members:

cdim	column dimension
idim	input dimension (same as cdim)
name	variable name
odim	output dimension (same as rdim)
rdim	row dimension
sdim	state dimension
type	variable type

Query functions based on dimensions:

isnull	TRUE if null
isempty	same thing as isnull
isscalar	TRUE if 1x1
isvector	TRUE if a vector
ismatrix	TRUE if any dimension >1
is3d	TRUE if #pages>1

Query functions based on variable type:

iscomplex	TRUE if a complex scalar
isint	TRUE if an integer
ispoly	TRUE if a polynomial
ispolym	TRUE if a polynomial matrix
isp3d	TRUE if a parameterized 3D matrix
isglobal	TRUE if global variable
isquad	TRUE if # states > 0
isreal	TRUE if a real scalar
isstr	TRUE if a string
istf	TRUE if a transfer function
istfm	TRUE if a transfer function matrix

MATRIX OPERATIONS

all	TRUE if all nonzero
any	TRUE if any elements zero
cond	condition number
conv	convolution
cumprod	cumulative product
cumsum	cumulative sum
det	determinant
diff	difference
expm	matrix exponential
inv	matrix inverse using Gaussian elimination
lls	linear least square problem
max	maximum
min	minimum
norm	matrix and vector norms
null	null space using SVD
pinv	pseudo-inverse using SVD
prod	product
range	range space using SVD
rank	rank
rcond	estimate of reciprocal condition
sort	sort in ascending order
sum	sum
trace	sum of diagonal elements

MATRIX BUILDING FUNCTIONS

diag	diagonal matix
eye	same as iden
iden	identity matrix
ones	matrix of ones
length	maximum dimensions
rand	random matrix, (0,1) uniform distribution
randn	random matrix, n(0,1) normal distribution
reshape	change dimensions
size	return dimensions
tovec	convert to real or complex vector
tril	lower triangular matrix
triu	upper triangular matrix
zeros	matrix of zeros

MATRIX DECOMPOSITION FUNCTIONS

balance	balance row and column sums
chol	Cholesky factorization
eig	eigvenvalue decomposition
hess	Hessenberg decomposition
geig	generalized eigenvalue decomposition
ghess	generalized Hessenberg decomposition
gschur	generalized Schur decomposition
lu	LU factorization (Gaussian elimination)
qr	QR factorization
reig	packed real version of eig
schur	Schur decomposition
svd	singular value decomposition

MISCELLANEOUS FUNCTIONS

Variables:

clear	clear some or all variables
global	declare global variables

Evaluating strings:

eval	execute a string variable
feval	execute a function passed as a string

Files:

load	load variable files
path	sets directory path
save	save variable files

Quitting:

exit	quit without query
quit	quit after query

Text editor:

edit	edit text file
new	new text file

OPTIMAL CONTROL FUNCTIONS

dkbf	digital Kalman Bucy Filter
dlqr	digital Linear Quadratic Regulator
dlyap	digital Lyapunov Equation
dricc	digital Algebraic Riccati Equation
kbf	Kalman Bucy Filter
h2	H2 Optimal Control
lqg	Linear Quadratic Gaussian Problem
lqr	Linear Quadratic Regulator
lyap	Lyapunov Equation
ricc	algebraic Riccati Equation

PLOTTING FUNCTIONS

xy plots.

plot	x versus y
loglog	log10(x) versus log10(y)
semilogx	log10(x) versus y
semilogy	x versus log10(y)

Classical control plots:

bode	log10(abs(s)) versus dB and phase of g(s)
nichols	phase versus dB of g(s)
nyquist	real versus imaginary of g(s)
rootlocus	real versus imaginary of locus of roots
rl	shorter name for rootlocus
time	simulation response
stripchart	x versus multi-axis y

Defining where a plot is located in a plotview:

figure	defines the current figure
gcf	returns name of current figure
subplot	defines the current plot

Changing an existing plot (also use the plot option dialog box):

axis	changes the axis limits
grid	includes a background grid
hold	plots new lines on same axis
line	add a new line
plotoption	change any plot option
tile	tile the windows
title	changes the title
xlabel	changes the x axis label
ylabel	changes the y axis label
ylabels	changes stripchart yaxis labels
y2label	change right hand side y-axis label

PRINTING AND COPYING

Copying:

copy	copy a plot to the clipboard
copyoption	change the copy options

Printing:

lpdisp	print variables and text
lpdisplay	alternative name for lpdisp
lpeject	page eject
lpoption	printer options
lpprintf	formatted printing
lptext	printing text using text options
print	print a plot

Printing transfer functions:

lpilt	inverse Laplace transform
lpizt	inverse z transform

lppfe	partial fraction expansion
lppzf	pole-zero-form
lpsho	shorthand form
lpshortand	alternative name for lpsho
lpsingle	single polynomials
lptcf	time-constant-form
lpunitary	unitary polynomials

SIMULATION FUNCTIONS

chirp	creates chirp time series
ilt	computes time series of the inverse Laplace transform
input	create time series of various types of inputs
izt	computes time series of the inverse z-transform
sim	linear simulation of transfer function or state space systems
sumsines	creates sum of sinusoid time series
time	computes and plots simulation result
timevec	creates vector containing timesState Space Quadruple Functions

balreal	balanced realization
chst	change the number of states
conmat	controllability matrix
fsfb	full state feedback
fsoi	full state output injection
lft	linear fractional transformation
obsmat	observability matrix
poleplace	pole placement
resid	residualization
similarity	similarity transformation
sisoltf	Computes loop transfer function with other loops closed
zeroreduce	reduces order of quadruple

STATISTICAL FUNCTIONS

corrcoef	correlation coefficient
cov	covariance
mean	mean value
meansq	mean square
median	median
std	standard deviation
var	variance

TRANSFER FUNCTIONS

Robustness:

airplanebw	manual control bandwdith
bandwidth	unit magnitude crossover
delaymargin	delay margin
gainmargin	gain margin
margin	different robustness margins
mpmargin	peak magnification ratio
phasemargin	phase margin

Factorizations:

blasche	blasche product
inner	inner factor
outer	outer factor
partial	partial factors
spectral	spectral factors

Model reduction:

effdelay	effective delay
hfa	high frequency approximation
lfa	low frequency approximation
maxtc	max time constant
near	pole zero cancellations

Design:

imc	internal model control problem
pid	proportional-integral-derivative controller
poleplace	transfer function version of the pole-placement problem

More:

bodegain	low frequency gain
der	derivative with respect to s or z
diophantine	solves polynomial diophantine equation
enter	enter transfer function using coefficients
gcd	greatest common divisor
laplace	returns the Laplace variable s
lcm	least common multiple
order	numerator and denominator polynomial orders
poles	returns complex vector with poles
rlgain	high frequency gain
roots	returns complex vector with roots
senter	enter transfer function using shorthand form coefficients
zeros	returns complex vector with zeros
ztransform	returns the z-transform variable z.