

NLID_Tools

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Getting nlid_tools

- Download
 - nlid_tools:
 - www.bmed.mcgill.ca/reklab/nlid_tools/nlid_tools.zip
 - utility_tools:
 - www.bmed.mcgill.ca/reklab/nlid_tools/utility_tools.zip
 - demofiles from the book:
 - www.bmed.mcgill.ca/reklab/nlid_tools/nlid_book.zip
 - Introduction (this file):
 - www.bmed.mcgill.ca/reklab/nlid_tools/nlid_tools/nlid_tools.pdf
- Unzip files to generate:
 - .../nlid_tools/...
 - .../utility_tools/...
 - .../nlid_book/...
- Put directories in matlab path


nlid_tools.zip

- An object oriented matlab tool box for linear and nonlinear system identification
- Requires system specific mex files.
Distribution includes files for:
 - Windows
 - Sun Solaris
 - Linux

nlid_book.zip

- Exercises and examples from:
 - Westwick, D. T. and Kearney, R. E. (2003). Identification on Nonlinear Physiological Systems: Theory and Practice, IEEE Book Series in Biomedical Engineering, IEEE Press.

Help methods

- Help nlid 
 - Provides a one-line list of top level routines and classes
- Help class name
 - Provides detailed help on each class
- Methods 'class_name'
 - Provides list of methods available for each class

help nlid_tools



```
>> help nlid_tools

NLID_Tools
Path -> /home/kearney/Working/matlab/nlid_tools

flb2nlid      - a nld object from flb|
hckern        - Q'th order Volterra kernel of a Hammerstein cascade.
k2filt        - the output from a second order kernel
kernel_convolve - the kernels in kerns with the irf or kernel object in subsys
nlid_demo     - - Demonstrate Object Oriented NLID identification
nlid_resid    - and displays prediction error in model output.
nlid_sig      - various signals as nldat objects
nlid_sim      - - simulate various nonlinear systems
nlmkobj       - call for NLID objects
phixy         - cross-correlation between two signals
smo           - with a 3-point, zero-phase, moving average filter
toep          - the Toeplitz matrix equation Tx=b.
vaf           - variance accounted for between two signals
vkfilt        - the output of an arbitrary-order Volterra kernel
wckern        - kernel of order Q for wiener system with g as its IRF.
wiener_1      -
zerokern      - an order q array full of zeros.

@cor/cor      - function object
@cor/nlident  - correlation objects
@cor/nlmtst   - of cor objects
@cor/nlsim    - response of IRF to input data set
@cor/pdefault - default parameters for cor object
@cor/pnames   - All public properties and their assignable values
@cor/pnv      - - returns public properties or vlaues of object sys.
@cor/pvalues  - Values of all public properties of an object

@cor/private/corx2y - Cross-Correlation Function
@cor/private/corx3y - Cross-Correlation Function
@cor/private/phixxy - second-order cross correlation between x and y

@fresp/delay  - a delay to a fresp object
@fresp/fresp  - response function object
@fresp/fresp2irf - a frequency response object to IRF
@fresp/nlident - an fresp ( frequency response function object
@fresp/nlmtst  - identification from data
@fresp/nlsim   - response of fresp to input data set
@fresp/pdefault - default parameters for fresp
@fresp/plot    - a frequency response object
@fresp/pnv     - - returns public properties or vlaues of object sys.
@fresp/set     - Set properties of nlm model fresp
```

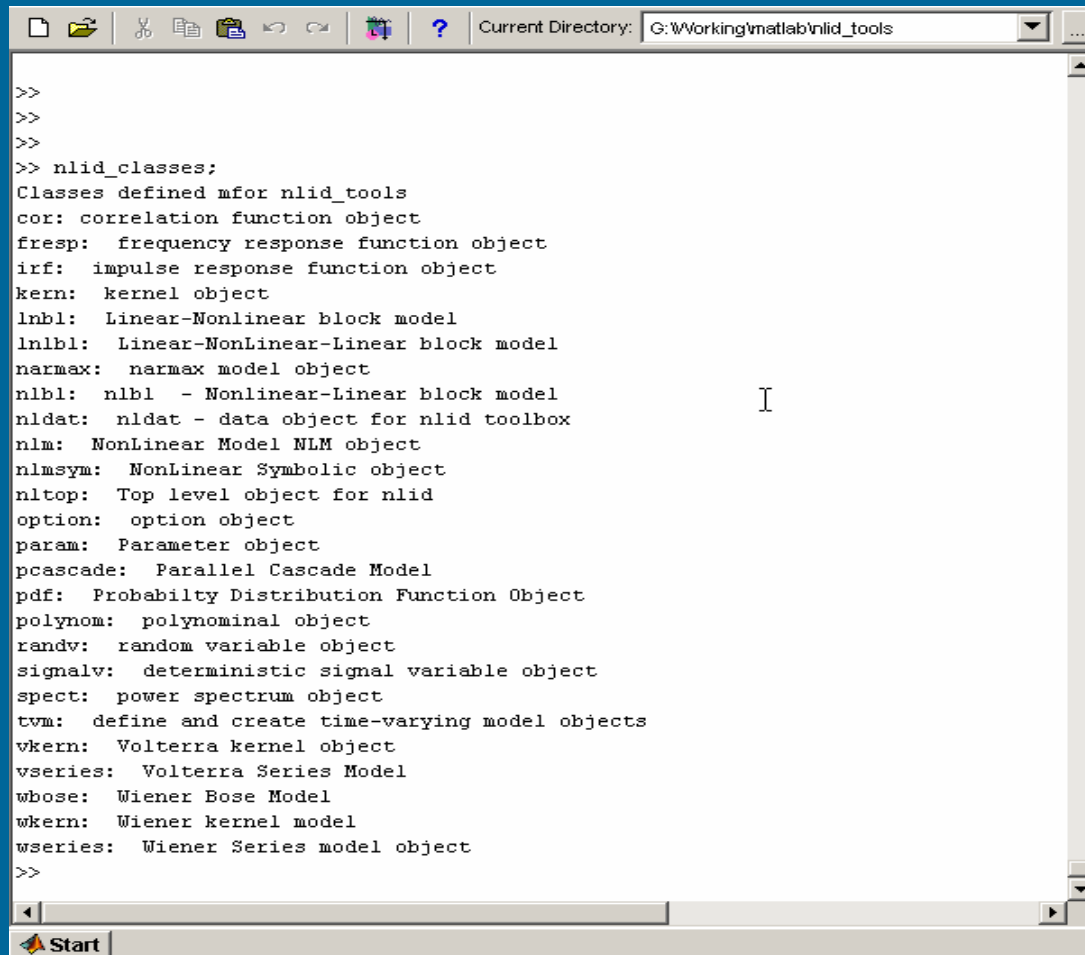
Utility tools

@cor/ ... – correlation
class and functions

@fresp/ ... – frequency
response class and
functions

nlid_classes

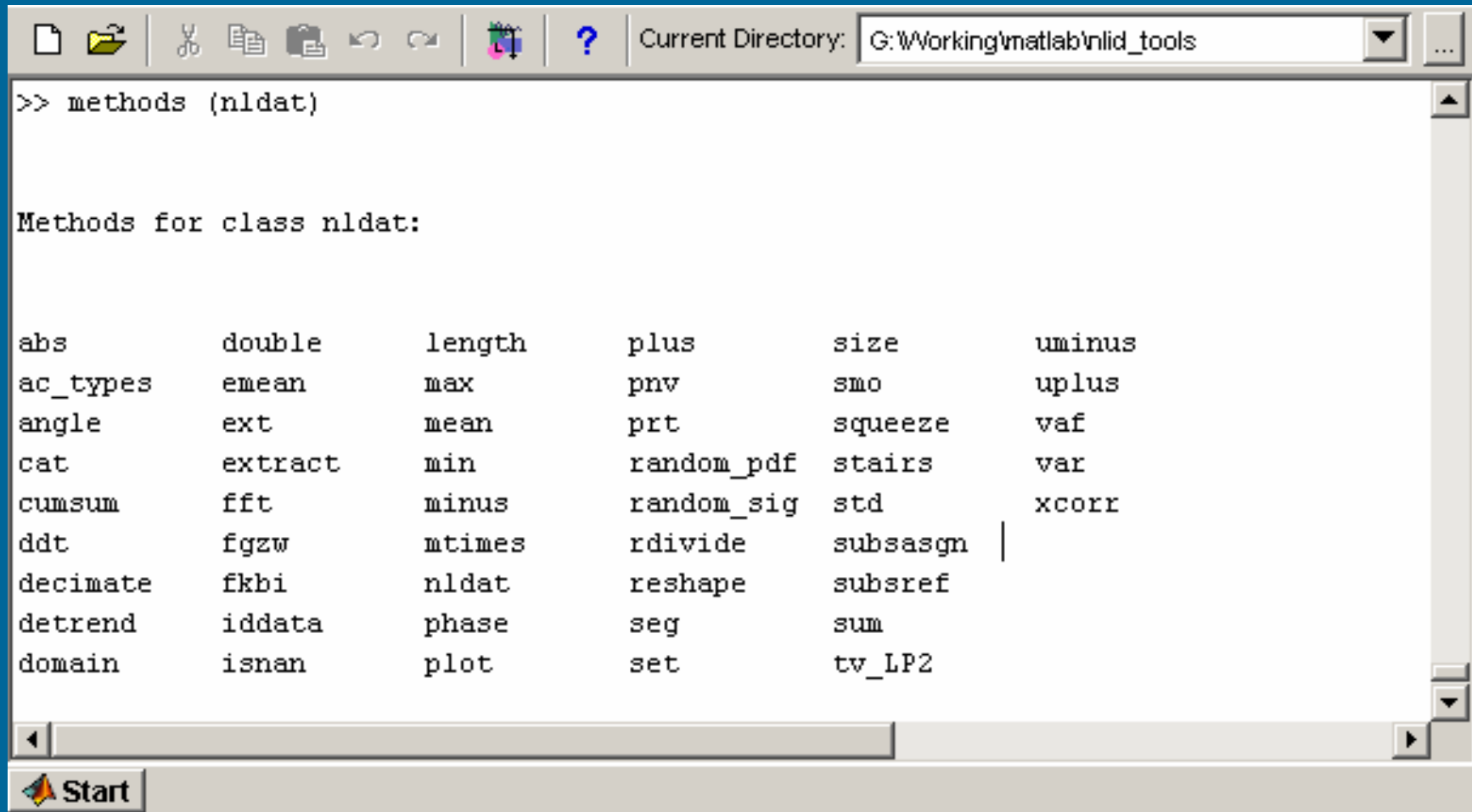
.... list classes and brief description



```
>>
>>
>>
>> nlid_classes;
Classes defined mfor nlid_tools
cor: correlation function object
fresp: frequency response function object
irf: impulse response function object
kern: kernel object
lnbl: Linear-Nonlinear block model
lnlbnl: Linear-NonLinear-Linear block model
narmax: narmax model object
nlbl: nlbl - Nonlinear-Linear block model
nlidat: nlidat - data object for nlid toolbox
nlm: NonLinear Model NLM object
nlmsym: NonLinear Symbolic object
nltop: Top level object for nlid
option: option object
param: Parameter object
pcascade: Parallel Cascade Model
pdf: Probabilty Distribution Function Object
polynom: polynomial object
randv: random variable object
signalv: deterministic signal variable object
spect: power spectrum object
tvm: define and create time-varying model objects
wkern: Volterra kernel object
vseries: Volterra Series Model
whose: Wiener Bose Model
wkern: Wiener kernel model
wseries: Wiener Series model object
>>
```

methods (class_name)

- list of methods defined for class



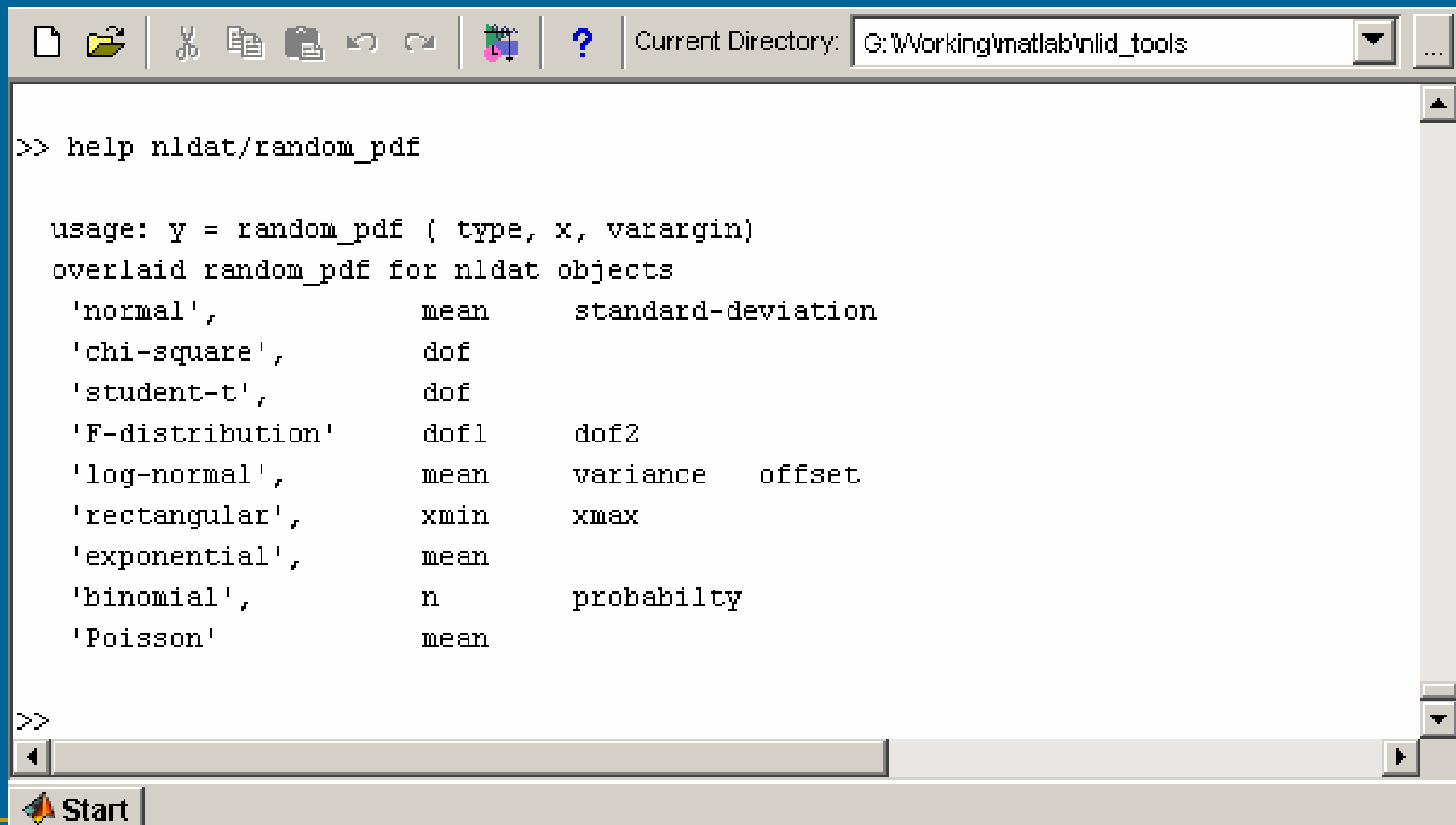
The image shows a MATLAB Command Window interface. The title bar indicates the current directory is 'G:\Working\matlab\nldat_tools'. The command prompt shows the command 'methods (nldat)' has been entered. The output lists the methods for the 'nldat' class in a grid format. The methods listed are: abs, double, length, plus, size, uminus, ac_types, emean, max, pnv, smo, uplus, angle, ext, mean, prt, squeeze, vaf, cat, extract, min, random_pdf, stairs, var, cumsum, fft, minus, random_sig, std, xcorr, ddt, fgzw, mtimes, rdivide, subsasgn, decimate, fkbi, nldat, reshape, subsref, detrend, iddata, phase, seg, sum, domain, isnan, plot, set, tv_LP2.

```
>> methods (nldat)

Methods for class nldat:

abs          double      length    plus       size       uminus
ac_types     emean         max       pnv        smo        uplus
angle        ext           mean      prt        squeeze    vaf
cat          extract      min       random_pdf stairs     var
cumsum       fft          minus     random_sig std        xcorr
ddt          fgzw         mtimes    rdivide    subsasgn
decimate     fkbi         nldat     reshape    subsref
detrend      iddata       phase     seg        sum
domain       isnan        plot      set        tv_LP2
```


help class_name/method_name ... help on a class method



The image shows a MATLAB Command Window with the following content:

```
>> help nldat/random_pdf
```

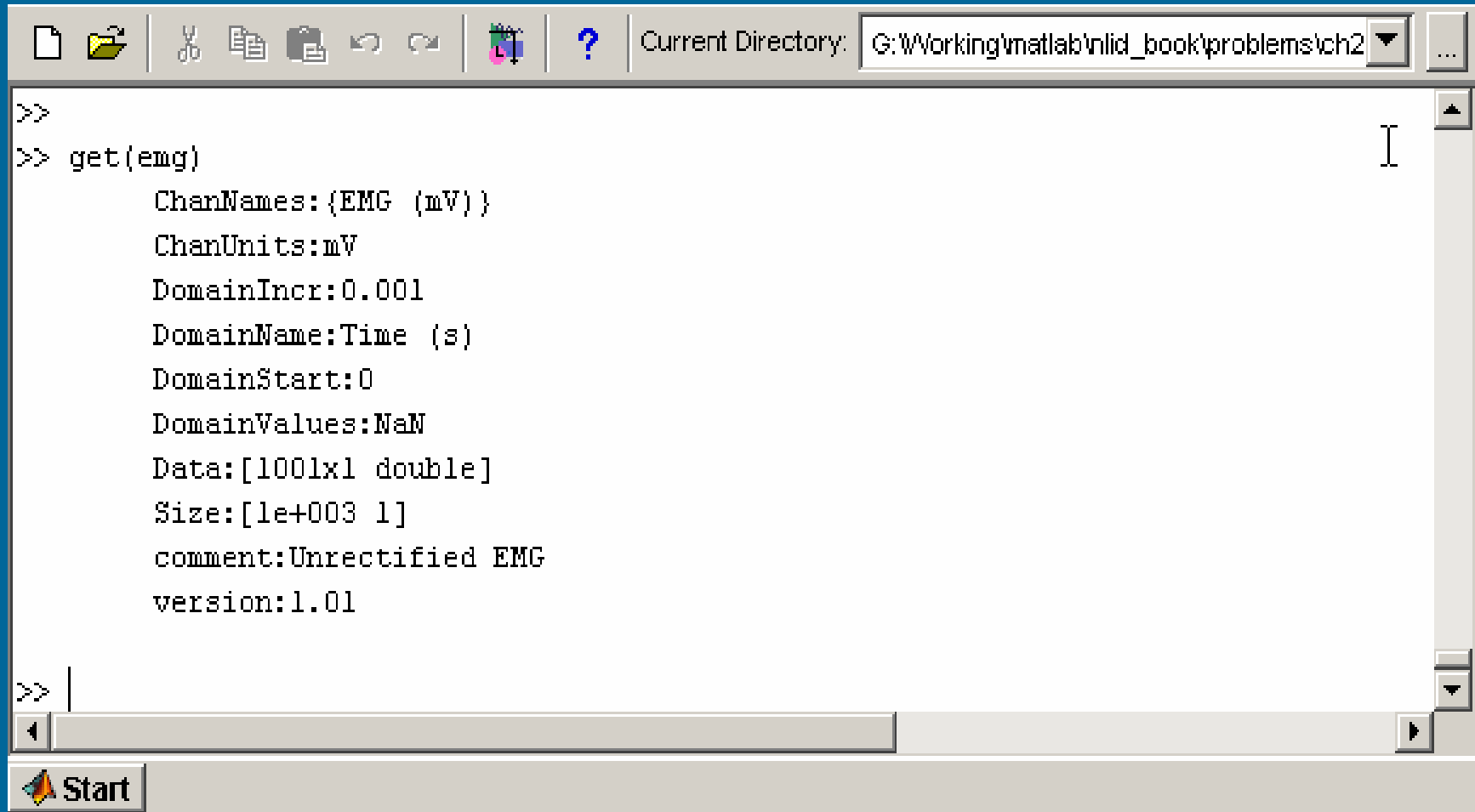
usage: y = random_pdf (type, x, varargin)
overlaid random_pdf for nldat objects

| | | |
|------------------|------|--------------------|
| 'normal', | mean | standard-deviation |
| 'chi-square', | dof | |
| 'student-t', | dof | |
| 'F-distribution' | dof1 | dof2 |
| 'log-normal', | mean | variance offset |
| 'rectangular', | xmin | xmax |
| 'exponential', | mean | |
| 'binomial', | n | probabilty |
| 'Poisson' | mean | |

```
>>
```

The window title bar shows the current directory as G:\Working\matlab\nlid_tools. The Windows taskbar at the bottom shows the Start button.

get (class_name)
.... show properties for class

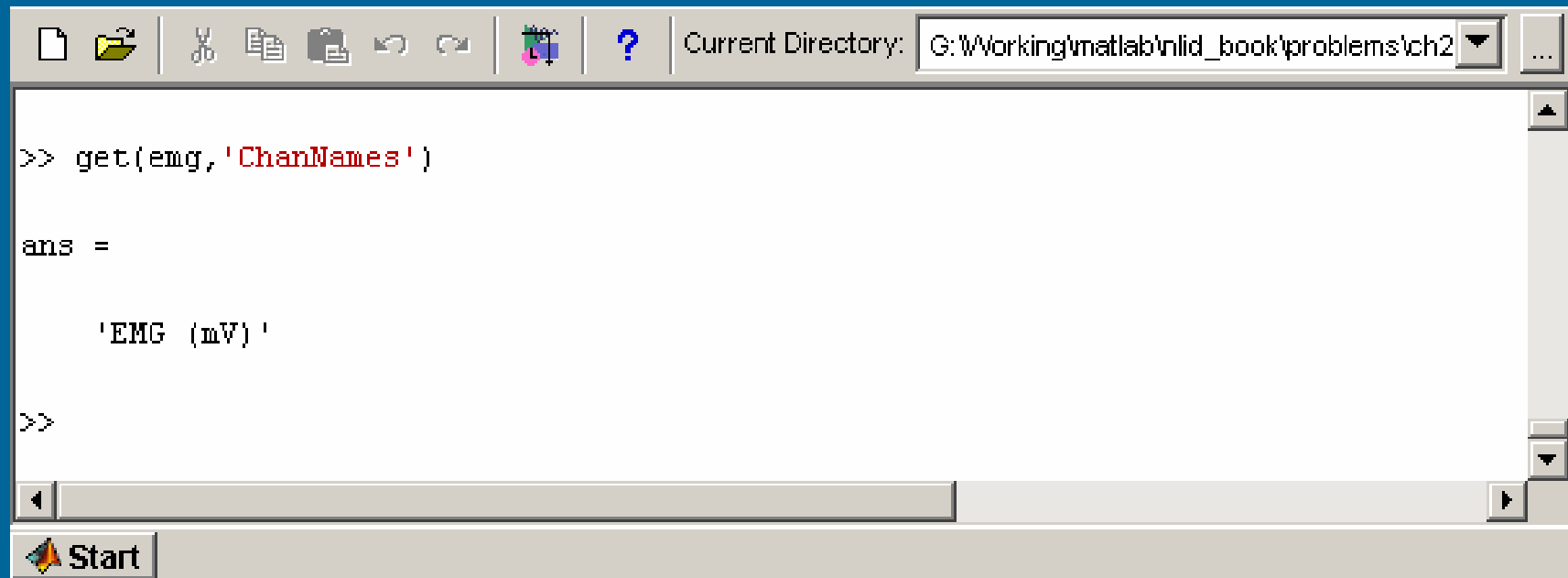


A screenshot of the MATLAB Command Window. The title bar shows the current directory as 'G:\Working\matlab\inlid_book\problems\ch2'. The command prompt shows the command 'get(emg)' has been executed, resulting in the following output:

```
>>  
>> get(emg)  
    ChanNames:{EMG (mV)}  
    ChanUnits:mV  
    DomainIncr:0.001  
    DomainName:Time (s)  
    DomainStart:0  
    DomainValues:NaN  
    Data:[1001x1 double]  
    Size:[1e+003 1]  
    comment:Unrectified EMG  
    version:1.01
```

The Command Window has a scroll bar on the right and a horizontal scroll bar at the bottom. The Windows taskbar at the bottom shows the 'Start' button.

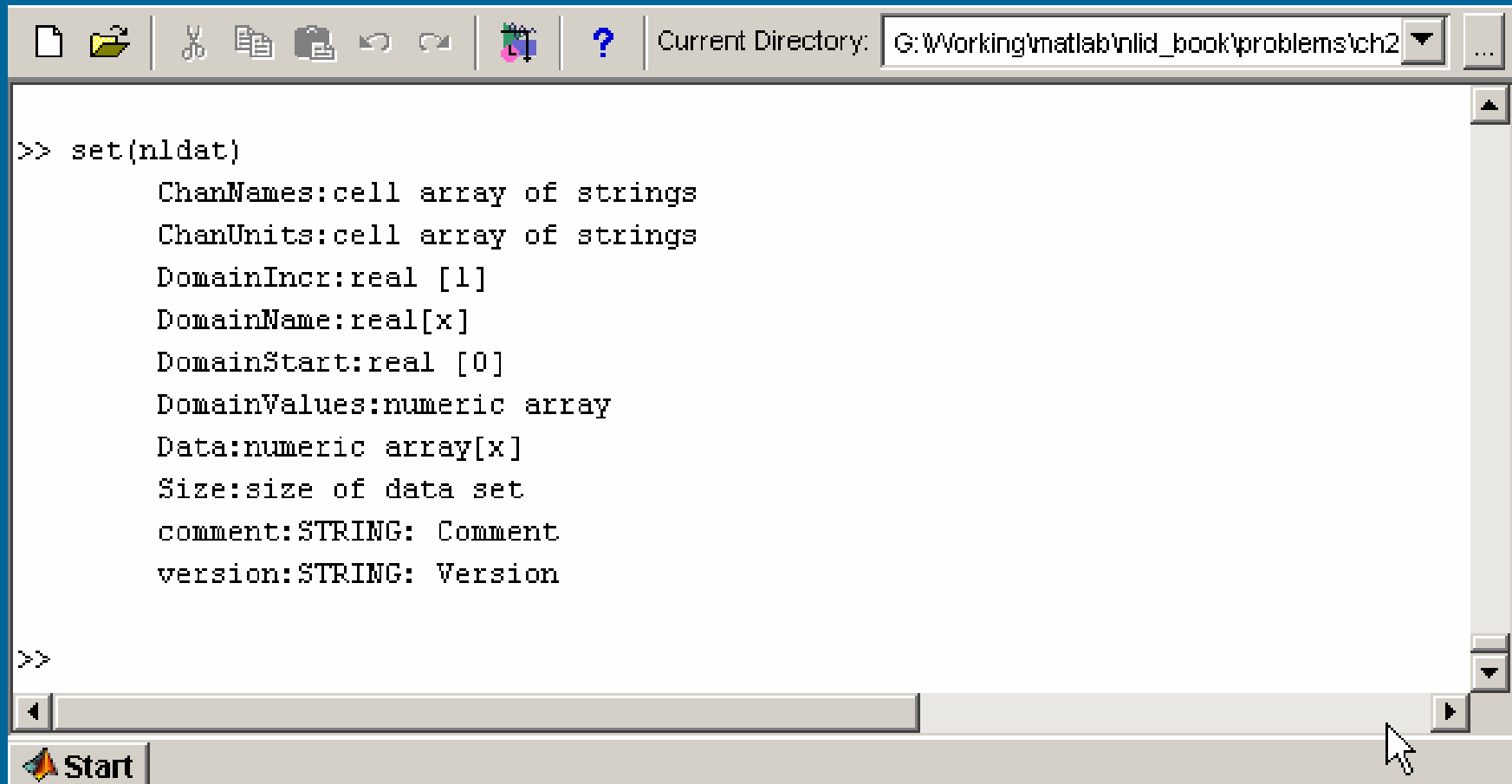
`get (var_name, 'property_name')`
... returns value of properties

A screenshot of the MATLAB Command Window. The title bar shows standard Windows icons and the current directory: G:\Working\matlab\inlid_book\problems\ch2. The command prompt shows the execution of `get(emg, 'ChanNames')`, which returns `ans = 'EMG (mV)'`. The window includes a scroll bar on the right and a 'Start' button at the bottom left.

```
>> get(emg, 'ChanNames')  
  
ans =  
  
    'EMG (mV)'  
  
>>
```

set(class_name)

... information properties that can be set



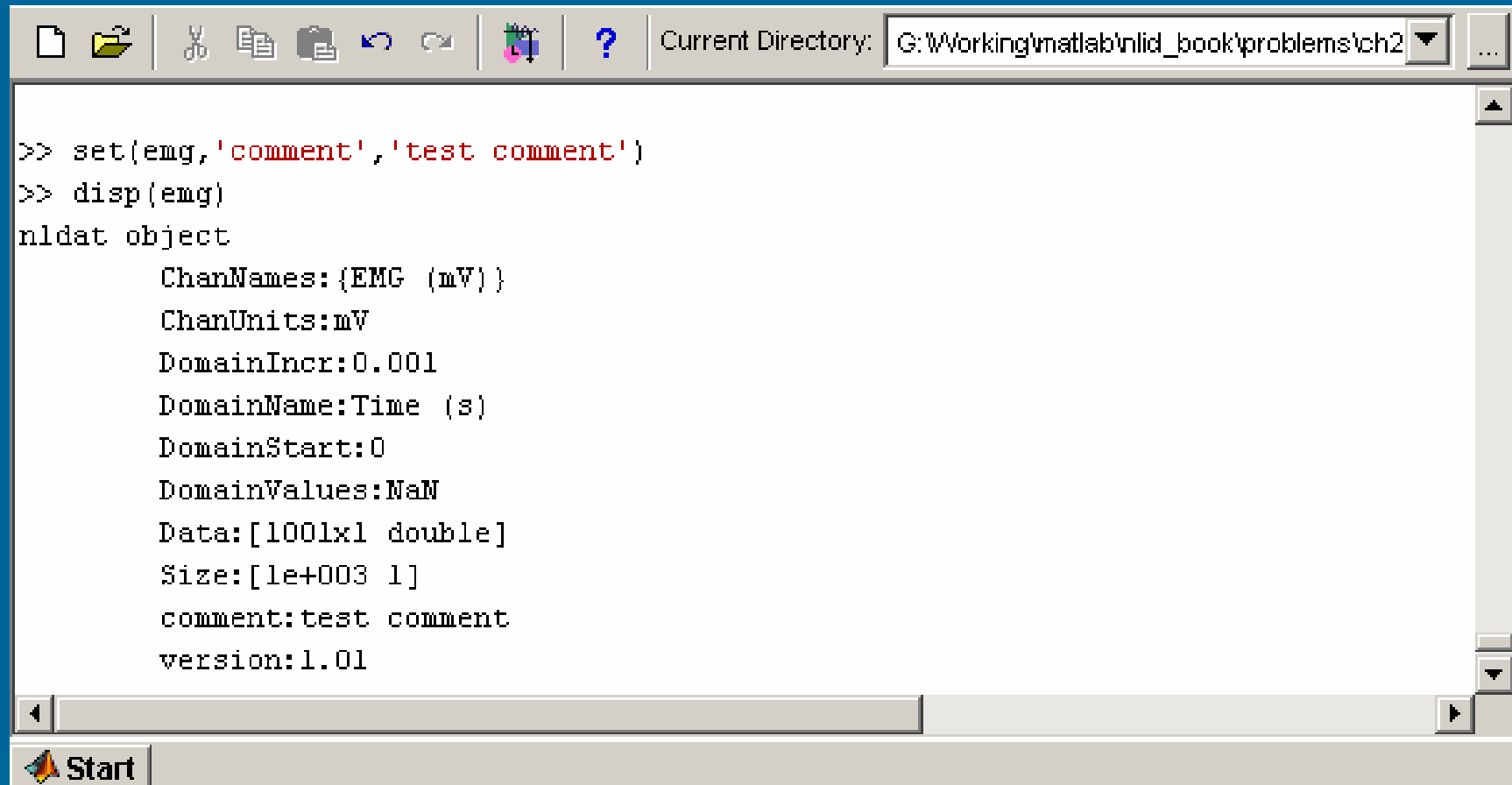
A screenshot of the MATLAB Command Window. The title bar shows the current directory as 'G:\Working\matlab\nlid_book\problems\ch2'. The command window contains the following text:

```
>> set(nlDat)
    ChanNames:cell array of strings
    ChanUnits:cell array of strings
    DomainIncr:real [1]
    DomainName:real[x]
    DomainStart:real [0]
    DomainValues:numeric array
    Data:numeric array[x]
    Size:size of data set
    comment:STRING: Comment
    version:STRING: Version

>>
```

The window has a standard Windows-style interface with a toolbar at the top, a scroll bar on the right, and a 'Start' button at the bottom left.

set (var_name, 'property_name', value)
... set property value

A screenshot of the MATLAB Command Window. The title bar shows the current directory as 'G:\Working\matlab\inlid_book\problems\ch2'. The command window contains the following text:

```
>> set(emg, 'comment', 'test comment')  
>> disp(emg)  
nldat object  
    ChanNames:{EMG (mV)}  
    ChanUnits:mV  
    DomainIncr:0.001  
    DomainName:Time (s)  
    DomainStart:0  
    DomainValues:NaN  
    Data:[1001x1 double]  
    Size:[1e+003 1]  
    comment:test comment  
    version:1.01
```

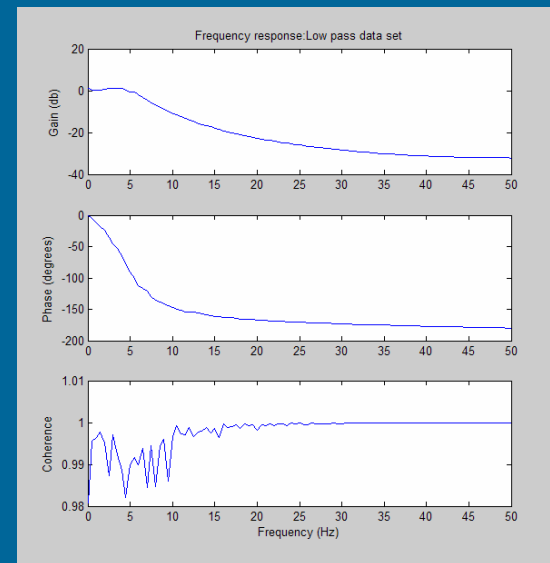
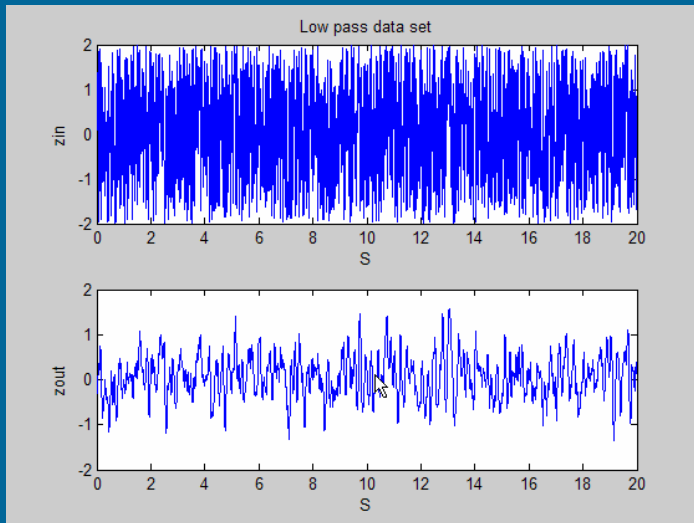
The window has a standard toolbar with icons for file operations and a 'Start' button at the bottom left.

`nltst(class_name)`

... test and demo class

`Nltst(fresp)`

- Generates test data set from low-pass filter
- Computes and displays gain, phase, and coherence



Nlm class