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/utilty_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

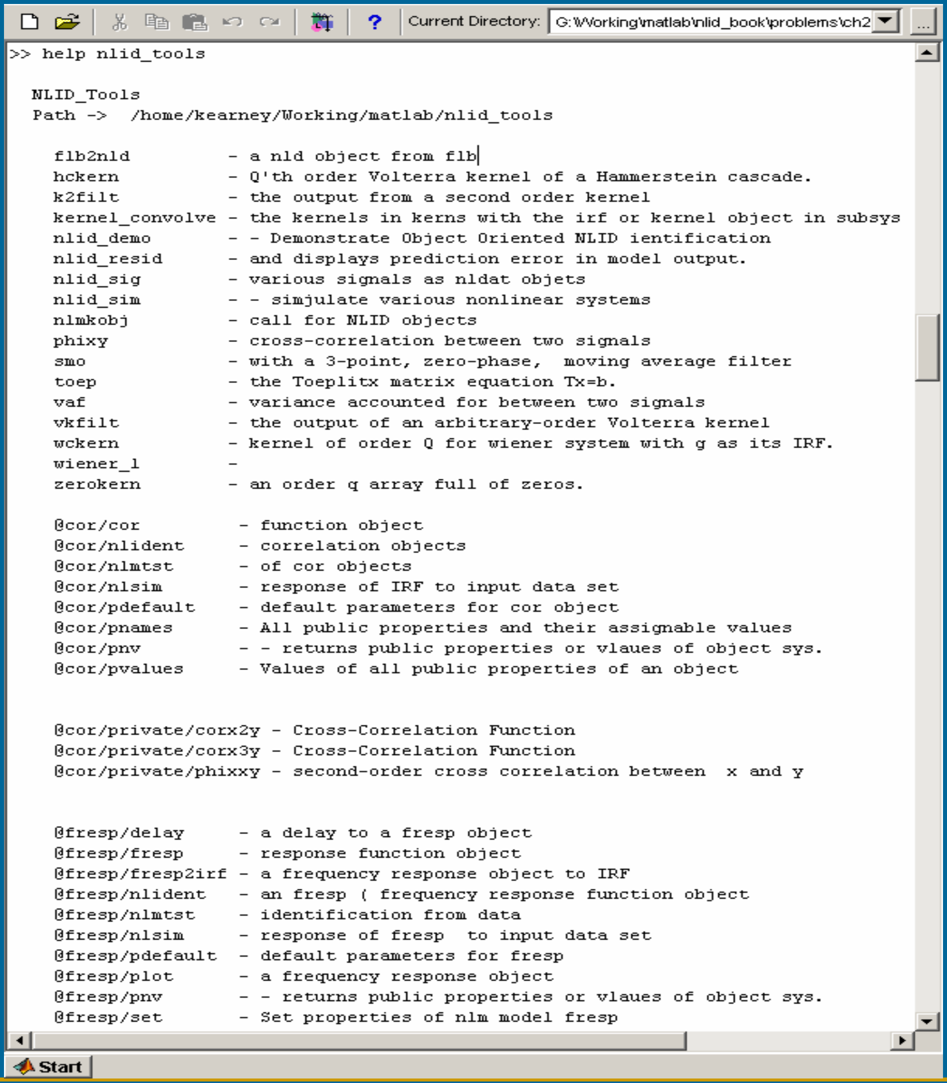
nlid_book.zip

- 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 classess
- 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

    flb2nld          - 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 ientification
    nlid_resid       - and displays prediction error in model output.
    nlid_sig         - various signals as nldat objets
    nlid_sim         - - simjulate 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 Toeplitx 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_l         -
    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
```

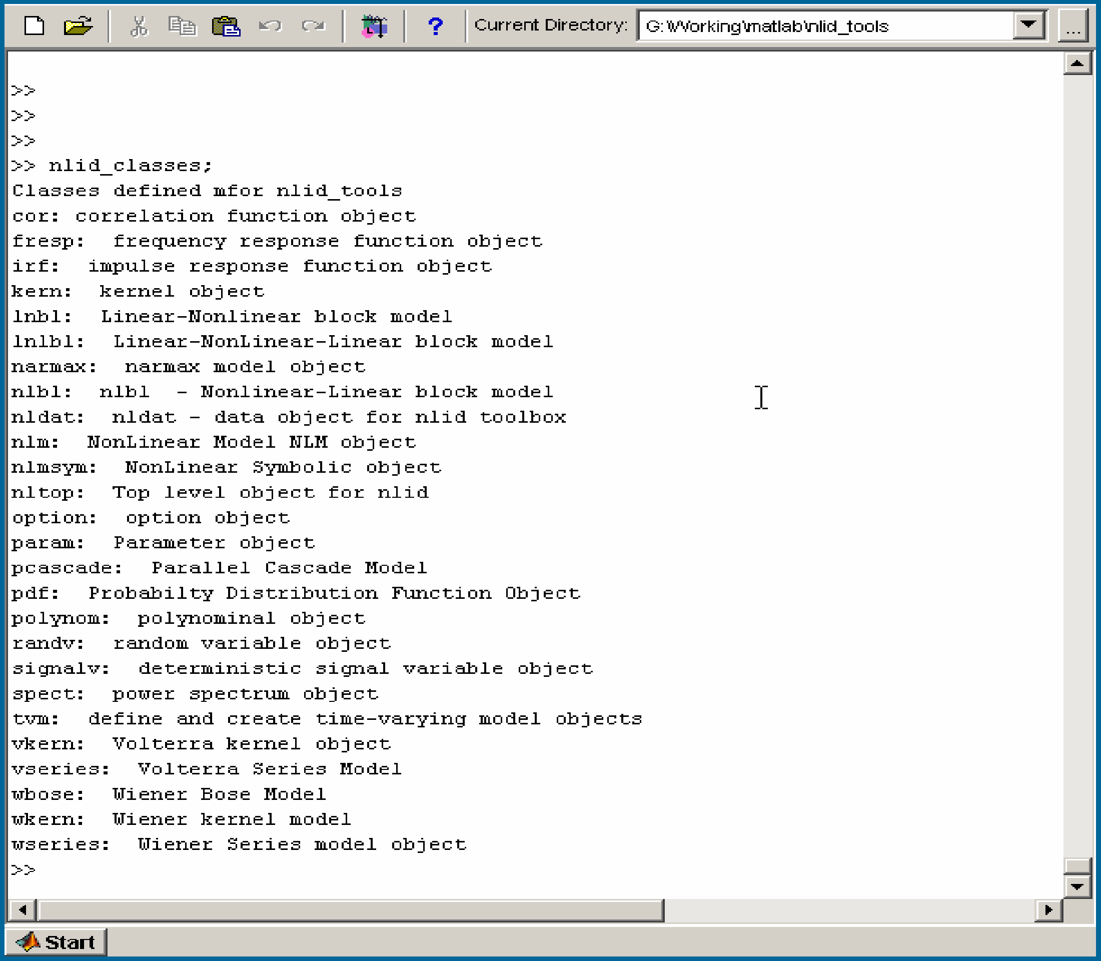
Utility tools

@cor/ … – correlation class and functions

@fresp/ … – frequency response class and functions

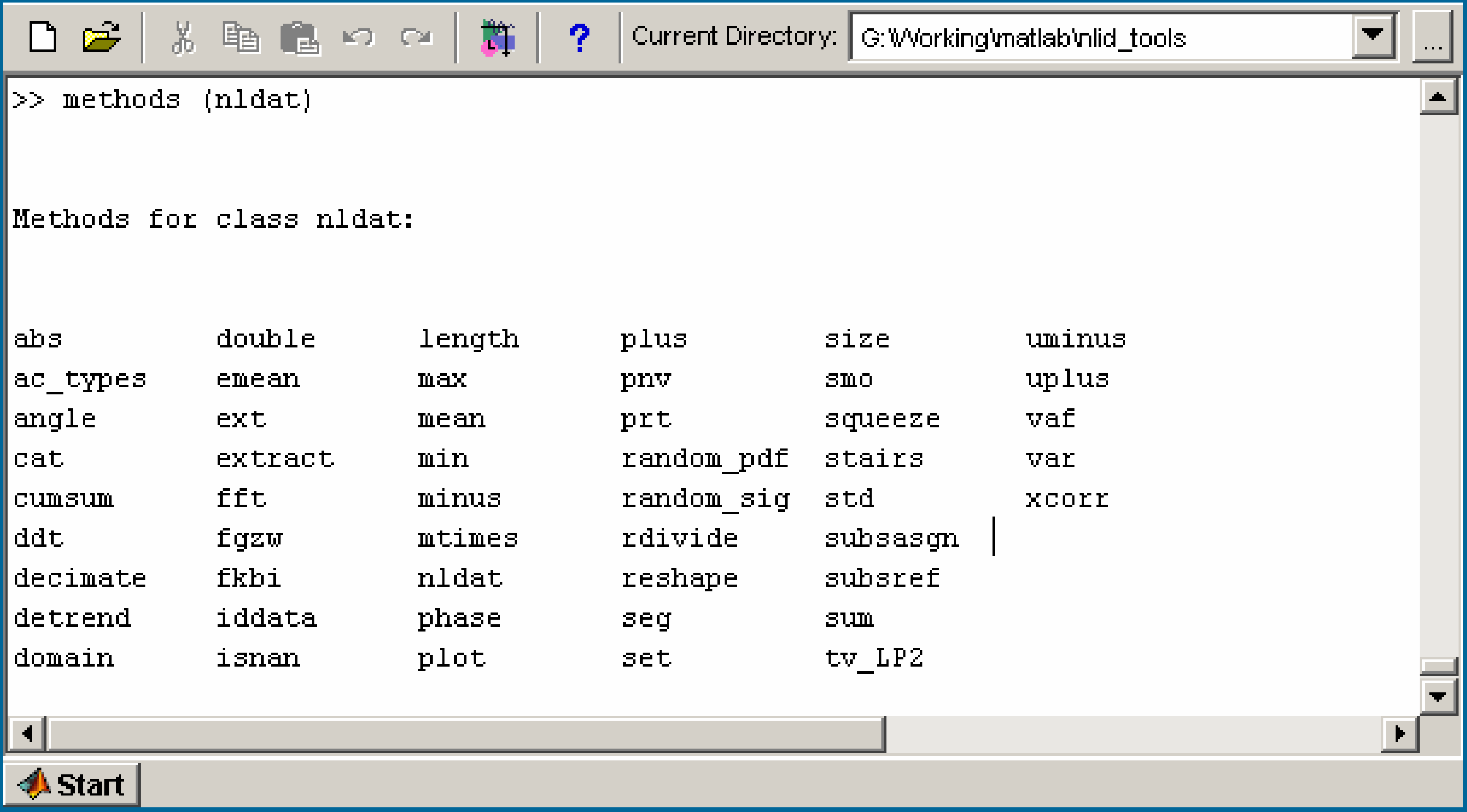
nlid_classes

…. 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
lnlbl:  Linear-NonLinear-Linear block model
narmax:  narmax model object
nlbl:  nlbl  - Nonlinear-Linear block model
nldat:  nldat - 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:  polynominal object
randv:  random variable object
signalv:  deterministic signal variable object
spect:  power spectrum object
tvm:  define and create time-varying model objects
vkern:  Volterra kernel object
vseries:  Volterra Series Model
wbose:  Wiener Bose Model
wkern:  Wiener kernel model
wseries:  Wiener Series model object
>>
```

methods (classs_name)
- list of methods defined for class



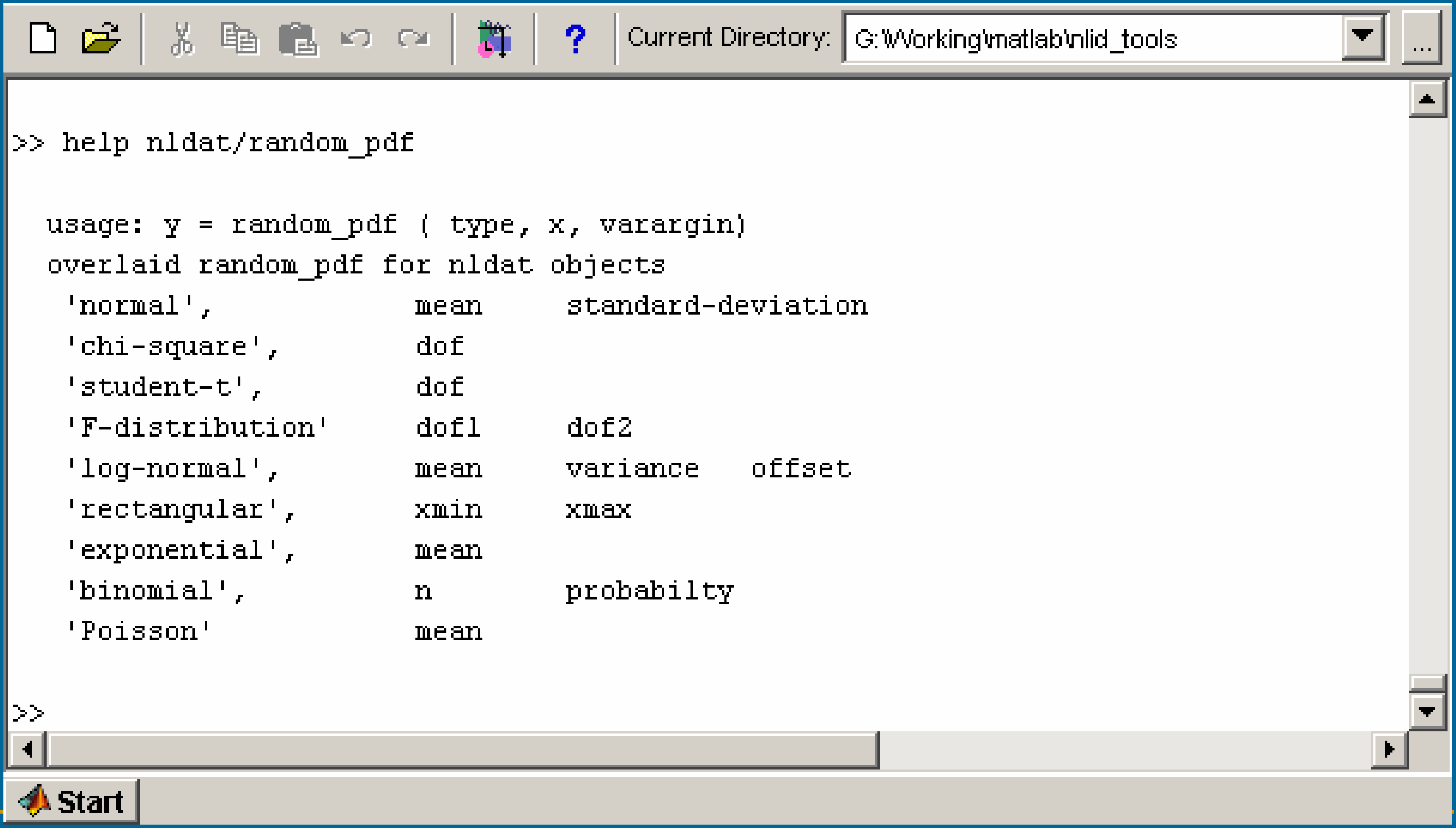
```
>> methods (nldat)


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



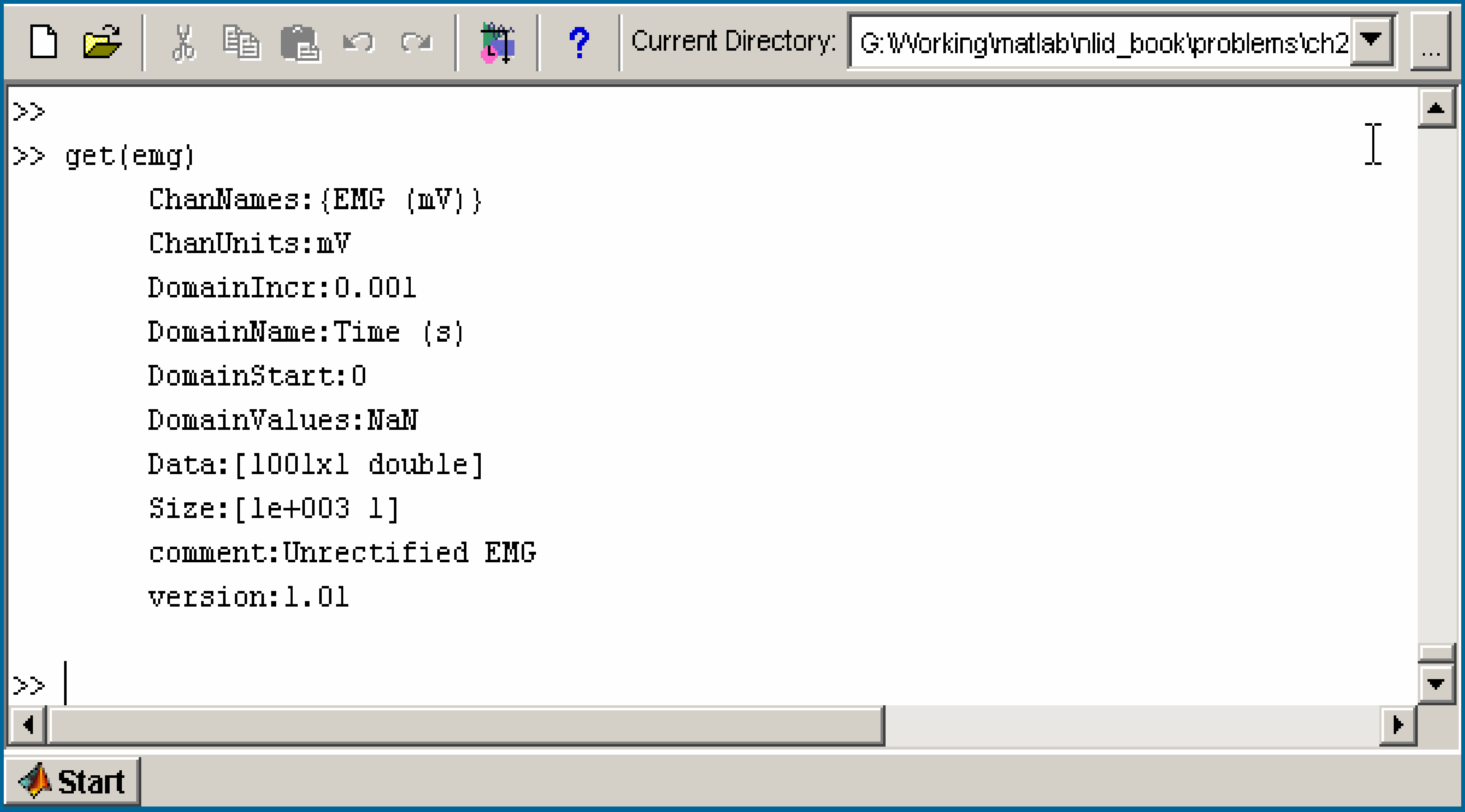
```
>> help nldat/random_pdf

  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

>>
```

get (class_name)

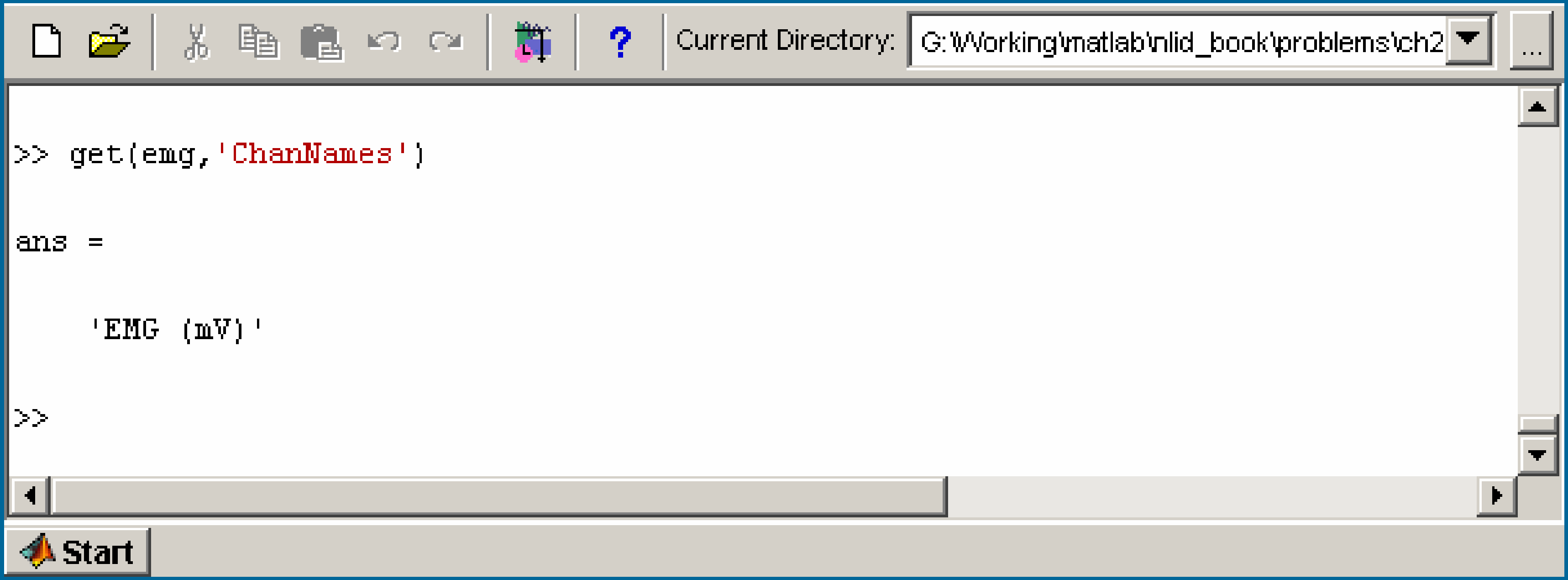
…. show properites for class



```
>>
>> 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

>>
```

get(var_name,'property_name') … returns value of properties



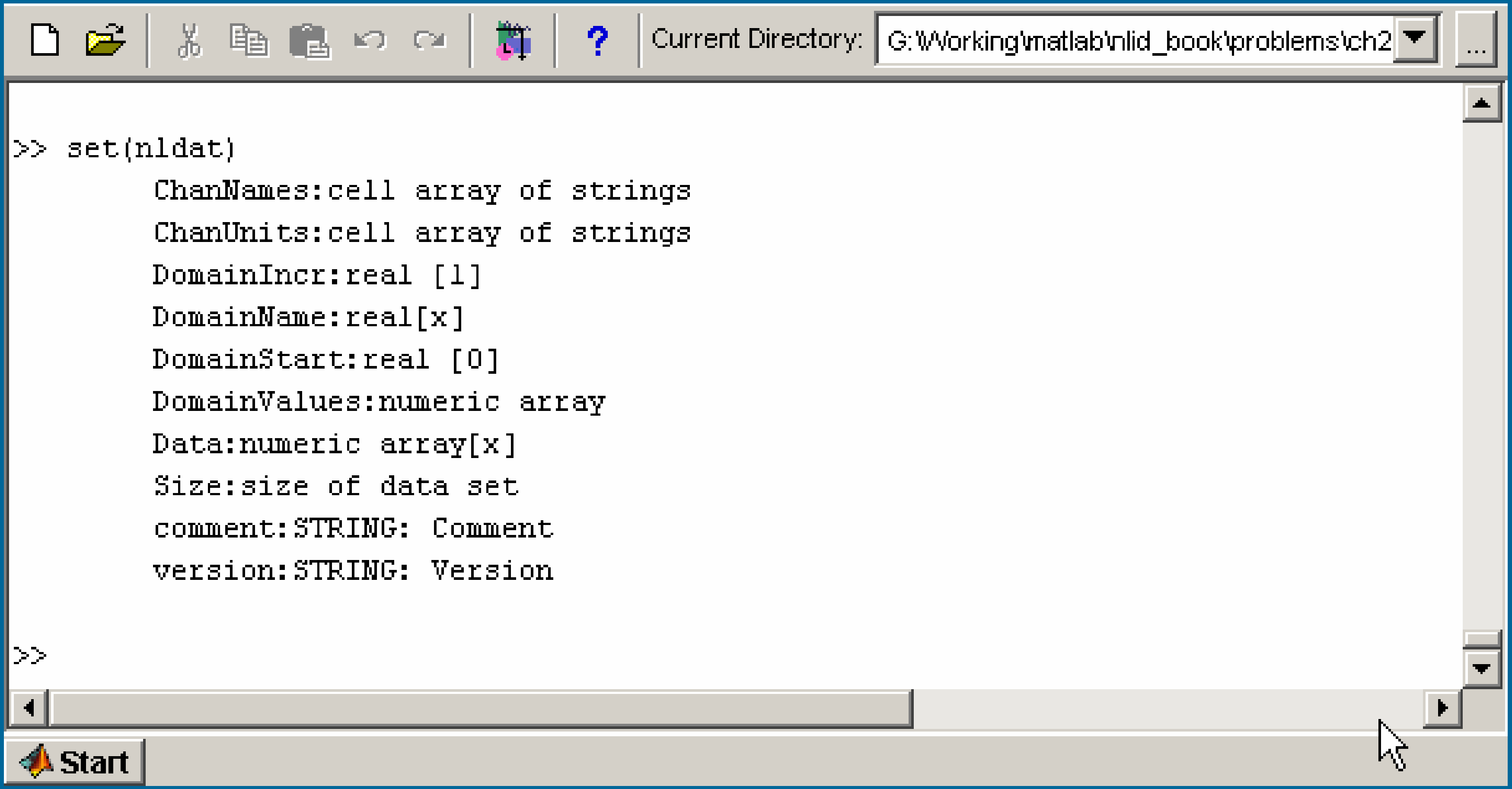
```
>> get(emg,'ChanNames')

ans =

    'EMG (mV)'

>>
```

set(class_name)
… information properites that can be set

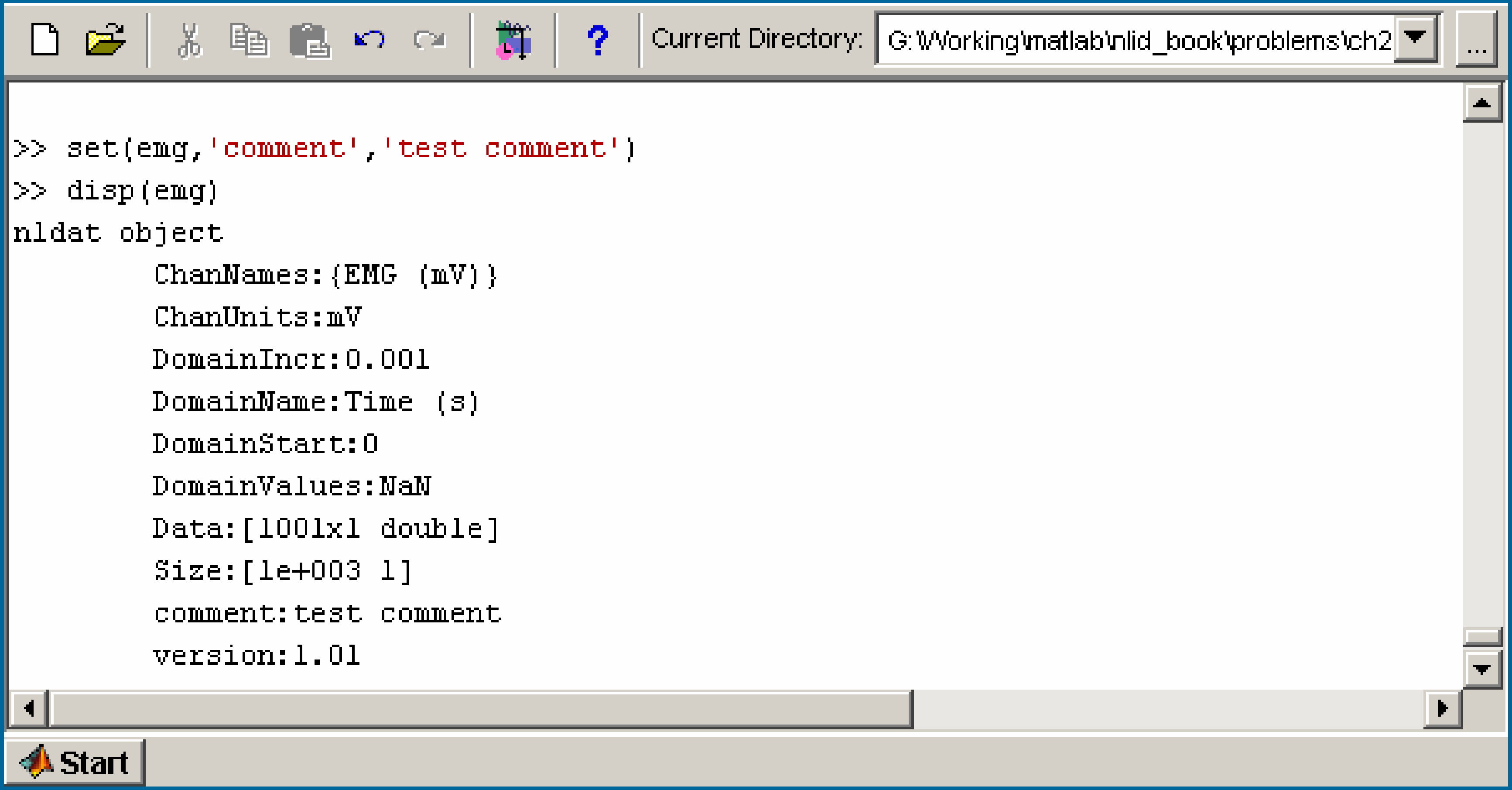


```
>> set(nldat)
        ChanNames:cell array of strings
        ChanUnits:cell array of strings
        DomainIncr:real [1]
        DomainName:real[x]
        DomainStart:real [0]
        DomainValues:numeric array
        Data:numeric array[x]
        Size:size of data set
        comment:STRING: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

>>
```

set (var_name,'property_name',value)

… set property value



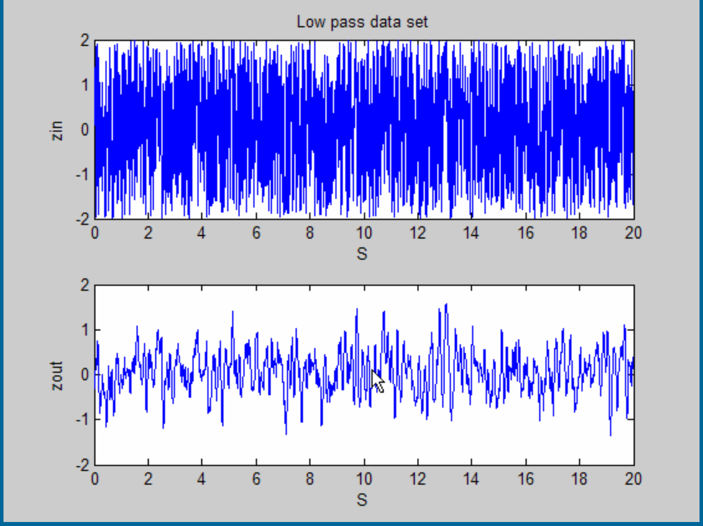
```
>> set(emg,'comment','test comment')
>> disp(emg)
nldat object
        ChanNames:{EMG (mV)}
        ChanUnits:mV
        DomainIncr:0.001
        DomainName:Time (s)
        DomainStart:0
        DomainValues:NaN
        Data:[1001x1 double]
        Size:[1e+003 1]
        comment:test comment
 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

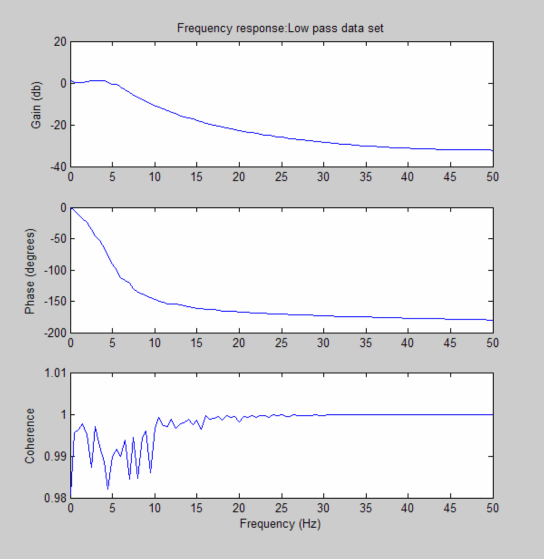
nlmtst(class_name) … test and demo class

Nlmtst(fresp)

- Generates test data set from low-pass filter

- Computes and displays gain, phase, and coherence





Nlm class