

## Matlab Addendum for Spinning Magnet

MATLAB is a sophisticated numerical analysis program used widely and available on different platforms. When data points are loaded into MATLAB they are stored as elements of arrays. The data set for each variable (e.g. time, position, etc.) is stored in a column "vector". MATLAB commands involve manipulation and display of these vectors. MATLAB has a rich command set. You, however, are likely to need only a few commands to perform the analyses necessary. Many common and useful commands are listed on the next page.

*NOTE: For the following programs to work you need to copy them from "Phys 417-01 Sungar" to your folder. One way is to use the MATLAB editor to open each of them from the shared workspace and then "Save As..." into your folder.*

Locally defined scripts for the spinning magnet experiment

magload	Loads the data from the text file generated by the computer data gathering software. The data file must reside in your MATLAB folder.
magsect	Creates an index of points one driving period apart. Used for creating Poincare sections.
magpwr	Creates Fourier transforms of the driver and the response.
magadd	Adds data from a data file to data already in memory.

### A sample session (items in bold are typed in by you):

*Load your data*

**»magload**

Welcome. Your data file, magdata5, appears to have been successfully loaded.  
Your data has been stored in the vectors: time, ang, angvel, angacc, force.  
Your file contains 3201 data points.  
Your driving frequency is 5 Hz.  
Your driving amplitude is 57 mAmps with a DC bias of -11mAmps.  
You have 40 data points per cycle.

*Now plot the data*

**»plot3(force,ang,angvel, '.')**

**»plot(ang,angvel, '.')**

**»plot(force,angvel, '.')**

*Generate a Poincare section*

**»magsect**

Sectioning successful. The index of the data points when the driving force is zero and increasing is stored in a vector called "indx".

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```
»plot3(force,ang,angvel, '.',force(indx),ang(indx),angvel(indx),'.')
»plot3(force(indx),ang(indx),angvel(indx),'*')
»plot(ang,angvel, '.')
»plot(ang,angvel, '.',ang(indx),angvel(indx),'.')
»plot(ang(indx),angvel(indx),'.')
```

*Look at the Fourier spectrum*

```
»magpwr
```

Fourier transform is complete. The absolute values of the Fourier amplitudes of the driving current are stored in the vector "pwrforce". The absolute values of the Fourier amplitudes of the angular velocity are stored in the vector "pwrangvel". The frequency bin values are stored in the vector "frequency". All DC amplitudes have been set to zero. Check the figure window for a composite graph.

```
»axis([0 20 0 1])
»
```

## USEFUL MATLAB COMMANDS

For more detailed descriptions of MATLAB commands and further options, type `help 'commandname'` (`help echo`, for example) at the prompt.

### General

1. `echo`: displays scripts as they run
2. `whos`: detailed list of all variables presently in use
3. `control-C` (keys held down together) : halts operations in progress

### Plotting

- `plot3(xvar,yvar,zvar)` : plots 3D graphs
- `plot(xvar,yvar)` : plots 2D graphs
- `polar(theta,rho)` : plots polar graphs
- `comet(xvar,yvar)` : plots animated graphs
- `axis([xmin,xmax,ymin,ymax])` : scales axes
- `xlabel('string')` : labels x axis
- `ylabel('string')` : labels y axis
- `title('string')` : graph title
- `plot(xvar(a:b),yvar(a:b))` : plots sections (a:b) of the data in xvar and yvar
- `view(a,b)` : rotates a 3-D graph by azimuthal angle a and angle b from vertical