

Gnuplot

Objective: Use Gnuplot to plot and analyze data.

Introduction

Though Excel can be used to plot data and find the best-fit line, it is not well-suited to curve-fitting. A tool used by many scientists is a free program called Gnuplot that is cross-platform, thus running on Mac, Linux, and Windows. In this exercise, you will learn to plot data and do a linear curve fit.

Record your data in a text file

1. Open a terminal window by right-clicking on the the desktop an choosing to open a terminal window. Alternatively, you can click the terminal icon at the bottom of the desktop.
2. Make a directory called `data` where you will put your files. Use the following command to make a directory, but do not type the prompt `>` symbol in any of the commands given below.

```
>mkdir data
```

3. Change to that directory by typing the following command.

```
>cd data
```

4. Open a text editor called *NEdit* by typing `nedit` .

```
>nedit
```

5. Type your data. Each row is a datapoint with x and y values separated by a tab. Here is an example set of data. Note that the first column is x data and the second column is y data.

```
.37e-3 .539e8  
1.1e-3 1.03e8  
1.8e-3 1.52e8
```

6. Save your file with the name `data.txt` .

Plotting a curve through data points

Sometimes, you do not know the function that fits the data. In this case, you may simply wish to draw a smooth curve through the data. Here's the Gnuplot program to draw a smooth curve through data in a file called `data.txt` . The lines beginning with `#` are comments. In this case, the commented lines show you the syntax needed to output the graph as a file.

1. Create a new text file.
2. Type the following Gnuplot commands.

```
set xlabel "stress"  
set ylabel "strain (N/m^2)"  
set nokey  
  
#set term postscript eps enhanced  
#set output "graph.eps"  
  
plot "data.txt" smooth bezier  
  
pause -1
```

3. Save the file as something like `graph.gpt`
4. From the command line type the following line:

```
>gnuplot graph.gpt
```

assuming that "graph.gpt" is the name of your gnuplot file.

Plotting your data and the best-fit line using Gnuplot

1. Create a new text file.
2. Type the following Gnuplot commands

```
y(x)=m*x+b

fit y(x) "data.txt" via m,b

set xlabel "stress"
set ylabel "strain (N/m^2)"
set nokey

#set term postscript eps enhanced
#set output "graph.eps"

plot y(x), "data.txt"

pause -1
```

The first line defines the function that we wish to fit the data to. This is the function of a straight line. The next line instructs Gnuplot to fit the function to the data in the file `data.txt` by finding the constants m and b that make the function best fit the data. The next three lines define the labels on the graph and tell Gnuplot not to print a legend (or key). The next two lines are commented out, but you can use these lines to output the graph to a file instead of the screen.

The `plot` command is then used to plot both the best-fit function $y(x)$ and the data on the same graph. The final line instructs Gnuplot to pause (i.e. not quit) when it is finished.

3. Save the file as something like `graph.gpt` .
4. Type the following command to run the file.

```
>gnuplot graph.gpt
```

assuming that “graph.gpt” is the name of your gnuplot file.