APPENDIX B

SUGGESTIONS FOR TABULATING AND PLOTTING DATA

Much of the data you take can and should be collected into tables for clarity. Any plot you make should have an associated table, and the location of the table (page number in the notebook) should be written on the plot.

In any table you make, the columns must be labeled with the names of the quantities being tabulated and with the units being used. Ordinarily the name is given first, while the units are given directly underneath in parentheses (see the example on p.2). Remember that it must always be clear from your notebook how each quantity in the table was determined. One way to do this (if you haven't already explained elsewhere how the measurement was done) is to use footnotes as in the example.

Think about how the table will look before writing anything down. For example, how many columns will the table have, how many entries, is there enough space left on the page for the table, etc. You may want to leave space for additional columns and entries just in case you need to add another calculation, such as converting data from degrees to radians, or if you need to add a few more data points. It is a good idea to start at the left with measured quantities and place calculated results to the right. It also helps to place quantities which are to be plotted against each other in adjacent columns, since this leads to fewer mistakes. Finally, record the data in an orderly fashion, with one of the important parameters monotonically increasing or decreasing.

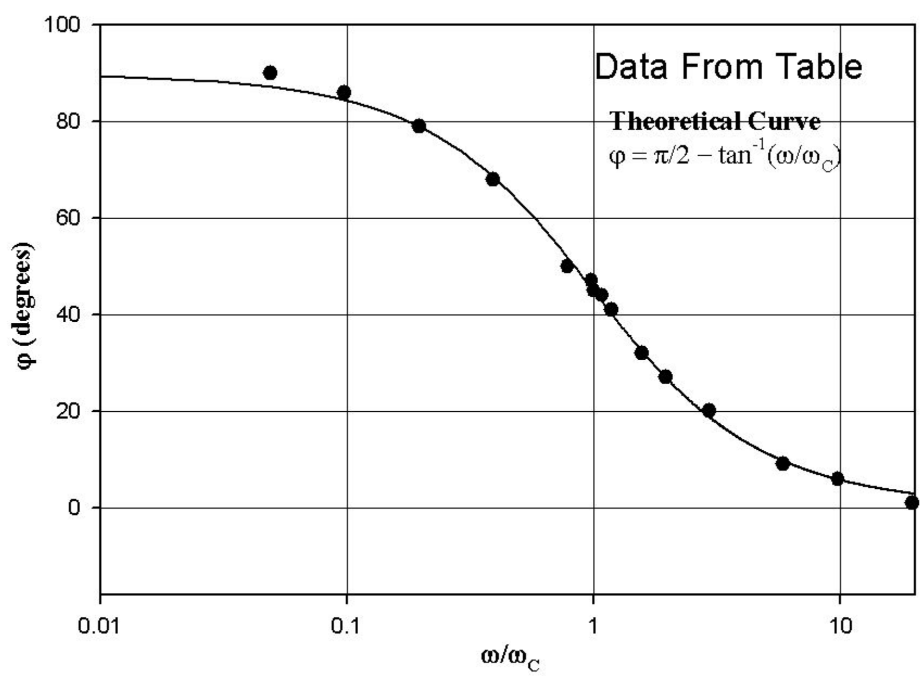
The table on the following page contains data for a high-pass filter (experiment 4). The measured quantities are the frequency, f, the input voltage v_{in}, the voltage across a resistor, v_R, and the phase angle ϕ between v_{in} and v_R. The derived quantities are v_R/v_{in}, $A_{db} = 20 \log_{10} v_R/v_{in}$, and ω/ω_C.

The figure directly below the table shows a good example of a plot. In any plot you make, the axes should be labeled with the name of the quantity being plotted, followed in parentheses by the units (in this example ω/ω_C is dimensionless). Reference should always be made to the source of the data, and the meaning of any curves should be made clear. In this example the plot shows the measured values of ϕ vs ω/ω_C for the high-pass filter. The curve is the prediction obtained from circuit theory:

$$\phi = \pi/2 - \tan^{-1} \omega/\omega_C .$$

Data for a High-Pass Filter

f (Hz)	Vin (Vrms)	V_R(Vrms)	ϕ (degrees)	ω/ω_C	Adb	V_R/Vin
50	7.54	0.37	90	0.049	–26.0	0.049
100	7.55	0.74	86	0.098	–20.2	0.098
200	7.54	1.45	79	0.196	–14.3	0.192
400	7.52	2.72	68	0.392	–8.80	0.362
800	7.46	4.57	50	0.784	–4.30	0.613
1 k	7.43	5.19	47	0.980	–3.12	0.698
1.02 k	7.42	5.25	45	1.00	–3.00	0.708
1.1 k	7.42	5.43	44	1.08	–2.71	0.732
1.2 k	7.42	5.64	41	1.18	–2.40	0.760
1.6 k	7.39	6.21	32	1.57	–1.50	0.840
2.0 k	7.37	6.54	27	1.96	–1.00	0.887
3.0 k	7.34	6.94	20	2.94	–0.49	0.945
6.0 k	7.32	7.21	9	5.88	–0.13	0.985
10 k	7.31	7.26	6	9.80	–0.06	0.993
20 k	7.31	7.29	1	19.6	–0.001	0.997



In general, quantities that are related by a linear function (such as current vs voltage for a resistor) should be plotted on linear graph paper, although if the range of the measurements is large, it may be preferable to use log-log graph paper, which permits you to see data covering several decades. For quantities that are related by an exponential formula (for example $V = V_0\, e^{-\gamma t}$) it is often best to use semi-log graph paper. Rewriting the formula as $\ln V = \ln V_0 - \gamma t$ shows that a plot of ln V (or $\log_{10} V$) vs t will make a straight line with a slope that depends on the decay constant γ. Quantities which are related by a power law ($x = Cy^{\alpha}$) will make a straight line if you plot them on log-log paper. To see this, note that the formula can be rewritten as $\log_{10} x = \log_{10} C + \alpha \log_{10} y$.