EGR 120
Introduction to Engineering
File: Power Regression - statistics.xls

Power Regression using Microsoft Excel

Method: This method uses Excel's tool for regression analysis which determines the slope and intercept of straight line data.
A power equation has the general form: $y = bx^m$
Taking the log of both sides of the equation yields the equation: log(y) = mlog(x) + log(b)
The equation above is the equation of a straight line with both x and y on log scales.
Regression analysis performed on the log(x) data and the log(y) data will yield the slope, m, and the intercept, log(b).

Problem 3.8 - Plot R vs A and use regression to find a power formula that expresses R in terms of A (A is the independent variable)
Resistance vs Area for an Electrical Conductor

Measured data from textbook:

Area, A (sq. mm)	Resistance, R (milliohms per meter)
0.021	505
0.062	182
0.202	55.3
0.523	22.2
1.008	11.3
3.320	4.17
7.290	1.75

Extra columns for regression:

log(A)	log(R)
-1.678	2.703
-1.208	2.260
-0.695	1.743
-0.281	1.346
0.003	1.053
0.521	0.620
0.863	0.243

Regression data for straight line on graph:

501.161	formula: =C$48*B19^C$50
176.605	
56.599	
22.635	
12.029	
3.815	
1.788	

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99971082
R Square	0.999421725
Adjusted R	0.99930607
Standard E	0.023119674
Observatio	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regressior	1	4.618995074	4.618995	8641.399	2.7309E-09
Residual	5	0.002672597	0.000535		
Total	6	4.621667671			

Perform power regression as follows:

1. Form columns for log(x) and log(y) data - see above
2. Select Tools - Data Analysis - Regression from the menu (see Note below)
3. Use the log(x) values for the independent variable and the log(y) values for the dependent variable. For the output range, specify the cell location for the upper left corner of the report.

Note: If Data Analysis is not listed under the Tools menu, first select Tools - Add-ins - Analysis Tool Pack

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.083569983	0.00947518	114.3588	9.7E-10	1.059213298	1.10792667	1.0592133	1.10792667
X Variable	-0.963420128	0.010363911	-92.95913	2.73E-09	-0.990061366	-0.93677889	-0.99006137	-0.93677889

log(b) = 1.083569983 Note: From cell B31, R Square = 0.99942172 ***Good fit!***

so b = 10^log(b)

or b = 12.122

m= -0.963 so $y = bx^m$ or $R = 12.12(A)^{-0.963}$

Form an xy graph using A = x-axis series, R = 1st series, and $R = bA^m$ data = 2nd series.

Use log scales for both axes. The data should fall in a straight line. Show points only for the 1st series and line only for the 2nd series.