LAB 5 Part II

In this lab, we will perform an experiment that demonstrates the concept of propagation of errors. The experiment consists of measuring 100 pairs of resistors. The total resistance for each pair of resistors is

$$R_0 = R_1 + R_2$$
.

By propagation of errors, the total uncertainty is just the radical of the quadratic sum of the errors of individual resistance,

$$\sigma_0 = \sqrt{\sigma_1^2 + \sigma_2^2} \; .$$

The two resistors are 1.0 and 1.3 K Ω . The resistors have been mounted on a board with each board containing ten pairs. To do the experiment, you would select a board and measure the first resistor, second resistor, and the two resistors in series. To speed up the measurement, ask a friend to record the measurement on the computer (e.g. Excel) while you hold the probes of the multi-meter on the two leads of a resistor. You should keep track of the serial number of each board so that you do not reuse the same board. Histogram the three resistance distributions and fit each distribution to a Gaussian to extract the standard deviation. Is Gaussian a good description of the data, i.e. how is the χ^2 of the fit compare with the number of degree of freedom? Is the total uncertainty consistent with the expectation by propagating the two individual errors?