Prelab – Experiment 3
Bridge Circuits

Read the lab instruction sheet and Appendix A thoroughly, then

1 Question 1

Derive the "null" conditions described in Step 1 for ***both*** the DC and AC bridge sections of the experiment.

Hint: The reduction methods used for DC circuits work with fixed-frequency AC circuits, but reactive impedances are complex quantities, $Z_L = j\omega L$ and $Z_C = 1/j\omega C$, while $Z_R = R$ is real. You must manipulate them as complex numbers.

2 Question 2

Derive Eq. 4 in Appendix A starting from Eq. 2. Use the result to evaluate the percentage uncertainty in $R = R_1||R_2$ when R_1 is 10 kΩ (±0.5%) and R_2 is 1 MΩ (±10%).

Now note that if you had solved the parallel combination by adding conductances, you wouldn't have the "correlated error" problem. You could also immediately note that 10% of 1 microsiemens is a five times smaller uncertainty than 0.5% of 100 microsiemens and can be ignored. (Taking a reciprocal is a division and the "1" has no uncertainty, so the % error remains the same.) Since the total conductance is only 1% larger than than the 100 microsiemens part, it will have about the same percentage error, and the uncertainty in the parallel combination is just 0.5%, or 50 ohms. (If you work the equation for this error out exactly, you get the same answer as equation 4.)