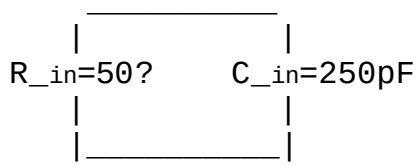
Quiz #1 (due IN CLASS on Thursday, January 31, 2002)

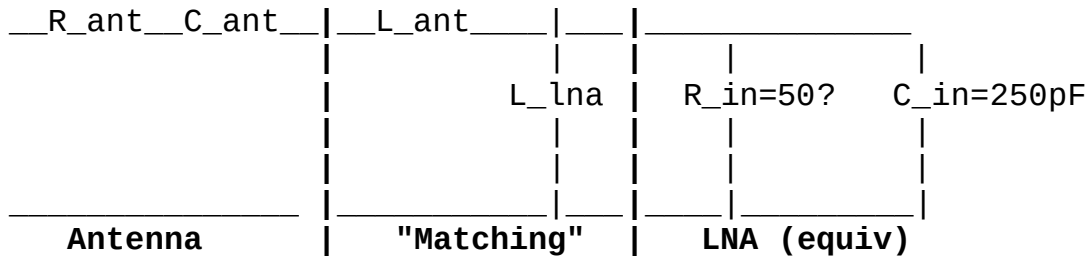
Assume that with further adjustments to RF and RE for your LNA that you achieve the following equivalent parallel R_{in} and C_{in}:



Where R_{in} is again the amplifier (with feedback) and C_{in} is the total input capacitance $C_{pi}+C_{mu}(1+g_mR_{load})$--basically Miller capacitance and C_{pi}.

1) Determine the series equivalent $R_{LNA} + jX_{LNA}$. How do these values compare with your network analyzer impedance data? (i.e. does this help to explain what you observed and maybe some hints about changes you'd like to consider later in the quarter)

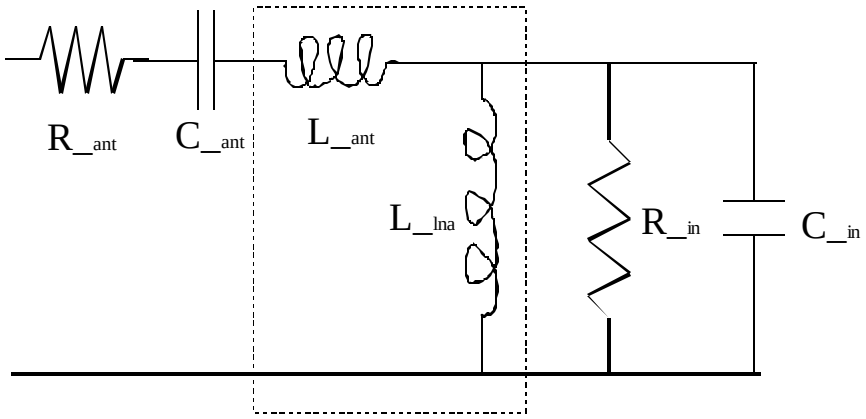
The antenna for our final project has a series equivalent (as measured using the SWR Meter) of $R_{ant}=40$, $X_{ant}=100$. The X-term is capacitive. The following "matching network" (actually more like an approach for resonance) is proposed to connect the antenna and LNA. A large coupling capacitor which is not shown needs to be placed between the L_lna and actual LNA to avoid shorting out the DC bias.



2) Determine suitable values for L_{ant} and L_{lna}. Since this circuit topography cannot realize a perfect match, what's the best you can do? Clearly explain how you approach the problem and choose values. (there are several approaches you can take: a) based on examples in Text, b) brute force computations, c) Smith Chart reasoning, d) inductance transformation...)

3) Determine the power loss (in dB), assuming that the source signal comes from the far left in series with R_{ant}. That is, determine the power ratio of what is actually delivered to R_{in} vs. what max power could be delivered to R_{in} if it were matched to R_{ant}. (i.e. see p. 231 in the Text)

4) Bonus/Challenge--Can you think of some minimal (i.e. the fewest components in a simple configuration) matching network that actually matches the antenna with the LNA. You don't have to find actual values, try to suggest a simple configuration that could actually realize a match. Here it might be useful to spend a few minutes looking at the Smith Chart.


R_ant
C_ant
L_ant
L_lna
R_in
C_in