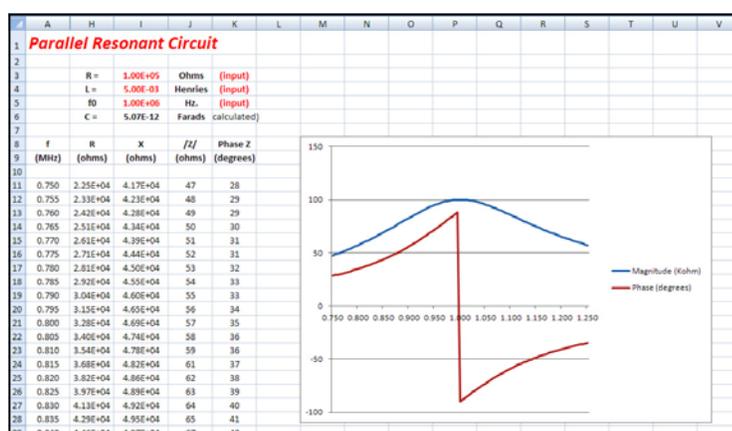
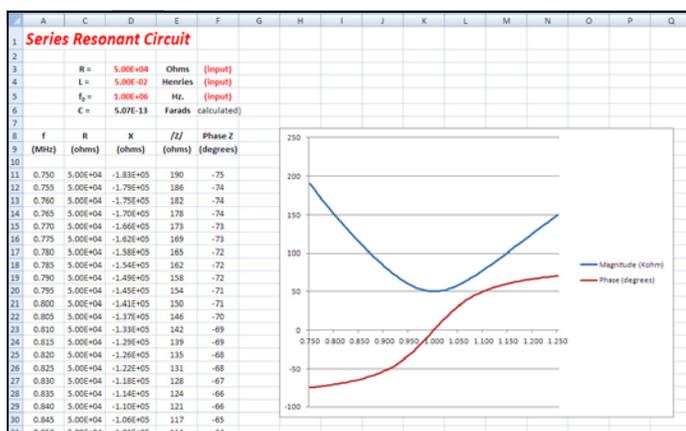


Impedance and Pattern Calculations

In teaching a General, and to a greater extent an Extra licensing class, I'll spend some time describing the difference between parallel- and series-resonant circuits, and how the values of the circuit components affect not only the resonant frequency but also the shape of the impedance-vs.-frequency curves and the Q of the circuit. For some classes the discussion consists largely of just pointing out the differences between the two types of circuits: "At resonance, the parallel circuit has high impedance while the series circuit has low impedance." And this type of explanation, along with the material presented in the ARRL study material would suffice to impart enough information to the class participants to allow them to pass the exams.

But I was recently teaching a lunchtime General and Extra licensing course to employees of a local Lockheed Martin facility and after an initial discussion it was clear that the simple explanation did not satisfy the engineers and technicians comprising the majority of the class – they wanted to know more about how component values affected the way the circuits worked.

Since the engineers and technicians were being, well, engineers and technicians, I decided to give them something that they could use to delve into the properties of parallel and series resonant circuits in greater detail. So I developed two Excel spreadsheets, one for each type of circuit, e-mailed them to the class participants and allowed them to experiment with various values of circuit components and resonant frequency to see how the impedance and phase characteristics of the circuits would be affected. (Figures 1 & 2)



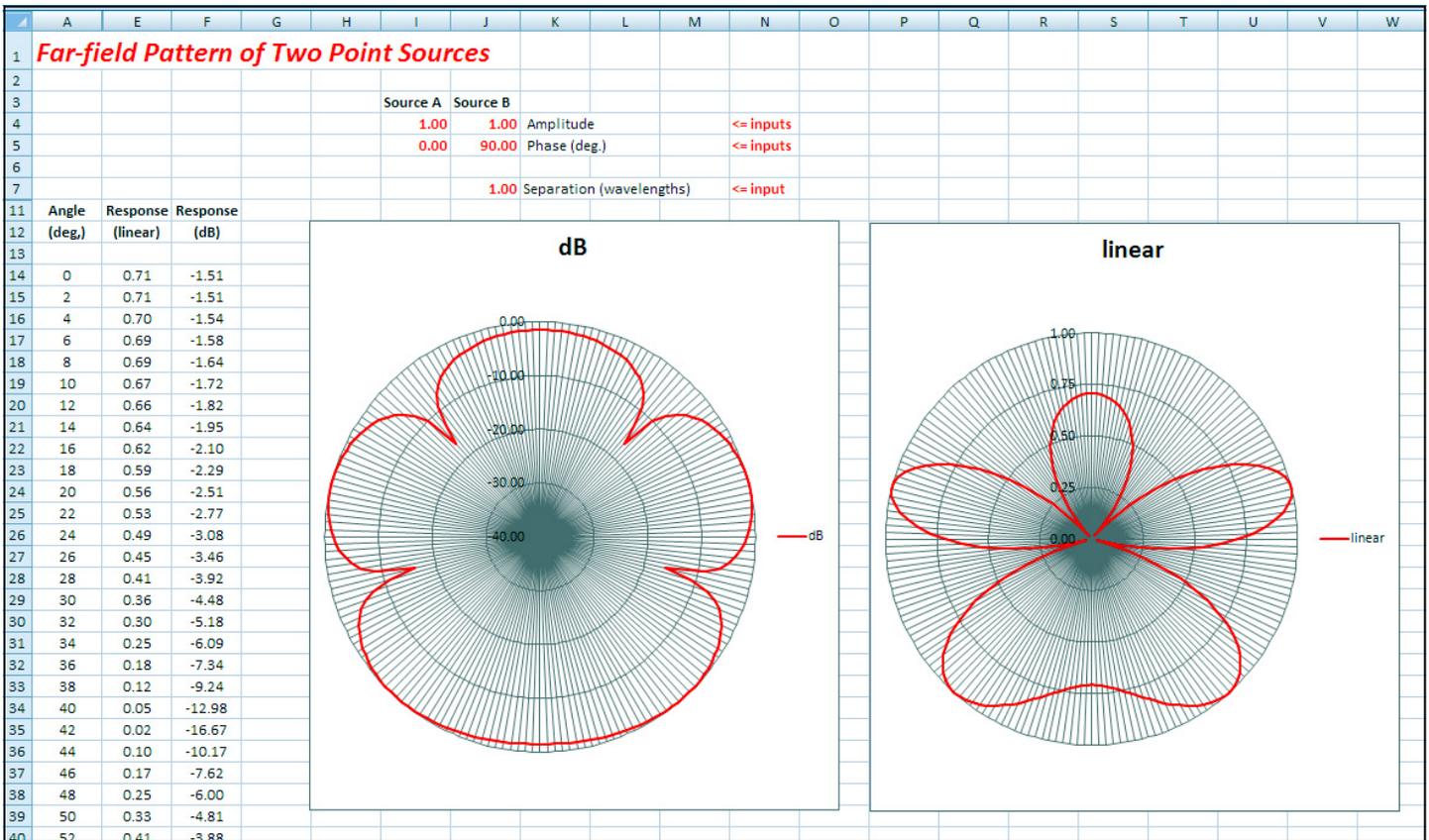
Now I know that there are many circuit analysis programs that will do much, much more than a simple Excel spreadsheet. But with these spreadsheets they could easily change a component value and immediately see the impact on impedance and phase versus frequency curves.

While series and parallel resonant circuits tend to be fairly intuitive in their workings after a little thought, the far field patterns produced by two point sources are a little more complicated as the pattern is affected by the separation, amplitude and phasing of the point sources. Figure E9C01 in the Extra pool does a good job of presenting patterns for a number of separations and phasings. But again, it did not allow the students to investigate on their own how the three variables affected the patterns.

So a third Excel spreadsheet was developed that allowed the students to input values for separation, amplitude and phase and immediately see the effect on the patterns. It also illustrated the difference between linear and logarithmic pattern plots. And incidentally, it also prompted a competition between the students to see who could produce the "strangest" pattern. (Figure 3)

(Continued on page 2)

(Continued from page 1)



So these tools are probably not suitable for every class. But if you have a class that wants to go a bit beyond the bare fundamentals, you might consider letting the students in your class use something similar to one of these spreadsheets.

73, Steve Auyer-N2TKX