Letters to the Editor

Q Calculations of L-C Circuits and Transmission Lines: A Unified Approach (Sep/Oct 2006)

Hello Doug,

I would like to add the following corrections to Equations 30 and 31 of my article.

They should read as follows: (Thanks to Dan Maguire, AC6LA for reporting these errors).

$$R = 2\ \alpha_c\ \mathrm{Re}\left[\ Z_o\ \right] \qquad \text{(Eq 30)}$$

Where R is in ohms / foot and α_c is the attenuation in nepers / foot due to conductor losses.

$$G = \frac{2\ \alpha_d\ \mathrm{Re}\left[\ Z_o\ \right]}{\left|\ Z_o\ \right|^2} \qquad \text{(Eq 31)}$$

Where G is in siemens / foot and α_d is the attenuation in nepers / foot due to dielectric losses.

The coefficients α_c and α_d are obtained from $A_o c$ and $A_o d$, as in Equations 18 through 21.

Please add a PDF version of the MathCad files on ARRL Web at **www.arrl.org/qex-files/**. (This has been done. Look for **9x06_ Audet.zip** in the files for the September 2006 issue. — Ed.)

MathCad Explorer for MathCad files, V8 and below, may also be downloaded from: **www.ecs.soton.ac.uk/~msn/book/mcexp802.exe**

— *Thanks, Jacques Audet, VE2AZX*; **ve2azx@amsat.org**; *Web:* **www.geocities.com/ve2_azx**

An Alternative Transmission Line Equation (Jan/Feb 2007)

Doug,

Oops! On page 15 in Equations A6A and A6B (last step in both) [you are wrong]. After one finishes the hard/interesting part it's easy to lose focus and mess up something basic. — *73, Martin Davidoff, K2UBC*; **MDAVIDOFF@ccbcmd.edu**

Martin,

You're right! The expressions at the right-hand sides of those equations are wrong; but in the center section, they are correct.

$$\sinh 2x = \frac{e^{2x} - e^{-2x}}{2} = \frac{e^2}{2}\left(e^x - e^{-x}\right) \qquad \text{(Eq A6A)}$$

$$\cosh 2x = \frac{e^{2x} + e^{-2x}}{2} = \frac{e^2}{2}\left(e^x + e^{-x}\right) \qquad \text{(Eq A6B)}$$

— *73, Doug Smith, KF6DX,* QEX *Editor*; **kf6dx@arrl.org**

Doug,

Thanks for the presentation of Ron Barker's novel approach to the transmission line equation. Since I am one of those who has struggled with hyperbolic functions in the past, Ron is providing relief to a most vexing problem. I anticipate that his new equations will be the standard we hams will be using in the future. His article and others like it are why I subscribe to *QEX* magazine: to get answers that I won't find anywhere else. — *73, Patrick Wintheiser, WØOP*; **patw@goproweb.com**

Dear Doug and Ron,

I read carefully this article, which I found very interesting. I would like to add two thoughts about the paper:

1) By looking at Equation 6, we could think that voltage across the load (V_A) only depends on the load impedance (Z_A), the characteristic impedance of the line (Z_0), and the input voltage (V_S). Equation 6 is actually valid in a very particular case.

Indeed, V_A generally also depends on the length of the line. V_A can be independent of the line length in some very particular cases, such as when the line is terminated in a matched load *and* the line has no loss.

2) You say that Equation 7 is only valid when the line is terminated in a matched load. This is indeed the case. After that, Equation 7 is used to deduce Equation 10. So the validity of Equation 10 has only been proven for matched loads, and leads to $P_A = 0$ because our hypothesis is $Z_A = Z_0$! But is Equation 10 still valid for the unmatched load case, and is it correct to use it to compute Equation 11A (non-matched load)?

The answer is actually yes, but the proof is quite more complicated than in the article, and requires solving differential equations.

Congratulation on your article.

— *73, Christophe Bourguignat, F4DAN*; Web site **f4dan.free.fr**

Hello Christophe,

Thank you for your e-mail and for your interest in my article. I would first like to apologize for the delayed response. When I downloaded your e-mail I was in the final stages of preparing to leave for a six-week trip to visit family in Australia, where I am now, still somewhat jetlagged.

With regards to your first point Equation 6 is not a "very particular case." $\boldsymbol{V_A}$ is a vector quantity and the equation gives it in rectangular form as a complex number. The magnitude of $\boldsymbol{V_A}$ is independent of line length for any termination other than the effect due to line loss.

Turning now to your second point I think that the Thevenin derivation of Equation 10 is valid but maybe I was economical with the detail in my explanation. Essentially what the Thevenin Theorem states is that any linear network of voltage sources and impedances, however complex, has an equivalent circuit comprised of one zero impedance voltage source (emf) in series with one fixed impedance, the source impedance, Z_0.

A consequence of the theorem is that the maximum power that can be drawn occurs when the load impedance is equal to the source impedance, and the voltage across the load will be half that of the source voltage (emf). For any other value of load impedance the power delivered will be less and $\boldsymbol{V_A}$ will no longer be $\boldsymbol{V_S}$ / 2.

By virtue of its characteristic impedance, a transmission line meets the definition of a linear network to which the Thevenin theorem can be applied. When the line is terminated into a matched load $\boldsymbol{V_F}$ is equal to $\boldsymbol{V_A}$ and $\boldsymbol{V_S}$ (emf) must be equal to twice V_f as per Equation 7. When there is a mismatch, $\boldsymbol{V_A}$ is not equal to $\boldsymbol{V_F}$, the difference being $\boldsymbol{V_R}$ as per Equation 8. Your assertion that the derivation of Equation 10 was based on a matched load situation failed to take account of Equation 8, which is a key stage of the derivation.

I have seen the differential equation derivation of Equation 10 somewhere but my math was not up to understanding it and I can't remember where I saw it. — *73, Ron, G4JNH*; **g4jnh@onetel.com**

Doug,

Regarding this article in *QEX*, I mentioned in a letter to Ron only one of several problems I have. After pouring over it in great detail I decided it was all there because there might be someone who wanted to apply the transmission line equation and didn't have access to "modern machines" to do the job.

I went to my trusty Microsoft *Excel* spreadsheet and found that the hyperbolic functions are an integral part of the tool set to do functional calculations. It should be easy for any up-to-date ham to do calculations in *Excel*. If not, then I think the scarce resource of available pages and available time should be used to teach hams how to calculate things. Of course, their use of antenna modeling programs suggests that they have, as a group, a sufficient sophistication to handle *Excel*. So, I think that Ron's article was not the best use of the space in *QEX*. It was, however, entertaining. I offer these comments only as a "soft" suggestion.

I really appreciate your work as editor and author and moderator of the journal. The quality of *QEX* is high and I know that

you, probably, do any refereeing that gets done. If that is so, another suggestion I have is that a number of the readers be enlisted as a group of reader/reviewers to comment to you on publications under consideration. I'm sure you have much experience with reading refereed publications. Or this is already going on and I am just ignorant of it?

Again, thank you very much for a great publication.
— *73, Steven Bomba, K9IER*; **steven@sjbomba.com**

Hi Steven,

I'm a bit puzzled about the nature of your argument. Yes, the article is there for the purpose of explaining how computations may be simplified enough to be done on a standard hand calculator. Underlying that, though, is the exposure of basic facts about transmission line behavior that may not otherwise have been recognized by readers.

At *QEX*, we employ a team of Technical Advisors who review articles and make recommendations. While the final decisions rest with me, the weight of their comments is considerable. Our Contributing Editors also have a big say in what gets published and how. On the other hand, we are not swamped with submissions and we welcome your contributions. Perhaps you have some particular subject about which you are passionate, that you'd like to see grace our pages, eh? My door is always open.
— 73, Doug

Hello Doug,

I have found that many technicians have difficulty in understanding logarithms, so I found a simple method of calculating them without using a table or a calculator. Check out this page on my Web site:
www.science-site.net/logcalc.htm/
— 73, Weldon Vlasak, KCØFYW; **adaptent@alltel.net**

Remote Possibilities (Empirical Outlook, Jan/Feb 2007)

Hi Doug,

I am a relatively new subscriber to *QEX* (I joined at Dayton last year) and am enjoying the technical content, particularly your articles on receiver performance.

I have just received the Jan/Feb issue and was immediately drawn to the heading of your editorial, as I wrote a series of articles in RSGB *RadCom* 18 months ago called "There's a remote possibility." You may or may not know that December 1, 2006 was a major milestone for amateurs in the UK when a new license was introduced by Ofcom to allow remote operation to take place. This was largely as a result of the work I have been doing since 2000 under a special "research permit" that I obtained from the regulatory authority with the help of the RSGB that allowed me to experiment with remote operation.

I started off with a Kachina 505DSP complete with remote system, which worked very well but was limited for me by the audio delays on the single dial-up line. I don't like the idea of having an unattended PC at the remote site so I have gone down the route of using port redirection software and Ethernet-to-serial servers at the remote site. I used an ISDN line where I could use one line for control and one line for the audio. Unfortunately, I have just lost my remote site; it was sold and the new owners required me to move out.

The key issues as far as I am concerned are:

1) Latency: The system has to be able to work well under contest search-and-pounce mode.

2) A PC makes a lousy tool for tuning a rig! I used a technique available in *TRX-Manager* to tune a rig normally at home, and the remote rig was kept in sync through the software.

3) I think there is scope to use remote head rigs such as the Kenwood TS-480, which would give a more normal feel to tuning. I have been planning to implement two TTL-to-Ethernet adapters back to back, to allow the remote head to be used over an (extended) LAN or even WAN.

4) I would like to see an SDR with a proper hardware front panel to give a good user interface and facilitate remote operation.

5) We need to think about the feedback necessary to ensure the actions commanded have taken place.

It will be interesting to see how remote operation develops and what *QEX* can do to push it forwards. If I can assist in any way I would be willing to do so.
— 73, Dave, G3UEG; **dave@g3ueg.co.uk**

Octave for Transmission Lines (Jan/Feb 2007)

Hi Doug,

I received a query from a reader asking whether the code for my article would be posted for download from **www.arrl.org**. I don't see it there, maybe because I submitted the code embedded in the Word file that contained the text.

If you would be interested in making the code available, I'll send you the source code from Table 1 as a text file.
— 73, Maynard Wright, W6PAP; **m-wright@eskimo.com**

Hi Maynard,

It is done. The file is available at **www.arrl.org/qexfiles**. Look for **1x07_Wright.zip** with the files under the January 2007 issue.
— Doug, KF6DX QEX

In the next issue of QEX

In the May/June issue of *QEX*, Rod Brink, KQ6F, describes his phasing SSB rig for ragchewing on 75 and 40 m. Quality of sound and an image-rejecting mixer are featured in a direct-conversion design. Older hams will remember some of the requirements for good opposite-sideband rejection that Rod points out. In fact, what we now call the I-Q method is used in DSP to do the same thing that KQ6F has done in analog. Check it out! QEX