Subject: magnetizing inductance...

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So I'm going to do some minor backpedaling regarding the magnetizing inductance thing. I figured I better be able to back up all the smack talk I'm giving you about it, so I started writing the equations for a transformer - actively looking to put them in the form you always draw (with the mag inductance). And as far as I can tell it's even simpler than the whole "reflected impedance" crap I was talking about today (which is a bit more involved and actually has some usefulness). If you write KVL for the primary loop of a transformer (see my ugly drawing attached), you get:

```
 V_in = R_p*i_p + L_p*d(i_p)/dt - M*d(i_s)/dt         {1}
```

where V_in is the input voltage (that you apply), R_p is the primary resistance, L_p is the primary inductance, M is the mutual inductance (equal to sqrt(L_p*L_s)) and i_p and i_s are the primary and secondary currents, respectively. This is really bone-head. Now I'll just group the two derivative terms and factor out and L_p:

```
   V_in = R_p*i_p + L_p*[d(i_p)/dt - (M / L_p)*d(i_s)/dt]         {2}
```

And use the additive property of the derivative:

```
   V_in = R_p*i_p + L_p*d/dt[i_p - (M / L_p)*i_s]       {3}
```

Now let's call the quantity in brackets i_m (the magnetizing current) and call L_p the magnetizing inductance (L_m). So we can rewrite as:

```
   V_in = R_p*i_p + L_m*d(i_m)/dt      {4}
```

And that's all there is to it. So now you draw the transformer the way you did today (with the mag inductance). And you get to replace the real transformer (that has primary, secondary and mutual inductances) with an ideal (or perfect or whatever you call it) transformer where the voltages and currents are simply related by the turns ratio (which is the same as the sqrt of the inductance ratio). But the current through the mag inductance is a weird combination of the actual primary and secondary currents. And the current into the "ideal" primary is a scaled version of the actual secondary current. I'm at a total loss to see why anyone would want to do the analysis this way. It simplifies the equations a little bit, but at the expense of losing touch with what's really happening. After staring at it for awhile, you can see that the quantity in brackets in {3} (which we're calling the mag current) is a scaled version of the total flux in the transformer core. This explains why the i_m waveform in your notes looks like it did. Come to think of it, I could have factored out something other than L_p in eqn {2} such that the quantity left in brackets was exactly equal to the total flux. Then L_m would have been equal to something other than L_p. Still I don't get why people bother.

Anyway, I can't believe I just typed so many equations in an email, so I'll stop now. Bottom line is:
1) magnetizing inductance in NOT a function of load impedance like I was spewing today (minus 10 points for me); and
2) I still think modeling a TXF this way is stupid! Actually I hate it more now than I did earlier today.

-jb

Visio-txf drawing.pdf	**Content-Type:**	application/pdf
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