Re: Lumped element model limitation

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Date: 09/26/04

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Date: Sun, 26 Sep 2004 05:20:24 GMT
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"tsp" <tspjor@yahoo.com> wrote in message
news:8efbd3ef.0409232206.79cc2e2e@posting.google.com...
> *Can somebody tell me why the lumped element model breaks down when*
> *actual circuit impedances are very low, or when the length of the wire*
> *approaches the wavelength of the circuit's operating frequency?*
−−−−−−−−−
Lumped model circuit theory is a quasi−static approximation of field theory.
It works well when distances are considerably less than a quarter
wavelength. However, where it is valid −it is a lot easier than going to
more complex approaches. Below is a <list>(?) in order of complexity
Consider a 1 ft length of wire:
DC and low frequency−lumped model is a resistor.
Higher frequency− Inductance effects are measurable −lumped model OK
higher yet− both L and C lumped model works
Higher− Transmission line models as R, L and C must be considered
distributed− otherwise errors crop up
(example 100mile length of unloaded power transmission line will have about
a 5% higher voltage at the receiving end than at the sending end−lumped
model doesn't show this). However a lumped T or pi model can be used for a
specific line and is correct at the ends but not in the middle(10V at each
end of a 1/4 wavelength line and the mid−line voltage will be about 14V).
Higher yet and it is necessary to consider the line as a wave guide.
Beyond that −now you are not using lines− you are using antennae and
radiating .

As for the lumped model not being valid for low impedances− not true. The
breakdown may be that the model is not including all the factors which can
be ignored at higher impedance levels. For example−at Z=R=0.01 ohms an
ignored contact or meter resistance of 0.1 ohms can make measurements
meaningless. If R=100 ohms, the effect is negligible.

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remove the urine to answer
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