Re: AC sine wave: What does increasing the frequency do?

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From: John Larkin (*jjlarkin_at_highlandSNIPtechTHISnologyPLEASE.com*)
Date: 11/28/04

Date: Sun, 28 Nov 2004 10:52:50 −0800

On Sun, 28 Nov 2004 10:44:43 −0600, John Fields
<jfields@austininstruments.com> wrote:

>On Sat, 27 Nov 2004 16:53:47 −0800, John Larkin
><jjlarkin@highSNIPlandTHIStechPLEASEnology.com> wrote:
>
>>On Sat, 27 Nov 2004 17:52:36 −0600, John Fields
>><jfields@austininstruments.com> wrote:
>
>>> but it still looks resistive because current is
>>>staying precisely in phase with voltage, since where resitance is
>>>gonna be or where it was doesn't matter. What does matter is what's
>>>the resistance right now and what's the voltage across it right now.
>>
>>Phase shift has to be measured over time. No instantaneous measurement
>>of a circuit can identify a phase shift, even a circuit with real
>>capacitors. "Gonna be and where it was" is fundamental to a
>>time−referenced measurement. What matters is how the current waveform
>>looks compared to the voltage waveform, and a point measurement isn't
>>a waveform.
>
>−−−
>I don't know why you keep belaboring this point since I'm not
>disagreeing with you about the way a phase measurement has to be made.
>After all, I did describe my equipment setup and methodology early−on
>in this thread and, if you like, I'll post some scope screen shots of
>the tests.
>
>What I'm saying, and what you seem loath to agree with is that with
>respect to the circuit under discussion it doesn't matter how the
>resistance of the load varies, as long as it stays resistive the
>voltage and current through the resistance _must_ be in phase. Do you
>disagree?

I disagree. I contend that

a. For a sinusoidal source, a time−varying resistive load can have a load current with a non−zero fundamental phase shift, hence a reactive load component. This load component can be expressed as an equivalent inductance or capacitance.

b. For a sinusoidal source, a time−varying reactive load can have a load current with a non−quadrature phase shift, hence a real load component. This real component can be expressed as a positive or negative equivalent resistance. This is why a varicap can be used as a parametric amplifier.

In case a, it takes no power to vary the resistance (as say moving a pot wiper or switching resistors in or out) because the synthesized reactance doesn't dissipate power. In case b, power must be involved in varying the reactance (spinning the shaft of a variable cap, or pumping a varactor) because we're synthesizing a real resistance.

Also interesting is that, in case a, since we can shift the fundamental but can't shift the zero crossings, we must also generate harmonics. There's probably something similar in case b.

I'm not trying so much to win an argument as I am marvelling over a few things I hadn't given a lot of thought to before. There's some sort of neat duality going on here. I'm especially impressed by the requirement to generate harmonics to reconcile the fundamental phase shift with the zero crossings.

>
>Finally, since we're not talking about the harmonics generated by the
>TRIAC turn−on, since the load is resistive, and since the angle
>between current and voltage remains at 0° at any point during the
>cycle, I can't see where you think a phase shift is coming from.

JP and the Phantom have both done the analysis.

John