Re: "Stretching" an inductor

Source: http://sci.tech−archive.net/Archive/sci.electronics.design/2006−10/msg00443.html

- *From*: "Tom Bruhns" <k7itm@xxxxxxx>

- *Date*: 3 Oct 2006 09:40:26 −0700

You wrote, ". . . but I've never found a way of doing anything useful with this circuit."

If as you wrote in the paragraph after that, you put it in series with a resistor, you get a circuit that behaves much like a series resonant circuit. Not only does it go through a phase inversion, but it goes through zero resistance. Similarly if you put it in parallel with a resistor, you get something that behaves much like a parallel resonant circuit: where the gyrator negative resistance equals the parallel positive resistance, the net resistance goes to infinity. If you think of C−R−L circuits (or better, 1/sC, R, sL) as having components that contribute in quadrature, with 90 degrees going from C to R and R to L, you see that you can have the same effect with three components that behave as R, sL and s^2Gyrator; you've just multiplied everything by s. Or you can have a {1/s^2Gyrator, 1/sC, R} set. And you can expand your filtering horizons by having a set {1/s^2Gyrator, 1/sC, R, sL, s^2Gyrator} . . . that lets you implement higher order filters in simpler topologies (if only the gyrator were a simple passive two−lead part!)

Gyrators don't seem to be used very often, but I have seen them used to (presumably) keep the op amp out of the direct signal path, in an attempt to have it contribute less distortion in the passband.

Cheers,
Tom

TuT wrote:

> "John Popelish" <jpopelish@xxxxxxxx> wrote in message
> news:3−GdnQx1MP5UUrzYnZ2dnUVZ_r−dnZ2d@xxxxxxxxxxxxxxx
>
> > Joel Kolstad wrote:
> >
> > > Does anyone know of a simple network that has, say, more than twice the
> > > reactance at 2*f0 as it does at f0? Essentially I'm after a reactance of

> 2*pi*f*(something super−linear).
>
> You can readily convince yourself that going the other way is no
> problem... if you put a small capacitor in series with an inductor, the
> slope of the reactance is lowered (since the capacitor's reactance is
> dropping with frequency), hence making the reactance at 2*f0 less than
> twice what the circuit has at f0.

> There may be some version of a generalized impedance converter that produces a resistive impedance proportional to frequency squared. I have seen some that produce a negative resistance inversely proportional to frequency squared, i.e. −1/D*w^2, where D is a constant based on resistor and capacitor values in the circuit.

That's an FDNR, (Frequency Dependant Negative Resistor), and can be realised with the basic four−op−amp gyrator circuit using two capacitors and three resistors. You can get a negative resistance that either increases or decreases as the square of the frequency, depending where you put the capacitors, but I've never found a way of doing anything useful with this circuit.

You can make a frequency dependant voltage divider with an FNDR and a resistor, but the circuit goes through a phase inversion, the point of inflection being at the frequency where −R = R

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If it's not broken, don't fix it.

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