

Re: Constant AC Current Regulator

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- *From:* John Larkin <jjlarkin@xx>
 - *Date:* Mon, 16 May 2005 08:16:35 -0700
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On 16 May 2005 07:35:34 -0700, dajpe@xxxxxxx wrote:

>I got a call from a company who was having problems getting an AC
>current regulator working. They just needed some basic ideas. I often
>get such calls and I try to help as long as it doesn't take up too
>much of my time.
>
>As near as I can tell, they are using the current to test and calibrate
>current transformers. They needed to route 10 amps of pure 60Hz sine
>wave AC current through a single heavy wire, as part of a calibration
>circuit for one of their products. They said the total resistance of
>the loop was about 0.025 ohms. Their first approach used a small
>variac and a toroid transformer, to produce the needed current.
>However, it was not well regulated. The variac approach worked fine,
>as long as the line voltage remained at 120vac. But since they wanted
>to keep the 10 amps to an accuracy of $\pm 0.5\%$, any line voltage change
>would certainly change the current. They considered attaching the
>Variac to the output of a ferro-resonant constant 120vac supply or use
>a motorized Variac but they really wanted something much more compact.
> They were also concerned about distortion of the 60Hz waveform coming
>from wall outlet, especially at the waveform peaks. I suggested that
>perhaps a cleaner 60Hz signal could be synthetically generated and used
>as a reference. The signal would be fed to an audio amp, which would
>drive the winding of a low voltage transformer, perhaps 24vac. A
>custom wound secondary of the transformer could then generate the
>needed high current. By using another current transformer in line with
>the test loop, in conjunction with an op amp circuit, the AC current in
>the loop of wire could be kept constant. Can anyone think of another
>way this could be done?
>
>David A. Johnson, P.E. --- Consulting Engineer
><http://www.djandassoc.com>
> <http://www.imagineeringezine.com> Home of the Imagineering on-line
>magazine.
>Also, <http://www.discovercircuits.com> A collection of over 11,000
>schematics.

We do this. We use a homemade sine generator (uP and a DAC) to

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generate a stable 60 Hz sine, although there are lots of cheap synthesized waveform generators around these days, so I wouldn't go home-brew again. The homemade generator does generate voltage/current waveforms with phase switchable in precise 45 degree steps, which is handy for power testing.

The sig gen drives a 10-turn pot and a power amp, a Peavey 400 watt/channel 2-channel PA amp. We do two channels, one for current and one for voltage, to calibrate electronic power meters. The current channel has the power amp feeding an old radio-station filament transformer rated 5 volts at 190 amps. The secondary loop includes a current shunt to monitor the actual current. Active feedback would be nice, as the current drifts as things warm up so you have to ride herd on the pot. But you can hold 0.1% pretty easily.

We had to change some of the capacitors in the Peavey to reduce phase shift at 50/60 Hz. They kindly sent us a schematic and pointed out which caps caused the most rolloff.

DON'T use anything ferrous in the loop. We used a "brass" rod to slip the CT over, but it was actually plated steel, and it caused massive waveform distortion.

Working off the AC line is nasty, unless you do a bridge-type thing that doesn't care much about the actual drive level. Even then, harmonics and phase shifts will be a nuisance.

Pearson makes superb current sensors, CTs with integral burden resistors, probably better than using a shunt. The Danfysik DCCT's are even better. Expensive.

John

- **References:**

- ◆ **Constant AC Current Regulator**

- ◆ *From:* dajpe

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