

Pulse electrolysis myths  
Contactless charger update  
Extracting Acrobat PDF url's  
Versatile capacitor switching  
Some electrochemical resources

Uh, whoops. The contactless charger components that we reviewed in [MUSE142.PDF](#) are really *TDK* products.

Additional details can be found at [www.component.tdk.com](http://www.component.tdk.com)

One competitor is *Panasonic* with their model PHS contactless charger. Found up at [www.panasonic.com](http://www.panasonic.com) The [MUSE142.PDF](#) online ezine reprint is now corrected. Sorry about that.

### Pulse Electrolysis?

There are claims kicking around the web that high voltage pulses fed to water easily generates "miracle" amounts of hydrogen quite cheaply. After my careful review, I personally conclude these claims seem based on nothing but wishful nonthinking and appallingly incompetent labwork. In fact, the known physics turn out to be the *exact opposite* of the claims.

Apparently the Ross County, Ohio judge seems to agree. Who has found "gross and egregious fraud" and "a loose grip on reality" involved.

Firstoff, *Faraday's Law* is a pretty basic electrochemical principal that has gotten verified untold countless times. This law clearly tells us that the amount of stuff you'll get at a cell terminal depends absolutely upon the current through the cell.

Electrons in equal electrons out.

This law is so utterly profound that it can be used to accurately measure and even *define* electric currents.

Second, electrolysis is a very poor way to generate hydrogen. Almost all commercial hydrogen gets produced more efficiently and more cheaply by the reformation of methane.

Generating hydrogen is simply not a problem. Your key problem using hydrogen is finding a dense and safe way to store it. STP hydrogen has an energy density of 3.5 watt hours per liter. Uh, gasoline is *three thousand* times better at 9600. Dense storage is what the carbon nanotube excitement is about. We looked at this on back in [RESBN88.PDF](#), [MUSE115.PDF](#), and in [MUSE120.PDF](#), and [MUSE141.PDF](#).

Thanks to *Fourier Series*, any old

group of pulses is *exactly* equivalent to a dc term and some number of ac harmonics. We saw proof of this in [MUSE90.PDF](#). Except for carefully chosen exotic waveforms, all higher order harmonics are normally very weak. Bunches more on Fourier is in [www.tinaja.com/magsn01.html](http://www.tinaja.com/magsn01.html)

Water has a dielectric constant of 81, so we could expect it to be hugely capacitive. It should dramatically *low pass filter* all higher harmonics and *weaken them further*. Thus, a series of water cell pulses can get analyzed

as a dc level plus a few rather weak sinewave low harmonics.

To even suggest that the pitifully weak audio harmonics can remotely approach the microwave frequencies associated with molecular hydrogen resonance is absurd. Even if they did, there's flat out not the tiniest shred of believable evidence that anything unusual or unexpected would happen. Especially since the energy in a weak amplitude harmonic is that weakness *squared*.

Figure one shows us some of the

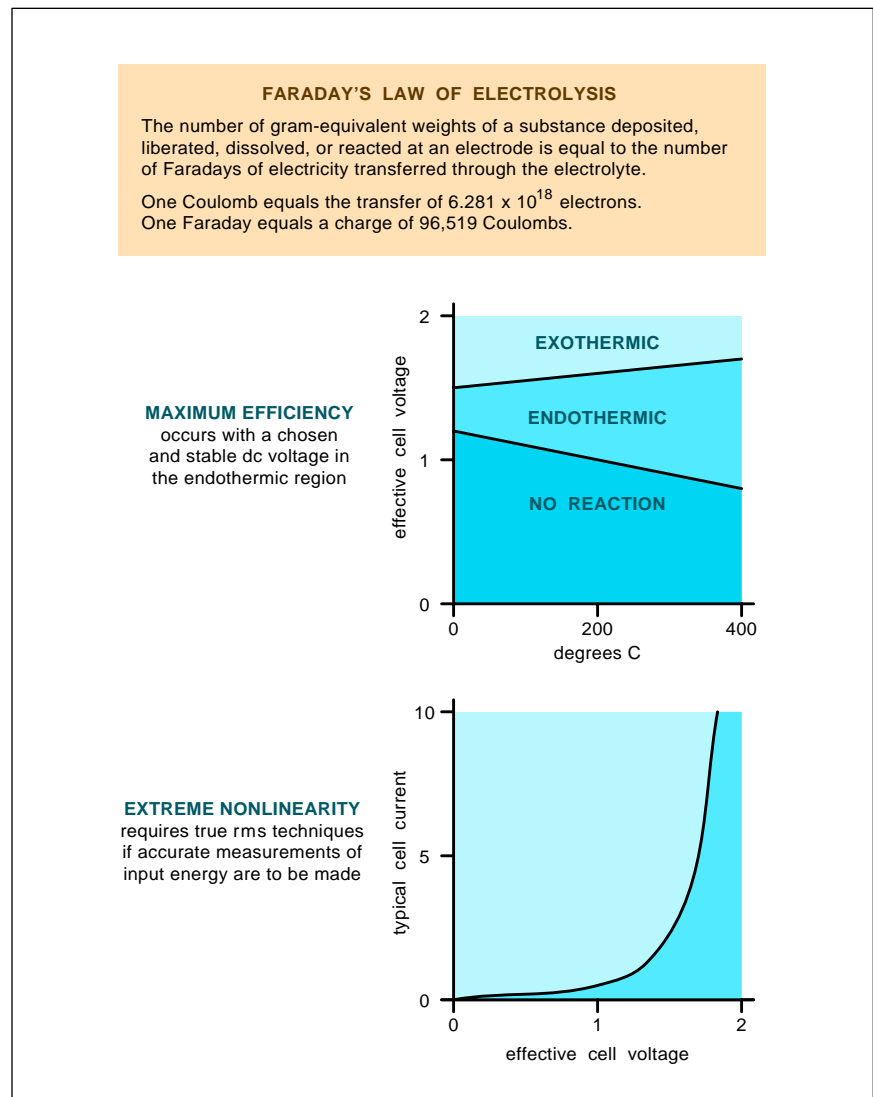


Fig. 1 – FUNDAMENTAL PROPERTIES of hydrogen electrolysis.

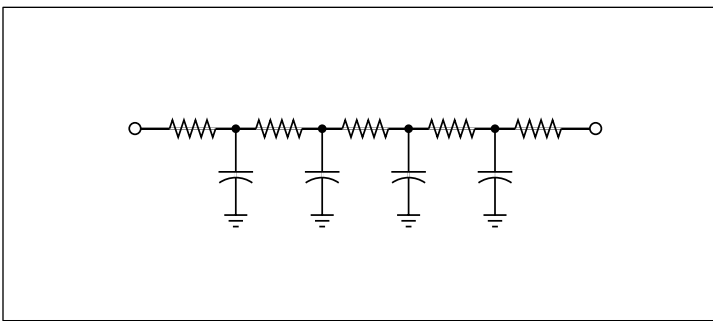


Fig. 2 – A WATER DROPLET can act as a low pass filter that largely prevents the high frequency pulse components from ever reaching the electrolysis terminals.

properties of an electrolysis cell.

Electrolysis takes place from the current that results when a dc voltage is applied to conductive water. Under the *threshold* voltage near 1.28 volts, nothing happens. In the *endothermic* region between 1.28 volts and 1.45 volts or so, heat has to be *added* to the water for electrolysis to occur. *As much as one sixth of all your stored hydrogen energy can originate from ambient heat.*

In this endothermic region, claims of "stays cool" operation would be normal and expected. Just because energy has to be absorbed to produce the gas.

At a *thermoneutral* voltage of 1.45 volts or so, all of the stored hydrogen energy comes from your electricity. Additional input energy is required,

though, to cover *overvoltage* effects and system losses. If you go above the thermoneutral voltage, even more electricity gets wasted as *additional* heat in an *exothermic* reaction.

Naturally, there is no way to profit from being endothermic. Because an electrolysis cell might be up to sixth endothermic, the finest fuel cell you could possibly build will, of course, have to be one-sixth exothermic.

Or worse.

An optimum hydrogen generation cell would apply its nearly constant voltage in that endothermic region. All that superimposed sinewaves can do is shift you temporarily *away* from this optimum. And thus *reduce* your overall efficiency.

Proof? Exotic EIS *electrochemical impedance spectrometry* instruments

routinely measure the pulse response of water and other electrolytes. We saw back in [MUSE137.PDF](#) how EIS sees use in everything from cancer research to corrosion protection.

The untold thousands of EIS tests routinely made day in and day out tell us over and over again that super efficient pulse electrolysis flat out is not gonna happen. In fact, they tell us the *exact opposite*.

There's also this new "hands off" water faucet design which uses the *Qprox* technology you should find at [www.qprox.com](http://www.qprox.com). All their published research clearly shows that very little high frequency energy ever gets even remotely near the contacts of a water droplet. Higher frequency energy is instead *internally* converted to heat.

The *Qprox* faucet from *Quantum Research* emphatically *demands* the *exact opposite* of the pulse claims for its operation. In fact, high frequency losses are carefully *maximized*.

As figure one shows, electrolysis current is extremely nonlinear. It is trivially easy to create pulse power measurement errors. Use of plain old average-responding meters typically give results that can be low by 300% to 500%. For meaningful results, you have to use the *true rms* methods we looked at both in [MUSE112.PDF](#) and [MUSE113.PDF](#) Even then, there are lots of hidden gotchas to gitya.

Figure two shows us how the bulk properties of a water droplet act as a lowpass filter. One that will *prevent* most pulse energy components from ever getting even remotely near the electrolysis terminals.

These outrageous and "not even wrong" hydrogen pulse electrolysis claims are easiest explained by bad labwork. In which a cell impedance mismatch plus lack of understanding got combined with hugely misleading measurement errors and a possible failure to remove excess water vapor from the output streams.

If you feel otherwise, please show credible and reproducible evidence. Sorry, but third hand anecdotal urban lore hearsay of a few clearly misled gullibles won't hack it.

You'll find more hydrogen info at [www.tinaja.com/h2gas01.html](http://www.tinaja.com/h2gas01.html)

It sure would be handy to have an "at the terminals" SPICE model of an electrolysis cell. I've been unable to

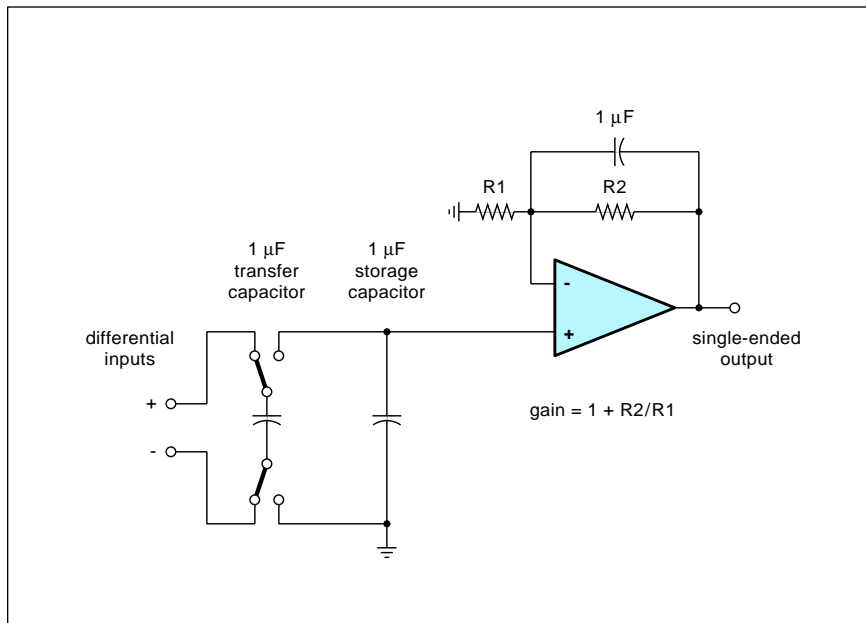


Fig. 3 – AN AMAZINGLY VERSATILE capacitor switching scheme that offers many unusual circuit possibilities.

locate one so far, so this just might make an interesting research project. Such a model clearly would eliminate pulse electrolysis hogwash before it got out of hand.

### Electrochemistry Books

All the electrolysis fundamentals are quite well known and have been kicking around for several centuries. If you think you've found something new, the odds are overwhelming that you are making the very same stupid beginner mistakes that everyone else always does. There are untold layers of subtle gotchas here.

So, if you are at all serious about exploring electrolysis, it makes your most sense to start off with what has long been in print. With this in mind, I have gathered together a few of the better electrochemistry journals, a few newsgroups, and texts for you as this month's Resource Sidebar.

A few of these are volumes in a series of ongoing books. I have only included one sample of series titles.

Your best starting point is right where it always has been: Faraday's superb *Experimental Researches in Electricity*. By far the easiest place to pick up this "must read" text is in Britannica *Great Books* #45.

More info on all of these titles is in [www.tinaja.com/h2gas01.html](http://www.tinaja.com/h2gas01.html) and in [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html)

### Sneaky Tricks With Capacitors

Several rather unique new circuits involve repeatedly connecting two or more capacitors to each other. Those *Quantum* folks we just mentioned at [www.qprox.com](http://www.qprox.com) have a white paper and bunches of tech journal reprints on this topic. Mostly aimed at faucet proximity detectors and obscure stuff like watching fruit ripen.

But by far your best paper of all is the little known, seldom viewed, and underappreciated *Application Note #3* from *Linear Technology*. Otherwise titled as *Applications for a Switched Capacitor Instrumentation Building Block*. Be sure to get their LTC1043 data sheet at the same time.

Figure three shows us where all of these magic tricks start. These are all based on switching a capacitor from an input source and then discharging it into a second capacitor at a chosen rate. While CMOS analog switches

```

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% This routine reads a specified Acrobat file, and attempts to extract all
% PDFMark linked url's from that file. These url's can then be manually
% checked, used by a supervisory language, or converted to HTML where routines
% such as DOCTOR HTML can verify the links.

% To use this program, enter the full path sourcefile and optional html
% target file names below and resave. Then distill the file.

% The url's are returned to the Distiller log file. Note that a NO FILE PRODUCED
% message is normal and expected, since you are after only the log file, not pdf.

% IMPORTANT: Be sure to use "\" when you mean "\"" in any PostScript string!

/sourcepdffilename (C:\Medocs\Muse\Muse 145\muse145a.pdf) def
/targethtmlfilename (C:\Medocs\Muse\Muse 145\graburls.html) def

/wanthtmloutput true def % set flag here if html output wanted
/workstring 65000 string def % temporary workstring

% checkline tests to see if a /URI followed by a space and string is present...
/checkline {(/URI () search {pop pop truncateextra addurltohtmlfile print (\n) print
flush}{pop} ifelse } def

% truncateextra crops everything beyond the closing url parenthesis...
/truncateextra { () search {exch pop exch pop } (There was a sting closing error.\n) print
flush stringclosingerror } ifelse } def

% /starthtmlfile conditionally creates a html file object and writes a html header to it...
/ws {writefile exch writestring} def % file writing utility

/starthtmlfile {wanthtmloutput {targethtmlfilename (w+) file /writefile exch def (<HTML>\n)
ws (<HEAD>\n) ws ( <TITLE>Acrobat PDF url Extractor</TITLE>\n) ws (</HEAD>\n\n) ws
(<BODY TEXT="#000000" BGCOLOR="#FFCC99" \n) ws (LINK="#0000FF"
VLINK="#008000" ) ws (ALINK="#FF0000"> ) ws (<P><B><FONT SIZE=5>\n) ws
(\n\nLinked URL list extracted from ) ws sourcepdffilename ws (\n\n<UL>\n<UL>\n</P>\n)
ws (</FONT>><FONT SIZE=3>\n) ws } if } def

% /addtohtmlfile conditionally adds the current url line to the htmlfile...
/addurltohtmlfile {wanthtmloutput {{<A HREF="} ws ws (>) ws ws (</A><BR>\n) ws } if } def

% /endhtmlfile conditionally finishes up and closes the htmlfile...
/endhtmlfile {wanthtmloutput {{</UL>\n</UL>\n\n) ws (</BODY>\n</HTML>\n\n) ws writefile
closefile} if } def

% ain loop.reads one line of the source pdf file at a time...
/graburls {sourcepdffilename (r) file /workfile % make a file to read
exch def starthtmlfile % start html file if wanted
{mark workfile workstring readline % read one line at a time
{checkline}{exit} ifelse % test lines till done
clearbookmark} loop

(\n\nDone extracting url's from ) print % optional trailer
sourcepdffilename print (\n) print
(\n) print flush

endhtmlfile % complete html file if wanted
pop} def

graburls % This actually does it

```

Fig. 4 – POSTSCRIPT CODE to extract URL's from Acrobat .PDF files.

such as the 4016 or 4066 can be used, special switches with lower and more balanced gate charge coupling are a better choice. One good example is the just mentioned LTC1043.

Let's take a quick tour of some of the amazing things you can do with a seemingly simple circuit...

By repeatedly connecting the first capacitor to a pair of inputs and then

to the second capacitor, you can do a powerful *differential to single ended conversion*. Common mode rejection can easily go beyond a stunning 120 decibels for precise instrumentation opamps. This is also superb for hum reduction or to eliminate any ground loops. You also gain input isolation and possibly get rid of a transformer. But only within the spec limits of the

SOME ELECTROCHEMICAL RESOURCES

Journals & Publications–

Analytical Electrochemistry  
 Electrochemistry Communications  
 Journal of Electroanalytical Chemistry  
 Journal of the Electrochemical Society  
 Journal of Hydrogen Energy  
 Journal of Power sources  
 Surface Engineering & Applied Electrochemistry

Newsgroups–

[sci.chem.electrochem](http://sci.chem.electrochem)  
[sci.chem.electrochem.battery](http://sci.chem.electrochem.battery)  
[sci.energy](http://sci.energy)  
[sci.energy.hydrogen](http://sci.energy.hydrogen)

Books–

Experimental Researches in Electricity (Michael Faraday)  
 Advances in Electrochemical Science ( R. Alkire )  
 Analytical Electrochemistry ( Joseph Wang )  
 Comprehensive Treatise of Electrochemistry ( Brian Conway )  
 CRC Handbook Series in Inorganic Electrochem... (Louis Meites)  
 Electroanalysis ( Christopher Brett )  
 Electroanalytic Chemistry ( Kenji Hirasa )  
 Electrochemical Cell Design (Ralph White)  
 Electrochemical Hydrogen Technologies ( Hartmut Wendt )  
 Electrochemical Interfaces: Modern Tech... ( Hector Abruna )  
 Electrochemical Engineering Principles ( Geoffrey Prentice )  
 Electrochemical Engineering: Science & Tech... ( Hartmut Wendt )  
 Electrochemical Methods: Fundamentals... ( Allen Bard )  
 Electrochemical Process Engineering: A Guide... ( F. Goodridge )  
 Electrochemistry ( A. Hamnett )  
 Electrochemistry for Chemists (Donald Sawyer)  
 Electrochemistry in Mineral & Metal Process... ( R. Woods )  
 Electrochemistry on Liquid to Liquid Interfaces ( P. Vanysek )  
 Fundamentals of Electrochemical Deposition ( Milan Paunovic )  
 Liquid State Electronics of Insulating Liquids ( W. Schmidt )  
 Modern Aspects of Electrochemistry #33 (Ralph White)  
 Modern Batteries: An Introduction to... ( Colin Vincent )  
 Principles of Electrochemistry ( Jiri Koryta )  
 Solid State Electrochemistry ( Peter G. Bruce )  
 Structural Effects in Electrolysis ( D. Scherson )

For more book details, see [www.tinaja.com/amlink01.html](http://www.tinaja.com/amlink01.html)

switches actually used.

If you put a small shunt resistance in your positive or ground lead, this same circuit can measure your supply current, automatically translating the voltage to something an opamp can deal with more elegantly. Thus, this switched cap trick can easily measure millivolts near either supply rail.

By inverting your output switching so your *upper* switch goes to ground, you *invert* the sample on your second capacitor. This generates a *negative* supply voltage. Or inverts your input signal. Use of multiple switches and caps can get you accurate positive or negative input multiples.

If the sampling capacitor is small and your transfer capacitor large, you could pile up a history of samples, or *integrate* your results over time.

The speed at which you flip your switches sets how much energy gets

transferred how fast. This acts like an electrically variable resistor. One that can be digitally programmed.

Careful choice of sampling speeds gives you voltage-to-frequency and frequency-to-voltage capabilities.

Taken together, these can also give you precision digital multipliers.

By sampling your input at a known

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 Web page: [www.tinaja.com](http://www.tinaja.com)

frequency, you can do a *synchronous demodulation*, detecting a very weak signal out of very strong noise. These schemes also once went by the name of *lockin amplifiers*. For very narrow bandwidth tracking filters. Other sync demod apps include the LVDT position sensors in [HACKAR2.PDF](#).

As we've seen, Qprox uses narrow pulse transfer cap switching to quite reliably sense very small capacitance changes. Such as a hand near a faucet or a pear ripening.

Many more examples of capacitor-to-capacitor switching techniques are found in the app note and in various devices from *Linear Technology*, *TI*, *Maxim*, *Dallas*, *National*, and others. More on the fundamentals of analog switches is in my *CMOS Cookbook*.

What can you come up with here?

Acrobat PDF link Extractor

Checking web links in your .PDF Acrobat documents can end up a real pain. Especially if you have to verify them one at a time. Our PostScript as language demo code for this month shows you an easier way. This utility reads any .PDF file and creates a new HTML file that lists *only* the links in the order they occur.

You can then view your created [GRABURLS.HTML](#) output to pick up any obvious spelling or misdirection errors. Or, you can view the file in a browser and live check the links.

But best of all, there's a free new service on the web called *Dr. HTML*. This checks most any HTML doc for everything from bad links to spelling errors to poor program structure. But they presently test *only* HTML files. You can easily reach them up at their [www2.imageware.com/RxHTML](http://www2.imageware.com/RxHTML). Or just click on the HTML button on my *Guru's Lair* homepage.

*PostScript* is exceptionally adept at reading or writing nearly any file in any format. This utility reads a disk stashed .PDF file one line at a time. Each line then can get searched for the magic /URI which has to precede a valid url. The url then gets written to a log and to an output HTML file.

As usual, you bring this utility up in any word processor or editor and then modify it to match your .PDF filenames and locations. You then send it to *Adobe* Acrobat Distiller or *GhostScript* to auto generate the new

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One gotcha: Be sure to use *double* reverse slashes in all your filename strings every time you want a single reverse slash! As written, this code recopies any duplicate url's. Fixing dups is easily done. Details are in my <http://www.tinaja.com/info01.html>

A few very rare url's doing strange things with parenthesis may generate errors. A non-adobe PDF generator could conceivably be incompatible. The unusually long string length used should freely pass most of the image formats stashed elsewhere in your PDF file without overflow errors.

This ready-to-run **GRABURLS.PS** utility and more on PostScript as a language can be picked up from my [www.tinaja.com/post01.html](http://www.tinaja.com/post01.html) or else in [www.tinaja.com/acrob01.html](http://www.tinaja.com/acrob01.html)

Lots of useful stuff here.

**New Tech Lit**

*Texas Instruments* has started up a *Analog Applications Journal*. Recent topics covered were precision voltage references, synchronous inverting, and crosstalk reduction.

A very useful fuel cell link farm is [216.51.18.233/index\\_e.html](http://216.51.18.233/index_e.html) One source of useful fuel cell experimenter kits is *Avista Labs* whose website is now at [www.infotech.com/avista.htm](http://www.infotech.com/avista.htm). The kit prices start under \$400, but more like \$900 is needed when you add up all of the necessary bits and pieces. More fuel cell resources are found up at [www.webconx.com/fuelcell.htm](http://www.webconx.com/fuelcell.htm) or at [www.tinaja.com/h2gas01.html](http://www.tinaja.com/h2gas01.html).

The bottom line is that we simply are not there yet with fuel cells. Big problems are costs, efficiencies, and lifetimes. But a lot of big bucks are being thrown at these issues.

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## Tech Musings

analog wizard Bob Pease is his new and nontechnical *How to Drive Into Accidents. And How Not To*. More at <http://www.tinaja.com/amlink01.html>

More on CD ROM recovery that we looked at back in [MUSE143.PDF](#): A free trial of a *CD-R Diagnostic* utility is up at [www.cdrom-prod.com](http://www.cdrom-prod.com) This code apparently allows recovery of many CD's with trashed directories or that insipid BURN bug.

A good source for odd networking cables and phone adaptors seems to be *L-Com*. You can visit their website at [www.L-com.com](http://www.L-com.com)

Our two featured trade journals for this month include *R.F. Design* and *Information Display*.

A uniquely interesting approach to managing motor harmonics is newly found at [www.borealis.com](http://www.borealis.com) in their *Chorus Technology*. Often, though, I have found the best solutions will mix fancy computing and plain old hardware. My own alternate solutions at [www.tinaja.com/magsn01.html](http://www.tinaja.com/magsn01.html)

For most individuals and smaller tech startups most of the time, any involvement with patents is virtually certain to end up a net waste of time, energy, money, and sanity. Find out why and explore alternatives in my *Case Against Patents* package. From my nearby *Synergetics* ad or through [www.tinaja.com/patnt01.html](http://www.tinaja.com/patnt01.html)

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As usual, most of the mentioned items should appear in our *Names & Numbers* or *Electrochemistry Books* sidebars. These are directly hotlinked at [MUSE146.PDF](#). Be sure to check here before calling my no-charge US tech helpline found in the nearby box. Let's hear from you. ♦

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