I just got yet another letter from somebody trying to "protect" the "idea" they have "invented" by getting a patent. As is typical nearly 100 percent of the time, their idea simply was not worth protecting. Their product has been available off the shelf from a high profile major supplier for several decades.

Yet they never heard of the leading company in the field! Nor did they do an economic analysis of who would buy their product how. Or check into the excessive regulations in their target market. They also did not pick up on the fact that lots of potential buyers would prefer a zero cost all-software solution instead.

The patent, if issued, could end up totally worthless. First, their concept involves a completely obvious safety lockout device. Forgetting that you could buy one off the shelf, there are centuries of prior art involved. Not to mention being completely obvious to any practitioner in the field. Almost certainly, hundreds of other patents would encroach on the claims.

And it’s not in the least clear what purpose their patent would serve once they actually got one. It would in no manner offer any "protection".

Urban lore appears to confuse the words "patent" and "product". These two are totally unrelated.

A patent is a sheet of paper which gives you the right to sue someone. Like a stock option, it is worthless unless exercised. A product is the useful item that goes out the door and makes a profit for you.

Patents have nothing whatsoever to do with today's successful product development! In any way, shape, or form. Most often, they are a totally unneeded sideshow. Guaranteed to cost you time, money, and sanity.

At least for most individuals and smaller startups the overwhelming majority of the time.

Do not even think about a patent unless you’re (a) a long term industry insider person who is (b) aggressively subscribing to all the relevant trade journals, shows, and technical pubs, and who (c) has thoroughly done all their homework, generating (d) full production artwork and real working models currently in an advanced beta test of (e) a genuinely and stunningly new product that has a (f) gross sales potential of at least $12,000,000.00.

Actually that twelve mil figure is sorta low. That’s only the theoretical breakeven. It is based solely on what percentage of final profits you are going to spend subsidizing attorneys and the patent system. The level at which a patent may start to overcome all of the hassles involved is more like a gross of forty million.

Trying to patent any million dollar idea is, of course, ludicrously insane.

In all my many years of running a helpline and developing hundreds of real-world products, not once have I ever found any individual or smaller startup that has genuinely profited from the patent system.

Yet I have thousands of examples of individuals very badly done in by patents. Even murdered by them in heart-attack-during-litigation cases. Putting my money where my mouth
Tech Musings

Fig. 3 – THE ALGORITHM that I’m now using to find magic sinewaves.

When two pole filtered, Magic Sinewave $0080 700F 81F1 F87F E3FF 0FFE$ has an amplitude of 0.84 and a total harmonic distortion (3-17) of a mere 0.034%.

Even when totally unfiltered, the third harmonic distortion is only 0.024% and the fifth ends up pretty much negligible.

Fig. 2 – SOME PRELIMINARY 384-BIT MAGIC SINEWAVES which combine high efficiency and really low harmonic distortion.

is, a free ISMM II if you can find me any exception.

For a check list of when patents and patenting may make sense, look at WHEN2PAT.PDF you will find on www.tinaja.com For lots of working and proven real world alternatives, pick up my Case Against Patents.

The Mensch Computer

What do you use when the BASIC Stamp is too wimpy and a laptop PC is clearly gross overkill? There’s lots of emerging uses for a no-nonsense and easily customized experimenter’s of emerging uses for a no-nonsense

is clearly gross overkill? There’s lots of emerging uses for a no-nonsense expe...
This Month’s Contest

I am not sure exactly what I’ll be doing with my Mench computer just yet. Improving my helpline database (now mostly a humongous notebook), serving my Synergetics Consultant’s Network service, finding new magic sinewaves, and designing CAD/CAM flutterwumpers come to mind.

The beauty of this system is the ease with which it can become most anything from a game to an email terminal to a data acquisition system to a survey instrument to a personal organizer to a special calculator.

Key Western Design watchwords are user empowerment.

But why don’t you tell me instead? For this month’s contest, just tell me what you would use a Mench for. As usual, there will be a dozen or more Incredible Secret Money Machine II book prizes going out to the better entries. Plus the all-expense-paid (FOB Thatcher, AZ) tinaja quest for two going to the best of all.

In addition, I will pass along the more interesting entries to the design engineering team at Western Design Center. At their discretion, they may or may not award Mench computers and development systems to several of the more promising entrants.

Send your written entries directly to me here at Synergetics, and not to Western Design Center or Electronics Now editorial. Let’s hear from you.

More Magic Sinewaves

I’ve been doing a lot more with the magic sinewaves we looked at a few columns back. There are several very exciting new opportunities here.

Megabuck ones even.

Your key secret to induction motor speed controls, auto electronics, solar energy interface, power conservation, uninterruptible line conditioning, and related power electronics is just this: Come up with a cheap and efficient source for variable voltage, variable frequency power sinewaves.

All done by suitably flipping some ordinary “H-bridge” switches from a fixed direct current supply.

Preferably flipping only one-half of the bridge at any time.

A magic sinewave is a repeating long serial string of ones and zeros. Picked to give a variable fundamental frequency and amplitude. Along with harmonics that are either zero or of tightly controlled low values.

Compared against traditional PWM pulse width modulation, these magic sinewaves can be far more efficient, can allow much less heatsinking, use cheaper parts, produce far less high frequency energy, can provide much cleaner waveforms, and end up vastly more “microcontroller friendly”.

To use a magic sinewave, you look its sequence up in a table and shove it out a port. The frequency can be separately set by picking a suitable dwell time between output bits. Most of the job is easily done by a dollar PIC or other low-end micro.

The magic sinewaves are brand new because the good ones have been so excruciatingly hard to find. Things do not begin to get interesting until you get up into the 200+ bit range. And there’s a lot of possible 200 bit...
numbers to thoroughly explore.

Great heaping bunches, even.

Let us see. We started off here a few columns ago with a listing of 210 bit magic sinewaves that had zero harmonics 2 through 10. I expanded on this with several 420 bit solutions which I published in the June 1995 Circuit Cellar and in MAGICSIN.PDF on my www.tinaja.com.

Meanwhile, a math genius by the name of Jim Fitzsimons suggested a “minimum harmonic energy” scheme. Where you make each bit contribute as much of its energy as possible to the fundamental.

Which leaves all bits with neither the energy nor much inclination to generate lots of strong harmonics. While all odd harmonics are present, these are often amazingly weak.

Any magic sinewave trades off its length against the amplitudes you can get, the jitter, the harmonic distortion (with and without filtering), and how many efficiency-robbing transitions are needed. Optimizing everything at once gets real tricky in a hurry.

I’m now working with “minimum harmonic energy” synthesis on 384 bit words. There’s some compelling reasons to use a bit length that is a multiple of 96. First, you’d like each of your four sine quadrants to end up identical. Especially if you are going to fit lots of amplitudes into a tiny address space. Second, you’d like a multiple of three for any three phase power applications.

And third, you’d sure like all three of those phases to be working on the same bit position in an 8-bit word at any given time. Otherwise your code will get too hairy. 3 times 4 times 8 gives you 96. This also easily handles single-phase systems.

The solutions for 96 and 192 don’t give enough amplitudes and require high distortions. 288 is marginal for low end apps. And values above 384 might raise the system clock rates. Or limit frequency choices.

Through a disgustingly sneaky half bit offset trick, you could make each one in your 384-bit word count twice. Giving you a seven bit or 128 level low jitter amplitude resolution. From 0 to 100 percent of supply power. In more or less uniform steps.

Figure two shows us the distortion levels for one collection of 384 bit by 16 transition magic sinewaves. And optimized both for low distortion and for best efficiency. Note that filtered total harmonic distortions average 0.1 percent or less!

One really useful 384 bitter has a quadrant of hex 0080 700F 81FF F87F E3FF 0FFE. Using a two pole filter, the total distortion for harmonics 3 through 17 is a mere 0.034%. Even with no filtering, the third harmonic is way on down at 0.025% and the fifth is utterly negligible.

Only 15 or 16 single switch events are needed per quarter cycle. A PWM circuit might need up to 192 double switching events. For twenty five times the switching losses.

Once you start synthesizing long magic sinewaves, there are all sorts of helpful games you can play. By predistorting you can force certain problem harmonics to zero. Possibly shifting energy higher in frequency where it is more easily filtered. You can also anneal in which you jitter the bits around a little and see if any of the results get better. Annealing can significantly assist most of the low amplitude magic sinewaves.

And by clumping, you can reduce all the transitions without hurting the
distortion all that much. A clumping can be based on an intelligent prebias that encourages a one if you have a previous one, and vice versa.

But a newer and better approach to clumping is to simply list all possible integer clump combinations that sum to the desired amplitude. Then pick the best one. See SUMINTS.PS for some working code.

Figure three shows the algorithm I’m currently using to discover good magic sinewaves. So far, it gives you good results. But not yet the best.

Some filtering is often needed with any magic sinewave. Typically, your motor inductance can give you the first pole for your filter. Results are dramatically improved if you can use a two pole lowpass filter that drops off at -12 decibels per octave. And cutting off at the second harmonic.

Even unfiltered harmonic energy could get reduced with longer magic sinewaves. Or by permitting extra transitions per cycle.

What does all this mean for you? There is now a brand new "magic" way to produce power sinewaves that looks like a very promising route to solve some rather tricky problems.

Judging by what’s happened so far, there are even more exciting magic sinewaves waiting in the wings. All that is needed is the time, effort, and funding to isolate them.

My preferred tool for this leading edge work is that incredibly superb general purpose PostScript computer language. Helped along, of course, by my good old Apple IIe.

PostScript handles 384 bit words with aplomb. You simply put them into strings and then manipulate the strings. It takes around a thirtieth of a second to find all the harmonics of any magic sinewave.

In fact, we’re sort of having a race. Jim is using absolute mathematical rigor on a gonzo supercomputer. And I’m intuitively "shaking the box" to see what falls out of an Apple IIe. As of last night, the Apple was at least temporarily in the lead.

Much more on all of this is on the magic sinewaves library shelf of my www.tinaja.com You will find dozens of the latest files here. Including a new MSINPROP.PDF development proposal. All of those actual magic sinewaves using the algorithm from figure three are in MS384X16.TXT and SINTOOLS.PS.

By the way, magic sinewaves can sometimes be used to eliminate the capacitor in certain two-phase motors such as those used in air conditioning blowers. But on the other hand, you should avoid using magic sinewaves with any capacitor or other high pass filtering device.

I have now got some brand new ready-to-run hardware. Including a three phase system in less than 200 machine language instruction bytes! And lots of source code that can be made available. On a consulting or a codeveloper basis.

Give me a call if you want to tap this big bucks opportunity.

A New Stepper Driver

National Semiconductor has been generous with free samples lately. Especially their LM45 temperature sensor, the ADC16071 Sigma-Delta converter, or the LMC6001 and LMC6462 op amps.

The usual way you pick these freebies up is with the postcards in E.E. Times, EDN, Electronic Design, and similar trade journals. Much more on this in my Resource Bin and Blatant Opportunist reprints.

Their LMD18245 stepper motor drive chip is interesting. Figure four shows us additional details on this 3 amperes, 5 volt device.

There are several problems when driving a stepper motor. The first is efficiently sensing the motor winding current. National uses the "lossless" scheme in which they parallel 4000 or so identical output transistors and then sense the current through only one of them. Giving a scale factor of a quarter mil per amp.

The second is to use current drive. When you attempt voltage driving a stepper, you’ll get into time constant problems that very much limit speed and power. Using current drive, you apply your full supply voltage to the
stepper winding. With zero current limiting resistance.

That inductance of your stepper winding should cause your current to ramp up at the usual \( \Delta I/\Delta t = e/L \) rate. When you reach the desired current level, you'll quickly turn your drive power off. You repeat this process many times per stepper phase.

A third problem is that you will usually want higher currents when you are stepping than when you are holding. National handles this with an on board four-bit D/A converter. Which lets you set your stepper drive current to sixteen possible levels.

Including zero.

As with any coil, you'll never want to suddenly stop the current. Doing so will generate destructive voltage spikes. Problem four involves safely shutting down the drive. To do this there is a brake input that effectively shorts the stepper winding, letting the current safely decay to zero.

A separate direction input lets you decide which end of the H bridge gets positive supply current.

The wide TO-220 package includes power drivers. Some heat sinking is required. A pair of chips are needed for two-phase stepper motor use as shown. This chip and others in the family may also be used in DC motor drives. External MOS transistors can be added for higher voltages.

A PIC chip is ideal to control the LMD18245. Suitable interfaces are offered by Scott Edwards Electronics with his Pseudo Stamp.

Yes, the new magic sinewaves will interface beautifully to several chips in this series for ac motor drive apps.

PCMCIA Card Resources

I’ve been getting quite a few calls on the "memory cards". Credit card plug-ins which first started life as laptop memory inserts. But they now include modems, MIDI drivers, data acquisition systems, new CAD/CAM driver interface, Ethernet comm, and even GPS receivers. So I guess we’re due for a resource sidebar.

These are correctly called PCMCIA cards. Short for Personal Computer Memory Card Interface Association. The best starting point is the PCMCIA Developer’s Guide. A book and disk combination available from Syocard Technology at $90 list. One second source for texts on cards and flash memory is Anabooks.

The leading industry trade journal is IC Card Systems & Design. The other names on our list are mostly suppliers of support hardware and test systems. Plus various cards.

Let me know if you want to get into more details on all the pinouts, timing, and similar specs.

New Tech Lit

From Hitachi a pair of new data books on Wireless Communications and Optoelectronics. Through Micrel Semiconductor, a new data book on Analog Power Integrated Circuits. From Temic, a catalog on RF IC’s for Wireless Applications. Temic is a renamed Telefunken. A data book on surface mounted transistors and such is offered by Central.

A Power Factor Correction guide is offered by SGS-Thomson. Speech modules suitable for toys and other low end applications are offered both from Ozen Sound Devices and Ming Engineering. Ming also has its new Electronic Products Catalog having some great breadboarding stuff in it. Wall adaptors at ultra low costs in infinite variety are available by the zillions at Surplus Traders.

PAIA Electronics has a brand new Theremin kit.

Motorola has a free sample pack including dozens of their new BRT Bias Resistor Transistors. These are your choice of a NPN or a PNP along with a pair of integrated resistors. Mostly for "RTL" glue logic, LED drivers, and such.

For the fundamentals of digital integrated circuits, check into my TTL Cookbook or CMOS Cookbook. Either by themselves or as part of my Lancaster Classics Library. See my nearby Synergetics ad for details.

As is usual, instant help answers, preprints and reprints of most of my stories and all referenced files are available on www.tinaja.com.

You’ll also find our consultant’s network and scads of annotated hot links here. Come visit.

Most of the mentioned resources will show up either in the Names & Numbers or PCMCIA Memory Card sidebars. Be sure to check here first before calling our tech helpline.

Let’s hear from you.