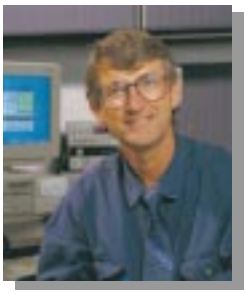
Engineering EDUCATOR
The latest news about teaching tools, measurement technologies and innovations in engineering education

Elderberries

Marsh Faber, Editor



ON a steep slope in our back yard we have a large "garden", most of which was planted by Mother Nature. From the looks of things, she is partial to bindweed. While doing some thinning last year, I spotted a bush with a pithy stalk. I didn't like the way it looked, so I chopped it back. This spring, while my wife Jean and I attended a wedding at a friend's house, we saw a familiar tree. Its leaf structure was similar to that of the bush I chopped. When we inquired what it was, our friend said, "Oh, that's an elderberry bush. It's actually a tree now. The horticulturist told us it's about 110 years old, making it the oldest one of its kind in Colorado."

That was a great lesson. I now nurture that bush in our yard. This fall I took my cereal bowl out into the yard each morning and topped it off with fresh, sweet elderberries.

During this transition phase, as Agilent Technologies moves from being part of HP into its own separate identity, I have met with people I have known for years. But they aren't the same people. There's a new excitement in their voices. Obviously, being part of a big "startup" is one reason for the excitement, but there's another: We have taken time to know each other. Not just by name, but by aspiration. I now know that one friend tracked down some osage orange wood and made several hunting bows. Another quit HP to become a Shakespearean actor for two years, while a third survived a near-death experience.

It's a powerful force, this sense of intimacy. Colleagues become friends, with a common sense of purpose. Of course, the excitement isn't limited to Agilent. It must run rampant in the education community. Imagine being surrounded by students full of idealism, and talents they haven't yet discovered. I envy your position: to stand in the rejuvenating breeze of enthusiasm and energy. Simply by getting to know each young, excited mind, you can grow your own garden, with roses and lemon mint, carrots and eggplant. And elderberries.

Marsh Faber
Education Marketing Manager
Electronic Products and Solutions Group

IN THIS ISSUE

VOL. 4, NO. 1
WINTER 2000

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Innovating the HP Way

Share Your Thoughts

Marsh Faber, Editor

This newsletter, as well as the HP Educator's Corner Website (**www.EducatorsCorner.com**), is intended to help you, the educators responsible for shaping students into competent engineers. But to do a good job of meeting your needs, we ask for your feedback. Please e-mail your comments, questions and concerns to Marsh_Faber@agilent.com.

Dear Readers,

At the last ASEE meeting, we asked a number of college engineering professors (that's you) to fill out a survey aimed at helping students get through engineering school and be successful in their engineering careers.

Your advice was varied, but there were a few common threads, such as:

- *Keep studying throughout life*
- *Don't get too specialized*
- *Go for a varied career*
- *Go where the "action" is*
- *Study ALL the homework questions and internalize them, so you can answer questions that go beyond the assignments.*

If you don't see your answer above, keep looking. We'll be publishing your answers along with your name and photo (if you gave us permission to do so) on the student website: ***www.FutureEngineers.com****. Look under "School Success".*

A hearty thanks to those of you who took the time to share your wisdom. And if you haven't already given us your input on what it takes to be successful in engineering school, feel free to do so by sending me an e-mail message (Marsh_Faber@agilent.com).

Marsh

Mirror Image

Hey Marsh,

I don't know if you noticed, but your picture in the "Engineering Educator" is a mirror image, not a true image. You probably look fine to you, but the equipment in the background looks odd.

Wayne Hill
Director of Engineering Labs
Drexel University

Wayne,
I know. Not sure why the photo is reversed, maybe it was my good side!
Marsh

Looking for Links

Here are two representative newsletter comments regarding the A/D converter-lab from the University of Michigan:

1. "Hi, I could not access the link from this home page: **http://www.tmo.hp.com/tmo/iia/edcorner/English/educatorlinks.html**. Do you have to have special rights?"

2. "Most of the microprocessor materials and ADC materials are not accessible on the Internet website. Your advertising is misleading. I can use this material immediately."

It's there. Honest. We're innocent. Call off the hounds.

It turns out there was a glitch at the University of Michigan, where someone accidentally turned off the permission to access Professor Reinhardt's site. If you need the direct URLs, they are:

Prelab Questions:
http://www.eecs.umich.edu/courses/eecs373/w99/lab8.pdf

Xilinx:
http://www.eecs.umich.edu/courses/eecs373/w99/DNLD.pdf

Lab Expansion Board & LOCAL DEVICES Macro in the EECS373 Library:
http://www.eecs.umich.edu/courses/eecs373/w99/

Basic I/O Schematic:
http://www.eecs.umich.edu/courses/eecs373/w99/SIMPLE.pdf

These are also accessible from our Links page on Educator's Corner. By the way, while the main site of Agilent Technologies has moved from ***www.hp.com*** *to* ***www.agilent.com****, please note that we still maintain the same URL for the Educator's Corner and Future Engineers sites:*
www.EducatorsCorner.com
www.FutureEngineers.com

Please come visit us.

Marsh
Marsh_Faber@agilent.com

Agilent Technologies: Business as Usual for New Company

Joanne Kelly
Freelance Writer
Boulder, Colorado

Here's a question your colleagues in the business department might want to include on their next exam:

Why would a multi-national company that's spent decades building a high-quality brand image decide to spin off its original businesses into a new company and give it a different name?

a. To sharpen focus and attention
b. To improve speed and responsiveness
c. To increase accountability
d. All of the above

The correct answer is "d" and, as you probably know by now, Hewlett-Packard has taken the dramatic leap, creating a new company called Agilent Technologies that incorporates the company's original test and measurement businesses.

The name "Agilent," derived from the word "agile," reflects the new company's focus on providing breakthrough products and services with agility, speed and a commitment to meeting customer needs.

Impact on Educators

That all sounds pretty wonderful, right? But if you're like most engineering educators, you are probably less concerned with the generalities of the corporate vision and more concerned with how this "strategic realignment" is going to tangibly affect you, your school and your students.

The short answer is "not much."

"Only our name has changed — now more than ever we have an attitude of finding better ways to meet your needs," says Marsh Faber,

Agilent Technologies
Innovating the HP Way

The Agilent symbol represents a "spark of insight."

"As Agilent, we should be able to widen the scope of the (education) program, becoming even more responsive and giving educators even more resources to use."

education marketing manager for Agilent's Electronic Products and Solutions Group. "As an $8-billion company with a small company attitude, we'll be even more responsive to our customers. We're already focused on engineering educators, so from their standpoint, things will not change a lot," says Faber.

Education Program

The Education Program will stay essentially the same. "The purpose of the Education Program is to share our company's resources — to help engineering educators be more informed and more productive," says Faber, who founded and led the program for HP. "That won't change. As Agilent, we're just as committed to providing a variety of resources — teaching tools, lab experiments and information about measurement technology, for example — to the faculty who are nurturing the next generation of engineers."

"We'll still publish the Engineering Educator newsletter and keep updating the Educator's Corner (**www.EducatorsCorner.com**), but our goal is to be even better. As Agilent, we should be able to widen the scope of the program, becoming even more responsive and giving educators even more resources to use."

Products and Service

HP benchtop instruments will soon begin to feature the Agilent name and logo on the front panel. Everything else about the instruments, however, will remain the same. "We'll continue our same warranty and excellent support throughout the world. We will continue to develop high-value products. These products are industrial products, they are not "education" products that have been stripped down for the marketplace. The students will still be working with the real thing. We will continue to service the HP instruments and honor those warranties, just as we have before," says Faber.

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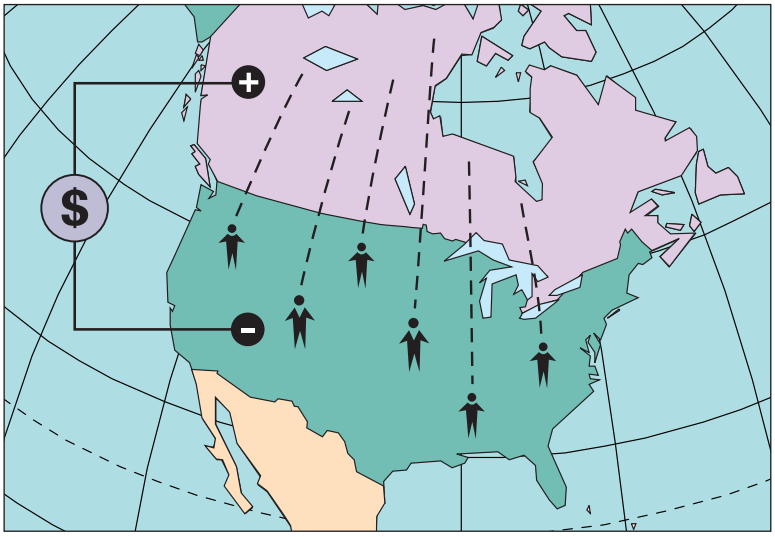
Canadian Engineers and Educators Head South

Many of Canada's "best and brightest" engineers and computer scientists are heading for the border. According to a recent study by the Conference Board of Canada, each year the equivalent of 52 percent of the country's new engineering graduates and 69 percent of its computer science graduates head for greener pastures in the United States.

Lower taxes seem to be the biggest draw, but higher pay and better job opportunities in the U.S. are also major factors fueling the Canadian "brain drain." Typical design engineers in Canada shoulder an average tax rate ten to 15 percent higher than their counterparts in the U.S. And the high-tech salary differential between the two countries is often even bigger, particularly when currency exchange rates are factored in.

The influx of Canadian engineering and computer science graduates is helping to alleviate the shortage of skilled engineers and scientists in the U.S. While the number of engineering jobs is steadily increasing, U.S. colleges and universities are awarding fewer engineering degrees. A study by the American Electronics Association says high-tech degrees awarded in the U.S. dropped five percent, from 218,820 in 1990, to 207,684 in 1996. One of the reasons cited for lower enrollment in engineering schools is that students prefer to pursue career opportunities in fields that are not so difficult to master.



"Many U.S. companies come to Canada to recruit engineering graduates—both at the graduate and undergraduate levels," says Safwat Zaky, chairman of the department of electrical and computer engineering at the University of Toronto. "They know that the quality of our graduates is very high."

Engineering Faculty Also Affected

But it's not just engineering students who are moving south. According to Zaky, University of Toronto has lost a number of good engineering faculty candidates over the last two or three years to more lucrative offers in the U.S.

"The process of hiring is becoming extremely difficult," says Zaky. "Our market for faculty is international—we attempt to hire the best candidates, no matter where they are from."

So how do you solve a problem of this magnitude? Zaky says his school has begun to take a fresh look at salary offers and cost-of-living issues. "We don't want money to be an impediment. We're trying to get to the point where a candidate's decision is not based on money."

Fortunately for Zaky and other Canadian engineering schools deans, many educators are motivated more by a love of teaching than by the lure of additional income. When we asked Peter Smith, associate professor of electrical and computer engineering at McMaster University, if he was ever tempted to jump on the bandwagon and head for the U.S., he replied without hesitation, "Goodness, no. I don't do this for the money."

On the following pages you'll find a lab exercise from another dedicated Canadian educator, Joyce van de Vegte, from Camosun College.

Vowel Spectra and Speech Recognition

Joyce van de Vegte
Electronics and Computer Engineering Technology
Camosun College

Human speech is a complex mixture of frequencies between 100 Hz and 20 kHz. The challenge of speaker-independent continuous-speech recognition lies in being able to parse words from strings of sound and match them to stored templates[1]. Speech signals are far too complex to compare in the time domain, as Figure 1 illustrates. For one thing, each time a word is spoken, it takes a different amount of time. For another, it is difficult to reproduce the word at exactly the same volume each time. Also, the unique characteristics of each person's vocal tract means the way words are produced and joined is different for each individual.

Most successful speech recognition algorithms rely heavily on the frequency characteristics of sounds. The spectrum of a signal shows, for each frequency, the size of that frequency's contribution. The size is often shown in dB. A sine wave contains only a single frequency, so its spectrum contains a single spike at that frequency. A piano chord, consisting of three notes, has three distinct spectral spikes. Normally, to observe signal spectra, it would be necessary to record the signal, then process it afterwards using a software package and finally present the results graphically. The process is much simplified through the use of the 54645A General Purpose DSO with the 54659B RS232/ Parallel Measurement/Storage module. It provides built-in FFT capability, which means that spectra may be viewed conveniently in real time. 34810B BenchLink Scope software allows the spectra to be inserted into documents with ease. Figure 2 shows the spectrum of the first instance of "five" from Figure 1. It is evident from the spectrum that the word "five" contains frequencies between 190.4 Hz and 1.521 kHz, with particularly strong contributions at 190.4 Hz and 771.5 Hz.

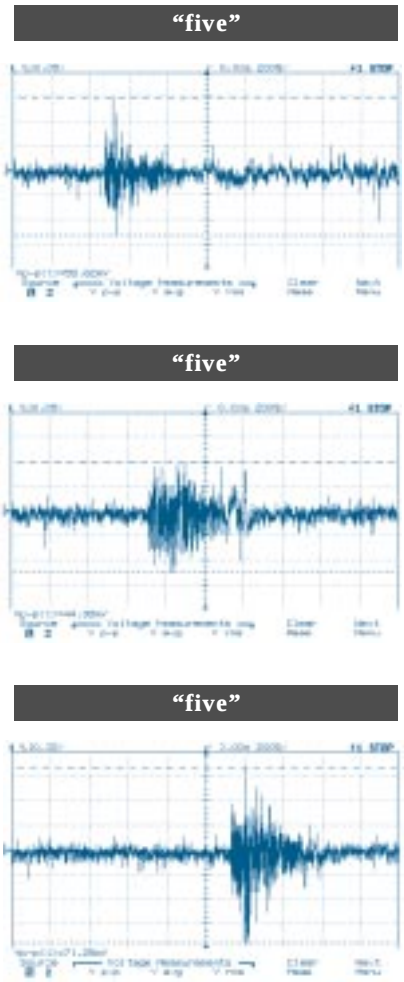


Figure 1: Time Signals

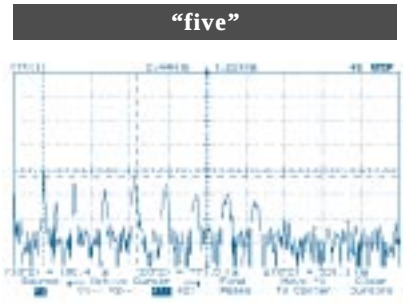


Figure 2: Spectrum

[1] All signals and spectra recorded using an Electret microphone and the 54645A General Purpose DSO and 34810B BenchLink Scope software.

Continued on page 6

Vowel Spectra and Speech Recognition

Continued from page 5

Of all the sounds that humans can produce, vowels have rather unique spectra. The time traces for vowels show their repetitive patterns, as Figure 3 illustrates. Sounds like this have very simple spectra, comprised of just a few peaks. For vowels, these peaks are called formants.

As a simple exercise in speech recognition, vowel spectra can be analyzed for formant frequencies, and these frequencies can be used to identify unknown vowels. Figure 4 shows a sample spectrum for each of the vowels, recorded with a sampling rate of 5 ksamples/sec. Four such spectra were recorded for each vowel and formant frequencies were identified using the “Find Peaks” and cursor capabilities of the scope. Table 1 shows the first four formant frequencies averaged for each vowel.

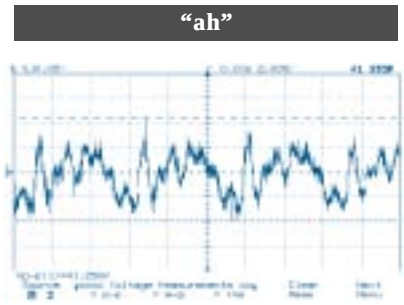


Figure 3: Vowel Signals

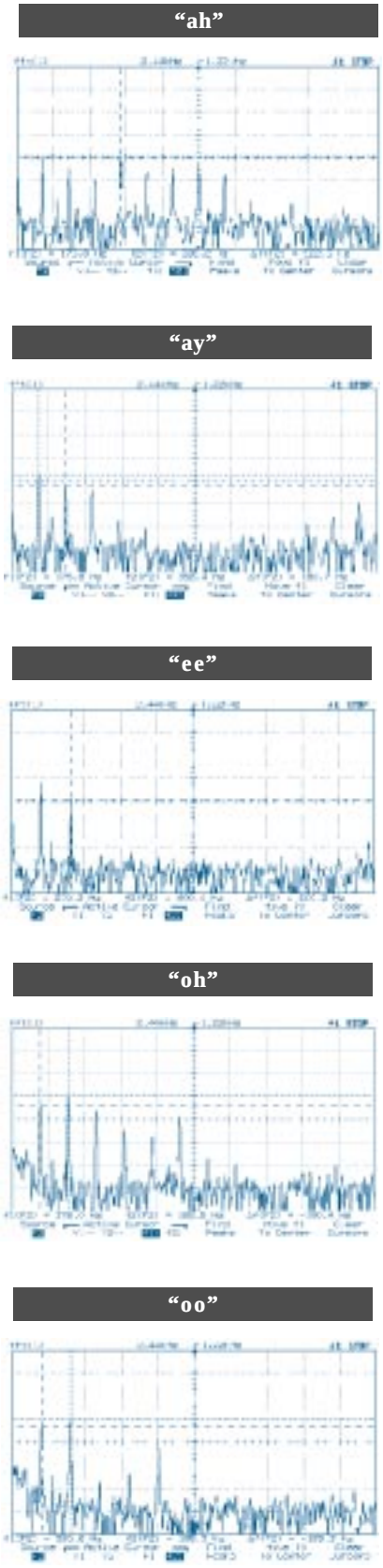


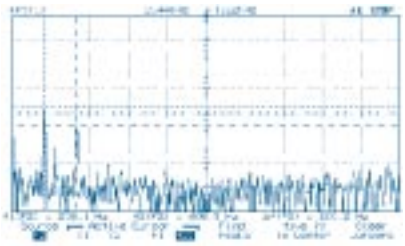
Figure 4: Vowel Spectra

Two unknown vowel spectra are provided in Figure 5. Can you identify the major formant frequencies? Table 1 and Figure 4 can be used to identify the vowels. The answers are provided below[2]. Realize, though, that the formant frequencies vary widely for different speakers, so this scheme is limited to simple, speaker-dependent isolated-vowel recognition. To test the system for your own voice, record spectra for each vowel and note the formant peaks. The more trials you use, the better your averages will be. Ignore any peaks that are present when you are not speaking. To get the best spectra, produce long, sustained vowel sounds. You should be able to verify that the data you collect are consistent with test vowels you record afterwards.

Vowel	First Four Formant Frequencies, Averaged (Hz)			
	f_1	f_2	f_3	f_4
ah	189.2	374.9	563.3	751.2
ay	184.3	371.3	555.2	
ee	195.3	387.9		
oh	186.7	370.9	555.5	741.5
oo	197.8	393.7	1131.1	

Table 1

Unknown Vowel #1



Unknown Vowel #2

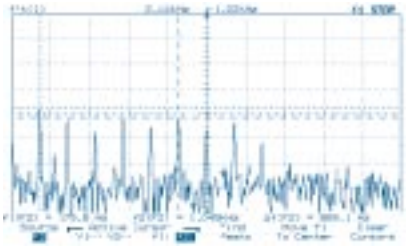


Figure 5: Unknown Vowel Spectra

Speech Recognition Technology in Action

The Camosun "Vowel Spectra and Speech Recognition" lab illustrates some fundamental concepts of speech recognition. As students break speech into short patterns, they begin to understand how the technology works. Relating this to real technology can be a powerful inducement to learning.

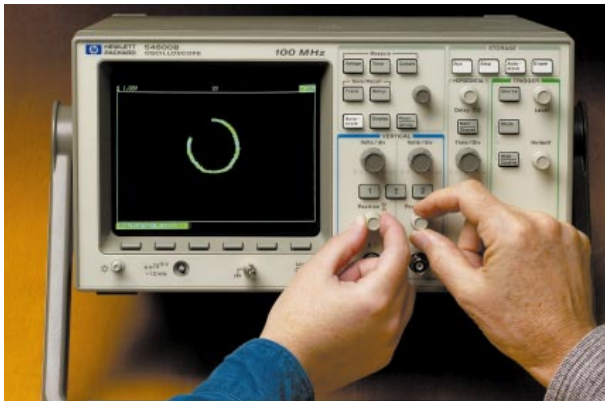
Here's one way to do that: show them the new VoiceControl option for Infiniium oscilloscopes. You simply speak into a collar-mounted microphone to operate the front-panel controls, leaving your hands free to deal with the intricacies of probing fine-pitch devices. Use natural English language commands such as "set channel one to 1.25 volts per division."

Now if you could just implant one of these voice recognition circuits in your students, imagine the results of a command like "learn this overnight" or "pay attention." Hmmm, maybe not.

For more information on Infiniium scopes go to **www.EducatorsCorner.com/links**

[2] Vowel 1: "ee", Vowel 2: "ah"

The Etch-O-Scope



An HP 54600B oscilloscope can be turned into a great lesson in teamwork.

Objective:

Sometimes students, especially those taking a course in "Engineering for Non-Engineering Majors", are hesitant to touch lab equipment. This simple exercise helps students quickly overcome that fear and learn about the operation of oscilloscopes in a non-threatening team atmosphere. Topics covered: XY mode, horizontal sweep.

Introduction:

When I was a kid, my parents gave me an Etch-a-Sketch®, a simple toy with two knobs. Move the knobs and you create a drawing on the "laptop display." To erase the drawing, you just turn it over and shake it. (We don't recommend that you erase the oscilloscope screen in this fashion.)

We can simulate the Etch-a-Sketch by using the X and Y inputs of an oscilloscope.

Procedure:

1. Remove any connections from the front terminals of the HP 54600B.

2. Turn on the power switch (white push-button, lower center).

3. Push the SETUP button.

4. Look at the "soft key" functions at the bottom of the display. One of them says, "DEFAULT SETUP."

5. Push the button just below "DEFAULT SETUP" to put the scope in its "default" mode, eliminating any changes that the last person made when using the oscilloscope.

6. Push the "MAIN/DELAYED" button. A new set of keys will be displayed.

7. Under the display "XY", push the button. This puts the scope in XY mode, so that anything going into Channel 1 will move the dot on the display in the horizontal (X) direction, and any signal into Channel 2 moves the dot in the vertical (Y) direction.

8. Look at the knobs above the input connectors for Channel 1 and Channel 2. Turn both the "Volts/div" knobs counterclockwise several

"clicks". This reduces the sensitivity of both channels and makes a smaller dot. You should see a green dot somewhere on the screen.

9. Using the "POSITION" knobs above CH1 and CH2, move the dot somewhere near the center of the screen.

10. Put the scope in AUTOSTORE mode by touching the AUTOSTORE button near the upper right corner of the panel.

Now the scope is set up. Each time you move the position knobs, the dot will move and its track will be "remembered" and displayed by the scope. If you want to get rid of the trace, simply touch the ERASE button (upper right-hand corner of the panel).

Now try this teamwork exercise:

11. One lab partner controls the CH1 POSITION knob (the X direction).

12. The second lab partner controls the CH2 POSITION knob (the Y direction).

13. With one lab partner on each knob (No cheating! Two partners required!), draw a circle. It will take a few tries, and you may have to erase the trace to get a good circle. When you feel you are getting good at it, try drawing it a little faster. Compare your circle with that of others in the class.

Just for fun, try your hand at producing some more creative images, like the samples on this page.

Marsh Faber
Agilent Technologies

What's the point?

This exercise demonstrates how a simple oscilloscope works. In old analog scope designs, an electron beam is deflected in the X or Y direction. Signals hooked directly to the deflection plates then produce a plot of X vs. Y when the electron beam hits the phosphor on the screen (Figure 1).

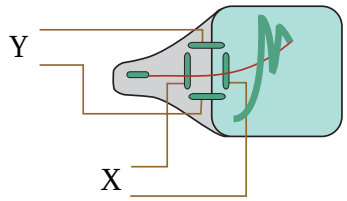


Figure 1. The electron beam is deflected in the horizontal direction by the "X" plates, and in the vertical direction by the "Y" plates.

This is called a "vector" display, because the X and Y static deflection plates can write in any direction, similar to a vector in math. In the real instrument, amplifiers and attenuators increase the dynamic range, but the principle is the same.

A vector display is expensive to build and calibrate against a physical grid. With the advent of good Analog-to-Digital (A-to-D) converters and digital signal processing (DSP), oscilloscopes no longer need to rely on a vector display to accurately reproduce the signal. In a digital storage oscilloscope (DSO), the data is simply converted to digital format and stored in a RAM, to be reproduced on an inexpensive raster display. Since the grid is also reproduced electronically, the need for calibration is partially eliminated. Still, the philosophy behind the modern DSO is similar to the ideas shown in these exercises.

Most measurements made on an oscilloscope are not X vs. Y, but are instead X vs. T, where T represents time. In order to look at the unknown signal vs. time, we'll inject a "Sweep" signal on the X input. Try it:

14. One lab partner is the "Signal" (Y input), while the other is the "Sweeper" (X input).

15. First, set the dot back to the middle of the screen, then erase the drawing.

16. Lab partner Y ("Signal") moves the CH2 POSITION knob at random to simulate an unknown signal. This should create a vertical line at the center of the screen. Notice there's not much information here—only the total peak-to-peak swing of the Y signal.

17. Now use the X and Y knobs to move the dot to the left center of the screen. Erase the drawing.

18. As lab partner Y ("Signal") moves the Y knob up and down, Lab partner X ("Sweeper") slowly moves the dot across the screen from left to right by moving the CH1 POSITION (X) knob.

Look at your results and comment on the arrangement.

19. How well calibrated is the sweep speed?

20. What happens when you get to the end of the screen?

In a real measurement situation, we often look at repetitive signals. That means we need to repeat the sweep across the screen, something like this:

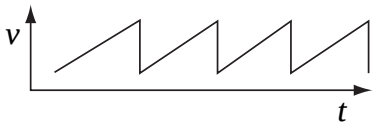


Figure 2. The sawtooth horizontal sweep waveform

Questions:

1. To which input should we connect this signal?

2. Why is the signal shaped like this?

3. What will happen to the display if the "fall time" of the vertical segment is too slow?

4. How will the oscilloscope know the proper time to begin the "sawtooth"?

Conclusions:

1. While most modern oscilloscopes do not use vector displays, this exercise helps us get a "feel" for what the oscilloscope does.

2. For a vector display, the sawtooth waveform must be linear, precisely timed and synchronized with the input in order to produce an accurate display on an analog scope. (Note: The sawtooth waveform is also used in raster displays.)

New Logic Labs Now Online

If you teach an undergraduate digital circuits course, be sure to see the latest labs we've added to the Educator's Corner website: a complete set of labs for an introductory logic course. Submitted by Professor Anthony Johnson of the University of Toledo (Ohio, USA), the labs introduce students to Boolean arithmetic and logic gates, starting with simple AND and OR functions, and building to more complex circuits like shift registers and counters.

With the growing prevalence of digital electronics in our world, some schools are not waiting, as they previously did, until the third or fourth year to introduce their students to logic courses. Schools like the University of Toledo are offering hands-on logic labs as part of the first-year curriculum.

One of the challenges of early logic-lab experiences is that first-year students are not yet ready to operate a logic analyzer. A more familiar, self-explanatory tool could make the professor's job easier and the student's experience less frustrating. One such tool is the Agilent Technologies 54645D Mixed-Signal Oscilloscope. This tool seamlessly integrates 2 standard oscilloscope channels with 16 logic channels, without sacrificing the simple controls and easy, intuitive operation of a "scope."

"The 54645D provides first-year students with a fairly simple way to do what they need to do, but it still has the power and flexibility to provide the functionality they need in more advanced courses," says University of Toledo Professor Richard Molyet.

For more information about the 54645D MSO or for a direct link to the new logic labs, visit **www.EducatorsCorner.com/links**

New Analyzer at Half the Cost is Easier for Your Students

Are you reluctant to offer a logic lab to your undergraduate students because you think logic analyzers are too expensive and too difficult for students to use? If so, you're not alone. But it may be time to reconsider. Agilent Technologies has just introduced Logic*Wave*, a new low-cost, PC-hosted logic analyzer designed specifically to be easy to use.

Logic*Wave* uses your PC monitor as the instrument's display, which is one of the reasons it's priced at about half the cost of comparable benchtop analyzers.

Familiar features like drag-and-drop, toolbars and pull-down menus make using the analyzer less complicated and less intimidating. Logic*Wave* is designed so that most common functions are available on a single screen, so your students won't have to search through layers of menus. Most people who try Logic*Wave* — students and professionals alike — are amazed by its simplicity.

You can preview the actual interface yourself, or have your students try it, by downloading the free Logic*Wave* interface from the web. We've even loaded some generic logic data, so you can use the downloaded example as a teaching tool. Go to **www.EducatorsCorner.com/links** for a direct link to the download page.

The Logic*Wave Logic Analyzer: 34 channels with 100 MHz state and 250 MHz timing analysis; 128 K sample depth per channel. Download the interface software free from our website.*

Agilent Technologies: Business as Usual for New Company

Continued from page 3

Philanthropy

Kay Lichtenwalter, Agilent university affairs manager, described the company's approach to philanthropy as "business as usual." "Before, when faculty from 4-year colleges wanted to apply for a grant involving test and measurement equipment, they'd go to an HP website and fill out the forms," she says. "Now they'll go to an Agilent Technologies website and fill out the forms. And if they go to the wrong company's website, they'll find a link to the one they're looking for. My goal is to make it as easy as possible for professors and administrators."

Some educators may notice one minor downside to the split. In the past, you could apply to HP for grants of both computer equipment and test and measurement equipment. Now you'll have to go to two different companies to get the same complement of equipment. "Educators are accustomed to going to Fluke for instruments and IBM for computers, for example," says Al Moye, Lichtenwalter's counterpart at HP. "Going to two different companies for what they need won't be strange to them, it's just that it will be different from their previous experience with HP."

Recruiting

For the near future, you won't see any changes in the college recruiting process. Through this spring, Agilent and HP will continue recruiting as one team and make the students available to both companies. After that, the two companies may be competing for the best candidates. "We'll probably be bumping into each other on engineering campuses," says Moye. "This is great news for students — now they will have two good companies to consider."

Headquarters for the newly formed company, Agilent Technologies, is being constructed on the site of the first building owned by HP.

According to Jim Shunk, former head of HP's corporate recruiting and now a member of the Agilent staffing team, Agilent should become an even better place for engineers to work. "We'll really be utilizing the skills and talents of those engineers who want to do state-of-the-art research and development," he says. "We're returning to our roots, to a paradigm where engineers spend their time inventing neat stuff that enables our customers to be more productive. I don't think we'll have any trouble attracting engineers who are interested in doing that kind of work."

Research Relationships

When HP spun off Agilent, HP Labs, the company's basic research organization, was divided between the two. Approximately one-third of the former organization is now Agilent Labs.

"All of the resources in HP labs that were working on test and measurement types of things are now part of Agilent Labs," says Tom Saponas, chief technology officer for Agilent. "We expect to maintain the same relationships that we previously had with universities. It truly is business as usual. Universities continue to be a source of some of the best basic research. We value those relationships and this source of new employees — both for Agilent Laboratories, as well as all of the rest of the corporation."

Continuing the Focus

Mel Downs, education program manager for the Americas, summed it up by saying, "We're STILL not here just to sell boxes. We're dedicated to helping educators teach engineering, just as we've always been. We've got the same program, the same people, the same products as we had before — but we expect to be more focused and more agile."

Visit **www.EducatorsCorner.com/links** for links to:

- an FAQ page
- philanthropy pages for both companies
- information about jobs at Agilent.

Free from Agilent

Free "Spamless" E-mail Accounts for Engineering Students

Do your students get frustrated weeding through all the "junk" e-mail that clogs up their electronic mailboxes? Agilent has a solution just for engineering students. It's a free "spamless" e-mail account, and a quick visit to the Resources for Engineering Students website (**www.FutureEngineers.com**) is all it takes to sign up.

The e-mail application differentiates between unsolicited e-mail and messages sent by people you've previously sent messages to. When mail arrives from a previous correspondent, it is sent through to the main "in" box. Messages from others are lumped together in a folder that students can access or ignore.

When students sign up for one of these accounts, they get an e-mail address with the FutureEngineers.com domain name. That means they can let the world—friends, relatives, and future employers, for example—know where they're headed in life, just by sending them an e-mail message.

We're hoping that one of these future engineers will someday invent a way to recycle all the junk e-mail into a usable product. :-)

Encourage your students to familiarize themselves with all of the other resources on the website when they go online to sign up for their e-mail account. They'll find a wealth of tutorials, as well as advice and tips on everything from succeeding in engineering school to landing that all-important first job. And when they're ready to relax, they can play on the website as well. The "Brainy Fun" page is full of cartoons, brain teasers and games that appeal to up-and-coming engineers. You might want to check it out yourself, since it's perfectly OK to borrow material from the site to use in your lectures and labs.

There is a Lissajous game and an associated teaching tool on the student site (**www.FutureEngineers.com**) under "Brainy Fun." It will help your students get a feel for how signals are related. Enjoy it.

Download Free Connectivity Software for HP 54600 Scopes

If you've got any HP 54600-series scopes in your lab, a trip to the web can make life simpler for you and your students. That's because you can now download Agilent BenchLink XL software, a program that simplifies the task of transferring images and waveform data from HP 54600-series scopes into Microsoft® Excel and Word.

With the click of a button on BenchLink XL's toolbar, your students can insert a snapshot of an oscilloscope screen directly into an Excel spreadsheet or Word document, or save the image as a bitmap file. This capability makes it easier for your students to document their lab exercises, and makes it easier for you to see where they are having problems.

You'll find a link to the BenchLink XL download page at **www.EducatorsCorner/links**

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