SYNERGETIC SYNAUD CON CON Volume 18, Number 4

AUDIO CONCEPTS

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My Gosh! It is a Farm

When Mario Maltese drove in the lane to the old house and saw Don standing in the yard, he leaned out of his Mercedes and said, "My Gosh! It is a farm."

"The Farm" is not a borrowed title intended to suggest something, but an accurate descriptor of an old family farm in the hilly country of southern Indiana. It's in an authentic piece of Daniel Boone country and its first white settler was a man that had been a sergeant in the revolutionary war. Indians carried out a massacre just three miles away in the early 1800s and paved roads, electricity and other modern conveniences came just before WWII. Hardwood trees, clay soil and shale underpinnings are part and parcel of a piece of land that has served Carolyn's family since the late 1840s.

Why "The Farm"?—Because that's where Don and Carolyn have found they can best find the inspiration that generates the spirit and drive behind Syn-Aud-Con classes. "The Farm" is basics—fundamentals—and requires work and wit to realize its potential. We approach audio and acoustics the same way. If you know your basics and work, you grow rapidly and achieve results that satisfy.

Having used the 108-year old house for meetings for the past four years, we now know that many of you have found the aspect of "high tech" in a cornfield an appealing and relaxing atmosphere for experiencing increased understanding of the roots of your industry.

If you wish to survive on a farm, you face facts not fantasy and work out solutions that harmonize with mother nature's wishes—not yours. Success in audio and acoustics is more accessible when you are not trying to fight the lessons physics teach.

"The Farm" and Syn-Aud-Con attracts certain qualities in others. Those who know that we live in a world where rules exist and obedience to such rules is not only logical but effective

seem to automatically sense that audio and acoustics will be subject to the same type of order.

Three days at "The Farm" can provide that overview of basic order in audio and acoustic systems design, and for those of you with the imagination to transport you back two centuries, a heartening sense of what it took to build the country we know and love. Similar men pioncered the audio and acoustic industry and learning to use the tools they have left us is the highest honor you can pay them.



Syn-Aud-Con Newsletter

NSCA—1997 Cincinnati, OH



Our preferred industry show is the NSCA once a year. This year Don presented one of the educational sessions which to our delight was sold out (over 300 attended). Don talked about speech intelligibility, signal synchronization, and what's available in computer programs. You can imagine the surprise that those raised on "gametype" computer programs felt when they witnessed and heard auralization of an, as yet, unbuilt space.





Jay & Brenda Mitchell

We've mentioned Jay Mitchell in these pages before. Here's a picture of his collaborator, Brenda. The lady on the right is not Brenda's sister, but her mother. That's one very fortunate youngster in the center, super bright attractive parents, exceptional grandparents (Harvey and Jo Earp) and Gene Patronis is the Godfather; what else can the world provide?



Benchmark Media Systems

Having seen the Benchmark equipment in use at the farm, Fred Fredericks stopped by the Benchmark booth. Al Beckary is demonstrating their new Interface System modules to Fred.

This is the first year that Benchmark has exhibited at NSCA. Though a majority of Benchmark's clientele has been broadcasters, an increasing number of astute consultants and contractors are specifying Benchmark products into churches, theatres, and performing arts centers.

J. W. Davis/Syn-Aud-Con Hospitality Suite

As is our custom, we shared a hospitality suite with the J. W. Davis Co. of Dallas, TX. The suite became one of the power centers of the world with Sam Berkow, Don Eger, Farrel Becker, and Fred Fredericks concentrating on Hyperception.

Community

One of the most impressive demonstrations we heard at NSCA was the four different sized Community loudspeaker systems starting with the RS220, followed by the RS660, the RS880, ending with the flying M4 Coax system in stereo played one right after the other while holding the tonal balance to imperceptible differences. We heard only an extended frequency range with each switch. This kind of compatibility allows tremendous freedom in the design of large arrays where smaller "down" devices can be mixed with larger main devices without difficult tonal equalization problems arising. It's the chance to hear special demonstrations like this that makes the shows like NSCA worth attending.

Community also arranged to take bus loads of people from NSCA to see and hear their new installation at the 3600 seat Cincinnati Music Hall. The sound system is as physically beautiful as the Cincinnati Music Hall which has a worldwide reputation for acoustical excellence. The Music Hall and Community Sound System is on the front cover of the Community brochure included with this Newsletter.

West Penn Wire

West Penn Wire showed a very superior fiber optics cable connector. They had a booth just to demonstrate the ease with which connections could be made with their new kit.

Frazier

Frazier has a new ceiling loudspeaker designed by Jay Mitchell that looks intriguing. Paul Peace, a Georgia Tech grad who enjoyed classes under Dr. Patronis, is now a transducer engineer at Frazier.

Tragedy struck Frazier/Soundcraft in early June. Earl Love and his wife and her parents were killed in a private plane piloted by Earl. Our industry lost a Gentle Man of enormous talent and wit.

LARES - Lexicon Acoustic Reverberance Enhancement System

LARES stands for "Lexicon Acoustic Reverberance Enhancement System." The LARES demo was probably the most important demo we heard at NSCA!

Over the past 40 years we have heard both good and bad attempts at enhancing natural room acoustics with electronics. Peter H. Parkin, back in 1973, showed us one of the best in Royal Festival Hall in London (became the ARIES system).

The N. V. Franssen system from Phillips was another effort.

Chris Jaffee pioneered several such efforts here in the U. S. using both the ARIES and then other variations custom built by IRP and others.

David Griesinger of Lexicon has long had our respect for his persistent, intuitive, and scholarly approach to applying electronics to acoustic situations.



Community's demo room during setup at NSCA

One of the early uses of LARES was by Neil Muncy in the Elgin Theater in Toronto, Canada. It was very successful. (He gave a paper at the Fall AES in Los Angeles, 1990.)

We had the opportunity to hear a demonstration of the processor at the NSCA. (Sam Berkow took me by the ear and said you must hear this. Sam was right!)

LARES's ability to allow up to 18dB more gain (not in the direct, but in the reflected sound) makes it a clever use of cross correlation techniques. We heard a remarkable illusion created in a very small hotel room with a sense of am-



Peter D'Antonio and RPG

Peter D'Antonio has increased the number of successful products he offers and is now using carefully selected "reps" to reach contractors that are as alert and mentally prepared as Randy Vaughan of Ambassador Enterprises to handle acoustic treatment of the spaces for which they design sound systems.

Of particular interest to us is the new light weight ceiling material blocking the unwanted "back wave" of an array down to 100Hz. Peter is shown holding one of the new cement block modules now available from RPG and in the background is the new VAMP -variable acoustics modular portable performance shell.

One day Peter D'Antonio will be the great industrialist!

bience and spaciousness that we had previously experienced only in the playback of ITE recordings.

In talking with Neil Muncy as to his experiences at the Elgin and hearing what we heard at the demo in Cincinnati, we have no hesitation in suggesting that the use of LARES in any of the contemporary multipurpose halls would be beneficial. Lexicon quite correctly points out that any serious acoustic problems in the room to be treated such as echoes, flutter, etc., should be corrected prior to the installation. The object is to enhance the room - not correct it - other than for too low a level and too short a reverberation.

Lexicon has an excellent booklet on LARES plus a well written AES paper by David Griesinger, preprint 3014 (B2), "Improving Room Acoustics Through Time—Variant Synthetic Reverberation."

Upbeat Convention

It was obvious from the activity in the exhibits that sound contractors are optimistic about the present welfare of our industry. Manufacturers continue to astound us with new products. The most surprising development over the past twenty years is that the leading contractors have gradually pulled ahead of almost everyone in their ability to handle complex systems.

NSCA serves a very useful purpose. We sincerely hope they avoid becoming politicized by "awards", manufacturer driven educational efforts, and other distractions from a selling show where all the exhibitors have a level playing field.

The educational efforts at this year's NSCA included names like Peter D'Antonio, David Marsh, John Bareham, Ted Uzzle, Jim Brown We would be pleased to see them continue on this track instead of the conflict of interest manufacturer programs sometimes presented in the past. This year's technical sessions had the advantage of truly professional instructors.

The young people attending NSCA remind us how much easier it was to get started years ago. Their ignorance is taken advantage of in more sophisticated ways, a problem most easily observed in the test instruments and computer programs they are attracted to and think work.

The difference between Syn-Aud-Con grads and those without our class experience is the difference between a questioning attitude vs total susceptibility to the major con-



job companies.

Cincinnati is an ideal place to hold such meetings with its convention center and hotels plus a multitude of good restaurants all conveniently grouped downtown but within a few blocks of readily accessible freeways. Los Angeles and New York City are becoming too threatening an environment to the pocketbook both for the exhibitor and to the people attending.

The smaller cities, such as Reno, Vegas, Nashville, Cincinnati are hungry for business and more solicitous of visitors.

As can be seen from the pictures, lots of very fine people had a very fine time sharing very exciting new ideas and products.

We were able to visit so many friends at NSCA. Oxmoor is becoming accepted. They are still young enough to be new, but we are seeing their products spec'd by consultants. Vic Hall had us all carrying around balloons with Communications Company logo on them. John Prohs was mobbed everyday in his PHD demo booth. The open booth arrangement makes it easy to spot a friend across the way, and the industry "parties" are fun: West Penn Wire dinner for EVERYONE at the show, the Contractors Caper the evening before the show, and many semi-private ones that keeps everyone entertained.

NSCA is a good show!



Neil Grant of Harris Grant Associates in England, found a minor error we published in Tech Topic V18N4. His correction is shown here. Yes, our grads do read the technical stuff.

Neil Grant has really hit the big time, as he said in his last fax, "We are negotiating for a New York office now that work in the colonies is picking up." Plot 3D $[1.414*x/((z^2 + 1 - x^2 + 1.414*z)^2 + (2*z*x + 1.414*z)^2),$ $\{x, 0, 2\}, \{z, -2, 0\},$ Plot Points ->30, Plot Range ->{0, 1}]



Sonic Boom Box From Intersonics

Tom Danley and Intersonics are a beautiful example of what focused research coupled with above average intelligence and wit can produce. Their's is a "niche" market by any description, and they are top man at the low end. Tom is enthusiastically interested in anything with a boom from 460 elephant rifles to the two items described in a recent letter to us.

Intersonics recently received a highly favorable review on their ContraBass for theater use. They work great with video films too.

From Tom Danley:

Greetings from Northbrook. It's been a while since I spoke with you.

The reason is the sonic boom simulator—it has been a nightmare project for sometime. Happily, though (after making my



A 1912 single cylinder gas engine that Tom has restored from 950 lbs. of rusty parts.



Two of 6 LF sonic boom simulators

forchead flat from banging it against the wall of science) we were able to deliver the required level (down to 3 Hz). I am sending photos of two of the six LF systems which have been so hard to develop. This system uses a new transducer (patent applied for) that utilizes a low-pressure, high-velocity air flow and a servomotordriven, large area "bridged" valve to produce the "flow" or output. The open end of the horn (which provides practically no acoustic loading but does diffuse the flow), measures four feet by eight feet and the air motion is just short of two feet peak-to-peak! For two units, the sound pressure at the mouth is about 126 dB SPL which is loud enough to actually HEAR at 3 Hz. One other requirement that made this difficult was that it had to disassemble into parts small enough for two people to carry and set up.

Unlike other high-pressure air modulators, this device exhibits no net flow (being push-pull as opposed to class "A"). This device produces both + and - phase simultaneously and responds from 25 Hz literally down to DC, and volume velocity is the only limit (which is around 36 cubic meters per/sec for all six units). The whole system includes 4 Bass Tech 7 horn loaded subwoofers, 2 high power mid bass cabinets and 4 HF horns, as well as 6 big woofers. The intention is to more or less coherently cover from 5 kHz down to 3 Hz to reproduce a sonic boom (or other signals) loud enough to damage housing construction. The system is to be set up six feet from an old house at Georgia Technical Research Institute. GTRI has a NASA contract to study improved housing construction methods. These techniques will have more resistance to the damage expected from the boomers that upcoming hypersonic airplanes will produce. Since it is a speaker, they could play music too!

Retro-Technology

Also enclosed is a photo of the bass producers that I work on as a hobby (in addition to speakers). It is a single cylinder gas engine from 1912, it has a 3.7 liter or 225 cubic inch displacement, runs at 450 rpm top speed and produces 6 horsepower. The piston, connecting rod and crankshaft are exposed (no oil bath). When I bought it, it was 950 pounds of rusty parts and now runs fine. Kind of retro-technology? These engines are fun to play with and they do satisfy my mechanical urge.

Syn-Aud-Con

Seminar & Workshop Schedule

* 3—Day Seminars—\$525 Farm—Norman, IN

* 2—Day Special Seminar Fee—\$400

Sept. 19-21 — Oct. 17-19

Kurt Graffy will be our assistant instructor for the September class and Randy Vaughan will be with us in October. It is lucky classes that have such experienced, articulate instructors. They KNOW and they SHARE willingly and freely. Loudspeaker & Array Measurements New York Area October 1-2, 1991

Our reps on the East Coast, Sam Helms and Vinnie Macri of Sigmet especially asked for this program and they are planning the content. It will be held "on location". Contact Sam and Vinnie (Outside NJ) at 1-800-526-2331 or 908-462-1221.

*Concert Sound Reinforcement ORANGE COUNTY, CA January 14-16, 1992

3-Day Workshop-\$650

The third in a series of Concert Sound Reinforcement Workshops will be sponsored by Synergetic Audio Concepts on January 14-16, 1992 in Orange County, CA.

These workshops have made audio history by bringing together the leaders in the concert sound industry in a cooperative joint effort to share the best in their business philosophies as well as their technical expertise.

Don and Carolyn Davis will host the workshop. Workshop Chairman, Will Parry of MSI, is pleased that the same major touring sound companies will be represented at this workshop as was at the previous two Concert Sound Reinforcement Workshops: Audio Analysts, Clair Brothers, Electrotec, and Showco. David Scheirman of Concert Sound Consultants will be the facilities coordinator for the workshop.

Will Parry says that this workshop will be different from the two previous workshops. The staff has already held a planning meeting and agreed that they want to retain the best from the two previous workshops, but add a new format for their new information.

Many men dream, but these are dreamers who have made their dreams come true. The staff of this workshop represents the pinnacle of success in an arduous industry. These men feel that major changes are on the horizon. They want to share with you. If this kind of thinking excites you, we will be pleased to see you at the 1992 Concert Sound Reinforcement Workshop. "Field Study of

Harmonic Loading

in Modern

Electrical Systems"

by Ed Lethert and James Moravek



Ed Lethert and James Moravek have recently published an article in the March 1991 Electrical Design and Installation magazine entitled "Field Study of Harmonic Loading in Modern Electrical Systems".

Ed helped teach one of our grounding and shielding classes a few years ago and is now an independent electrical and electronic consultant under the name of Ed Lethert and Associates, Inc. in Minneapolis.

You should read the article!

We are including one of their illustrations plus a few excerpts to acquaint you with its content:

"At this point, there would seem to be no concern for harmonic loading on the phase conductors in modern electrical systems. It generally appears as if the conductor ampacity, as determined in accordance with Sec. 310-15(a), results in the selection of a conductor size that is adequate for both the fundamental (60Hz) and harmonic currents it carries. The same cannot be said for transformers.

"Application of distribution transformers in modern commercial, industrial, and institutional facilities that are rich in harmonic content must be de-rated or be of the type specifically designed for harmonic loading (i.e. K-factor-rated).

"Although a fairly accurate de-rating value can be determined by dividing 1.414 by the average crest factor, without specific knowledge of the average crest factor value, determining the value of de-rating to be applied against the nameplate kVA-rating becomes essentially a guess. In some of our tests, the average crest factor would indicate that the transformers serving the loads studied require as much as a 70% de-rating!

"Although the K-factor-rated nonlinear load transformers may be loaded to their nameplate kVA-rating, a ballpark figure of harmonic content must also be determined to select the proper K-factorrating.

"Based on information available today, it would certainly seem that where conventional or standard (Non-K-factorrated) transformers are used, some value of de-rating should be applied to assure the transformers operating temperature does not exceed that for which it is rated. A general rule of thumb would be to de-rate to 50% of the nameplate kVA-rating. For Kfactor-rated transformers, our tests suggest that for other than commercial office spaces, a general rule of thumb would be to specify a minimum K-factor of K-13. For office spaces, however, it would seem that a K-20 rated non-linear load transformer should be the minimum.

The prevelance of this problem as indicated by these studies, reveals a serious need for the development of new approaches to power system design, as well as revision of prevailing codes and standards -especially those sections of the National Electrical Code that relate to the issues raised here. In the meantime, we must continue to investigate this phenomenon and devise solutions to overcome the potentially disastrous effects of high harmonic currents. As professionals, we must be aware that this is a field where the research is still in its infancy. The solution proposed and accepted today may not be viewed as correct six months form now. As we expand our knowledge, our response will become more effective, which, hopefully, will lead to concrete concepts with respect to proper design for harmonic-rich electrical systems."

And, further on in this important article:

"Conductors-In three phase systems, certain harmonic currents can overload neutral conductors The troublesome harmonics, called "triplens", consist of the 3rd and odd multiples of the 3rd (i.e., 3rd, 9th, 15th, etc). These harmonics will add rather than cancel in the neutral of a three-phase 4-wire system. Normally, the neutral carries only the unbalanced part of the phase currents but when triplens are present, it is theoretically possible to have neutral current at the triplen frequency that is 1.73 times greater than the phase current even if the phase currents are perfectly balanced."

"8. What type of harmonic currents can be expected from single phase loads such as personal computers?

"Personal computers are part of a large class of electronic equipment that employs diode-capacitor power supplies. These power supplies convert the ac line voltage to low voltage dc. The conversion process involves charging large capacitors each line cycle with narrow pulses of current that are time-coincident with the peaks of the line voltage. This process generates odd harmonics which are mostly 3rd and 5th with lesser amounts of 7th, 9th, etc.

"Note carefully that the 3rd and the 9th are "triplens" which will algebraically add in the 3-phase neutral causing conductor overloading and transformer heating."

The Analytic Signal

There are certain subjects we feel Syn-Aud-Con grads should master and the analytic signal is high on the list.

The analytic signal is the clearest depiction of the energy involved in what we call "communication". In the figure shown here we are in the frequency domain ('F' on the projected center axis emanating from the center of the Nyquist display.) The analytic signals "shadow" to the left is called the Nyquist display. The "shadow" to the upper right is



If we take 10 log Mag^2 we obtain our normal (to non-TEF users) frequency response (magnitude vs frequency). If we were to take for every point the length of the arrow (the amplitude) and divide it into the angle between the arrow and the real axis, we would obtain the phase vs frequency response.

$$\arctan\left(\frac{imag}{real}\right)$$

In Dick Heyser's work he named the real part (in the frequency domain) the coincident response and the imaginary he called the "Quadrature" response.

The Time Domain

160

Less common is the view of the time domain's analytic signal. It has been the traditional view to work from the impulse response, in the time domain, and then use a forward Fourier transform to go to the frequency domain. Today both the Ariel SYSid and the TEF acquire signal energy in the frequency domain and the use of inverse Fourier transform to go to the time domain. There are many good reasons to do this with the main one being better signal-tonoise ratios.



called the "imaginary" part, though as Heyser was wont to constantly point out, "there is nothing imaginary about it". The shadow below the analytic signal is the "real" part.

In a minimum phase system, the real and imaginary parts are Hilbert transforms of each other (i.e., 90° non-frequency dependent phenomenon).

This particular display is for a narrow band bandpass system The component named "the magnitude of the signal" is shown on the Nyquist display and is:

$$Mag = \sqrt{(real)^2 + (imag)^2}$$



100

The shadows of the time domain analytic signal are again a real part (which is called the impulse response) and an imaginary part (which is called the doublet response). Also, as before, the shadow of the on-axis view (time) is again a Nyquist display from which you can obtain both the magnitude and the phase of the energy time curve. The movement down the time scale is signal delay.

Usefulness of the Analytic Signal

At the most superficial level the analytic signal allows us to view the partitioning between the real and imaginary parts. For minimum phase systems this relationship is a Hilbert transform. The real part is the amplitude of output that is in phase with the input, whereas the imaginary part is the amplitude of that part of the output that is 90° out of phase with the input. When it is a non-minimum phase system the relationship is not so simple. Some questions that come to mind are:

1. What is the impulse "signal" of a non-minimum phase bandpass filter?

2. Is there such a thing as a minimum phase response for the time domain analytic signal?

New tools always breed new insights into subjects we thought we already knew all about. Every "frequency re-



sponse" curve you have ever seen has all these component parts along for the ride - you just couldn't see them before.

Challenge!

For those of you that consider all of this "old hat", we would like to see intensity measurements depicted as an analytic signal.

Once again, to all of you. This is not esoteric theory; it's the fundamentals of your business—a business called audio and acoustics.



Quoting from the JAMA, June 20, 1990, Noise and Hearing Loss-- Consensus Conference

"Both TTS (temporary threshold shift) and PTS (permanent threshold shift) in response to a given intense noise may differ as much as 30 to 50 dB among individuals....A number of extrinsic factors (eg, characteristics of the ear canal and middle ear, drugs, and previous exposure to noise) may influence an individual's susceptibility to NIHL (noise induced hearing loss).

"One factor that may be associated with decreased susceptibility to NIHL is conductive hearing loss; the cochlear structures may not be protected by any form of acoustic attenuation. For similar reasons, middle ear muscles, which normally serve a protective function by contracting in response to intense sound, when inoperative, can result in increased susceptibility.

Differences With Individuals

Ototoxic Drugs. — Among the causes of differences of susceptibility to noise exposure within individuals are ototoxic drugs and other chemicals.

"....precautions should be taken

with regard to noise exposures of individual patients treated with these medications. Although high doses of aspirin are widely known to cause TTS and tinnitus, aspirin has not be shown to

increase susceptibility to NIHL.

"Individuals should become aware of loud noise situations and avoid them if possible or properly use hearing protection. It is important to recognize that both the level of the noise and its duration (i.e., exposure) contribute to overall risk. Certain noises, such as explosions, can cause immediate permanent damage."



We know for sure that a bundle of Syn-Aud-Con grads have purchased this valuable manual put together for Klark Teknik by Peter Mapp as we have received hundreds of orders. Several people have told us that there is one problem with the manual-they didn't have it years sooner. It is an attractive 7-1/2" by

9-1/8" 3-ring binder with an assembled compilation of data that one often needs to refer to but shouldn't have to memorize (see Table of Contents).

Klark-Teknik lets us sell the manual to Syn-Aud-Con grads for \$25 + plus \$2.50 handling charge, and we have a good supply.



4,566,557 FLAT ACOUSTIC DIFFUSER

Guy Lemaitre, Toulon, France 28 January 1985 (Class 181/150); filed in France 9 March 1983

The patent warns us that "... the counter-reactions or dampening effect of the reflection of sound waves in the listening room on the membrane of the loudspeaker poses a persistent problem." The solution to this persistent problem is to mount the loudspeaker on a small open baffle and hang the



assembly on a wall, tilted downward. Now, you see, it is possible to "... receive attenuated sound waves from the front of the device and twicereflected waves from the rear thereof, thereby eliminating the counter-reactions or dampening effect due to the reflections of sound waves in the room."--GLA

We have reproduced a patent reviewed by George Augspurger in the Journal of the Acoustical Society. The patent helps explain why we smile wisely when someone tries to impress us with the information that they have a patent. This patent proves that anyone can get a patent for anything.

General Acoustics

Typical sound pressure levels Typical sound pressure level (SPL) versus sound pressure Combining decibels Inverse square law Wavelength of sound versus frequency Musical range versus frequency Frequency range of musical instruments and vocals ISO preferred octave and 1/3 octave centre frequencies with band limits AWeighting Background noise design criteria NR curves (noise rating NC curves inoise criteria PNC curves (preferred noise criteria) Sound Insulation & Absorption Average insulation values (mass law) Airborne sound reduction index of solid homogeneous wall

- (mass law) Typical sound insulation performance of building materials compared with mass law
- Resultant sound insulation of composite building
- structures Summary of sound insulation performance for typical building materials Average 100-3150Hz Sound reduction index
- Noise reduction INRI and transmission loss (TL)

Room to room transmission via ductwork Typical sound reduction data in dB

Absorption/attenuation of reflected sound components Dependence of sound absorption on the angle of incidence

Panel absorbers

Helmholtz absorbers Porous absorbers

Bass traps Average absorption coefficients

Room Acoustics

Room modes (Eigentones) Optimum room ratios Sound pressure and power level Relation between reverberation time volume and absorption Room constant versus surface area and absorption Critical distance as a function of room constant and directivity Reverberation time formulae Reverberation time criteria Reverberation time data for concert halls Typical reverberation time design targets

Psycho Acoustics & Speech Intelligibility

Dynamic range of hearing Equal loudness contours Typical hearing loss with age (Presbyacusis) Haas effect Directional characteristics of human voice Male speech spectra Relationship between articulation index, communication and speech privacy Dependence of the percentage syllable articulation on speech level Speech review a proximate guidelines: Percentage loss of consonants (% Alcons) Probable articulation loss of consonants Probable intelligibility Converting RASTI measurements to % Alcons PB worldlist

Sound System Engineering

Ohms law Basic electronic pad circuits Electronic noise measurement curves Distortion (THD) conversions Voltage versus dBv and dBu/dBm (600Ω) dB ratios Voltage and power conversions Acoustic power from a loudspeaker Power versus SPL 100 volt line loudspeaker systems Loudspeaker line losses Distance, velocity and time Wind and temperature gradients Atmospheric air attenuation Sound propagation through trees Speed of sound in various media (at 21°C) Effects of time delay Percentage disturbance Combfilter peak and nulls Speech integration and intelligibility Ceiling loudspeaker coverage Sound system equalisation curves

Physical Data

Metric conversion tables Conversion factor: Audio connectors

%ALcons ETC Parameters

We probably have the most experience with regard to comparing TEF %ALcons measurements to live listener samples of anyone in the field to-

Efforseder 1967/1980 1952/202 Fet 68 92 //8 Ed 75 1148 Sweerb(S) 2 //300 Fet 10 22 //300 Ed 75 1148 Sweerb(S) 2 //300 Fet 10 50 10 20 1

Figure 2. Same measurement showing where the cursor was placed for the LD-LR and the resultant score %ALcons = 4.7%

day, thanks to Intelligibility Workshop I and II. We know that, in terms of sound reinforcement system measurements, that %ALcons is always a more accurate correlation with the live listener than is STI or RASTI.

Increasingly we are finding that TEF users are adopting the very simple techniques we have suggested for such measurements.

The ETC's shown here let you see the variations that occur when you take the early decay time, EDT, rather than the later decay time, LDT.



Figure 3. Same measurement but with the EDT processed 0.23 secs. This is what high Q loudspeakers do for you in reverberant spaces.



Figure 1. Here the LDT is taken for 10 dB of decay, 2.67 seconds.



Figure 4. Same measurement again showing the cursor for LD-LR placed one step past first arrival. Score 2.6%



It's too rare that we have a woman in our classes and even more to have one that has been an acoustical consultant for 16 years! We were delighted to have Julie Wiebusch of The Greenbusch Group, Inc. at our class in Seattle.

W. Edwards Doming

W. Edwards Deming at 90 years of age is finally receiving the accolades in the United States that he so richly deserves for his work in quality control. (Prof. Deming is the man who taught the Japanese about quality control.) Here are a few key ideas for managers from Prof. Deming.

- 1. Don't shake up employees with annual reviews;
- 2. Don't offer incentive pay;
- 3. Don't set production quotas;
- 4. Do coddle your customers & suppliers;
- 5. To lower cost raise quality;
- 6. Do make your employees feel secure.

Prof. Deming's four-day seminars are sellouts that young managers and engineers scramble to attend - perhaps several decades late. The Japanese have been listening to Prof. Deming since World War II.

Nonvolatile Analog Memory Chip

IC holds 16 seconds of audio without power



A new start up company called Information Storage Devices (ISD) has developed an extended EE PROM technology called direct analog storage DAS.

With DAS they can achieve a signal-to-noise ratio of 40 dB and a 3 dB bandwidth of 3400 Hz with the THD at 2% at 2 KHz while storing, without the need of power, 16 seconds of audio program material.

The ISD 1016 is the first of a large family of IC's and multi-IC mod-

ules from ISD. It stores 16 seconds of better than Telecom-quality audio. Note all of this plus erase, record, maintain storage while disconnected from power and all without ADC or DAC.

Just connect a microphone, a loudspeaker, and batteries and you have a recording system.

Within two years ISD expects to market a version of a one-million cell device offering 60 dB (10-bit) SNR. Still further in the future 4 million cell devices sampling at 10 mHz. The SNR is anybody's guess.

Present devices are \$20 a piece in lots of 1,000. The power amplifier (built into the chip) can deliver 50 milliwatts of continuous power or 100 milliwatts of peak power into 16Ω .

For further information write: Information Storage Devices Inc., 2841 Junction Ave., Suite 204, San Jose, CA 95134 or call 800-825-4473.



Don Keelc's presentations are always illustrated by his still youthful exuberance over computer graphics. The speaker measurement options and practices are from some of his overheads that he used during the Loudspeaker Design Workshop in Atlanta last February.

While we differ in detail with Don's source for this info

such as reverberant rooms (they make excellent test sites for loudspeaker directivity factor by measuring the change in critical distance) and spatial averaging (advocated by someone still enthralled with level recorders and paper charts), the questions are the right questions even if you have to think some more with regard to the answers.





Average CEO Salary

is 85 Times the



To those of you who feel the Japanese or other outside sources are the cause of the present problems that large U.S. industries are experiencing need to read the financial journals articles on current U.S. executive salaries.

In the U.S., the average CEO of a

major corporation gets 85 times the pay of a typical factory worker. In Japan the ratio is 17 times the pay of an ordinary worker.

During the 1980s, executive pay climbed 212% compared to 73% for engineers and 95% for teachers.

A goodly number of the top pay executives are mis-managing companies that are losing money and competitive position (not that different from the Soviet system which pours more resources into bad ideas.)

Let's not look for scapegoats.





The originator of the Enhanced 911 (E-911) police call system back in the early 1960s, Tom Burroughs, formerly of Illinois Bell Telephone, is now retired in one of our favorite Arizona Rim Country areas. (The E-911 was the first to route



the emergency call to a designated dispatcher which was determined by the location of the phone where the call originated. It was also the first to display the address, telephone number and other data to the 911 dispatcher when the dispatcher answered the call.)

Tom is a remarkable man and has a beautiful home in a truly beautiful location. The walnut Klipschorns were handmade by Tom, even the midrange horn. (Yes! That is an authentic Bill Nebeker on the Klipschorn against the bookcase.) One



Klipschorn (the one on the left) uses a special 12" woofer as did the original Klipsch while the one on the right uses a 15" woofer. Both woofers are Electro-Voice WK models.

As can easily be imagined, men like Tom really don't retire-they simply regroup—and computers, precision wood working (we mean 1/ 1000th of an inch precision) along with skillful western art collecting mark one of the "Great One's" at rest.

Something New for the Farm Classes

We were constantly being indebted to Ron Steinberg of Rent Com in Chicago. Thanks to Ron, we were able to afford a new Sony 20" high resolution computer monitor and its associated Extron universal distribution amplifier. Shown in the picture is the Hyperception waveform being used in one of our auralizing demonstrations. This monitor allows instant switches between the video out of our TEF 12 and the computer monitor output from our 386-33.



Our new high resolution monitor with the Hyperception waveform.

Art Precedes Science

This 16th century painting of Charles V (1533) is a superb illustration of an optical Hilbert transform. David Hilbert (1862-1943) is the mathematician who provided the mathematical equations describing the effects of quadrant rotation. We say in class, "Art precedes Science" - this case by almost four centuries.

Engineering interest today in studying new perspectives (i.e., viewpoints) such as the modulation domain, the signal delay domain, and their interaction with the better known time and frequency domains, partakes of the same expectations and excitement that artists felt when they broke out of the two domain chains binding art by understanding perspective.

The analytic signal is not a physical entity but a mathematical convenience for visualizing what our ear/brain hears. Perspective in art was not a physical reality either, but it gave the viewer a better illustration of the reality the artist had viewed.

Hold the page so that the left edge is toward you and the right edge is away from you. Bow it slightly. The picture will "pop" into perspective just before 90° of rotation from the frontal viewpoint.



Figure 1. Gérman School, 16th Century: Charles V, 1533. Collection, Jacques Lipchitz, Paris

17



We were delighted, pleased, thrilled, and happy to once again find a source of precision step-type passive attenuators. Page 10 of Shallco's "Audio Engineering Data and Catalog" A-82 lists the Daven type T-349 Bridged "T", 45 step either 1.0 dB or 0.5 dB per step units. Impedance values for zero insertion loss include $30/30\Omega$, 75/ 75Ω , $125/125\Omega$, $150/150\Omega$, $200/200\Omega$, $250/250\Omega$, $500/500\Omega$, $550/550\Omega$, and $600/600\Omega$.

This catalog belongs on everyone's bookshelf. Shallco has purchased the old Daven audio components rights. This heritage is apparent throughout this catalog with their VU meter multiplier networks being one of the few we have seen in recent years that is rigorously correct. See Figure 1.

They list decade attenuators, impedance matching networks, fixed attenuators, multiple input and output networks, stereo attenuators (this is the best way to truly control both audio channels with complete precision) and VU meter multiplier networks. They make 8, 14 and 16 pin rotary dipswitches as well as 1/2-inch subminiature rotary "C" switches. They are willing to custom configure many of their designs.

The catalog is a useful text especially for those who still think 0 dBm is +4 VU or even worse, 0.775 volts.

Shallco, Inc., Precision Electronic Components, Smithfield Industrial Park, P.O. Box 1089, Smithfield, NC 27577. Phone 919-934-3135 or 800-876-3135. Product manager is Jason S. Shallcross.

"We find holes in their boat, and they are offended because we are not qualified to captain the ship." The other day I heard Don talking on the phone. I heard him make a statement that I really liked and I wrote it down.

Don was discussing with someone the fact that we are sometimes criticized for working in areas in which we have very little training but because of our knowledge of measurements and acoustics, we will "stumble" onto some new principle that we feel deserves work by people who are qualified to work in the field. Don said, " We find holes in their boat and they are offended because we are not qualified to captain the ship."



ACOUSTIC POWER FROM LOUDSPEAKER

$$W = 10 \frac{\left(LP + 20 \log\left(\frac{DIST}{REF}\right) + 10 \log\left(\frac{1}{Q}\right)\right)}{10^{12}}$$

In order to convert a loudspeaker Q and Lp at a given distance into L_W we first have to convert the Lp at the given distance back to the distance at which Lp = L_W for a Q= 1.0. The distance at which Lp = L_W for a Q = 1.0 is 0.282 meters or 0.928 feet. We must at the same time subtract out the directivity index D_I from the Lp at 0.928 feet (0.282 meters)

 $D_I = 10 \text{ Log } Q$

and to allow simple addition we take the reciprocal of the Q. Thus,

$$L_{W} = L_{P} + 20 \text{ Log} \left(\frac{\text{measured distance}}{\text{referencedistance}} \right) + 10 \text{ Log} \left(\frac{1}{Q} \right)$$

The equation for LW is

$$L_{W} = 10 \text{ Log} \left(\frac{\text{measured power W}}{\text{referencepower 10}^{-12} \text{ W}} \right)$$

The reference power is one picowatt or 10^{-12} W. Therefore to find the power in Acoustic watts we solve for W

$$W = \frac{10 \left(\frac{L_W}{10}\right)}{10^{12}}$$

Combining these two equations results in:

$$W = 10 \frac{\left(LP + 20 \log\left(\frac{DIST}{REF}\right) + 10 \log\left(\frac{1}{Q}\right)\right)}{10}$$

Example

A loudspeaker produces 99 dB at 4' and has a Q = 7.0 at the frequency of interest. Then:

$$W = 10 \qquad \frac{\left(99 + 20 \log\left(\frac{4}{0.928}\right) + 10 \log\left(\frac{1}{7}\right)\right)}{10} = 0.0208W$$

If, as in this case, the $L_P = 99$ dB was the result of a one watt, four foot sensitivity rating then:

د <u>م</u> ا

% effic. = $\frac{0.0208 \text{ watt acoustical}}{1 \text{ watt electrical}} \times 100 = 2\%$

This equation can then be generalized as:

% effic. =
$$\frac{\text{acoustical power}}{\text{electrical power}} \times 100$$

1-

and the power equation can be written as:

W =
$$\left(\frac{4\pi (D\chi)^2}{Q.10^{13^*}}\right) 10 \left(\frac{L_P - 0.5}{10}\right)$$

*when Dx is in feet use 1013 when Dx is in meters use 1012



"Home Insulation Helps Keep the Noisy World Out" - an Associated Press newspaper article in The Arizona Republic. We laugh about how the layman believes this stuff. If we can believe the accuracy of the quote, the layman is not the only one who lives in this dream world, unless we cynically think that Owens-Corning Fiberglas deliberately wants to sell fiberglass by spreading mis-information:

"Fiberglass can absorb airborne sound like television audio or voices, or conductive sound that moves through the house structure from machines, plumbing or footsteps, according to Frank Glover of Owens--Corning Fiberglas Corp.

Quoting Mr. Glover: "The inner walls ceilings in most homes do not muffle noise well. To block sound transmission, low density materials such as fiberglass insulation can be installed inside a wall or ceiling." (Italics mine, cd)

Farm Classes 1991

Sometimes the farm classes have a larger staff than expected because our close friends like to come here and help us.

The May class saw Fred Fredericks, Randy Vaughan (understudy for being an assistant instructor for a later class), John Prohs and John Wise, in addition to the planned instructors, Don Davis and Don Van Oort.

We know of no faster way to meet and get to know many of the giants of our industry than attending various Syn-Aud-Con classes and workshops.

Kurt Graffy, instructor extraordinaire, will be the assistant instructor for



John Prohs



July Farm Seminar





"The Contribution of Personal Radios to the Noise Exposure of Employces at One Industrial Facility" by Skrainar, Royster, Berger and Pearson. From the Am. Ind. Hyg. Assoc. Journal, April 1987.

"An investigation of the contribution made to an employee's noise dose from the output of personal radios was performed at a North Carolina textile manufacturing facility where the daily time-weighted average sound level (TWA) was approximately 87 dB, Aweighted sound pressure level [dB (A)]. The measured mean equivalent diffuse field output level for the personal radios was determined to be 83 dB(A) with a range from 70 to 98 dB (A). The daily TWA of a typical employee who did not use a personal radio was determined to be 86.6 dB(A), whereas the exposure of personal radio users was 88.5 dB(A) - an increase of 1.9 dB(A). This increase in exposure was estimated to result in 4 dB of additional permanent noise-induced hearing loss at 4 kHz for the 5th percentile (most sensitive portion) of the population after 20 years of exposure beginning at age 20. The study concluded that the additional contribution of the personal radios to the employee's daily TWA did not pose a significant additional threat to their hearing. Specific hearing conservation criteria, however, were recommended by continuation of personal radio use at the facility.

"It has only been in the past few years that researchers in the United States have begun to investigate the potentially harmful effects from the use of personal radios. One research effort reported, 'At a volume setting of 8 and above, the intensity level was predominately in excess of 115 dB(A) for all units tested.' These researchers used a standard audiometric coupler to measure personal radio output levels. In reporting their findings it appears that they neglected to account for the coupler-transformation of the recorded sound pressure levels (SPL's) that are required in order to estimate the equivalent diffuse field exposure levels [a correction of from -5 to -15 dB(A)]. The transformation to equivalent diffuse field levels is needed since damage risk criteria are not based upon eardrum SPL's, but rather upon diffuse field measurements taken near the worker's ear or with the worker absent'."

I often collect several articles on a subject then read them all at once. After reading the above about mismeasuring and misinterpreting the measurements, I read an article from the LA Times by Linda Roach Monroe saying that "Studies have shown sound levels from the machines (personal radios) can reach 115 decibels or more. At that level, permanent hearing damage could occur after just 15 minutes."

I couldn't help wondering if Ms. Monroe got her information from the flawed measurement study referred to by Skrainar et al.



Syn-Aud-Con Newsletter



Idea-ology

Syn-Aud-Con

Began as an Idea

Syn-Aud-Con is now halfway through its nineteenth year as I write and it will be three-fourths of the way as you read this. Our 20th year begins in 1992. Syn-Aud-Con began as an idea—"to create synergy in our industry." Ideas have a way of taking on a life of their own if based on the truth.

Carolyn and I don't think about Syn-Aud-Con as a company or even as something we have created, though we helped. The ideas we have all shared in have a power of their own. We had intended to simplify our lives during the nineties, but our grads and treasured associates now do to us what we used to do to them.

Tonight, a Saturday night, as I walked back on a path through windwaved orchard grass shoulder high and saw Carolyn out in her garden looking like a little child in paradise, I felt the pull of the simplicity the farm offers. But, at the same time, my mind was racing with what the computer can now do as programmed by the likes of Fred Fredericks, Farrel Becker, Joe Mitchell, Mario Maltese, John Prohs, Sam Berkow and Hyperception, Ron Bennett, Keith Jebelian, the Ariel crew, Dr. Ahnert and Dr. Fiestal, V M A Peutz, Gene Patronis, and many unnamed others. I felt the greatest desire to share it I have ever felt.

Ideas have a way of taking on a life of their own if based on the truth.

Farrel has just put everything into Windows so that I can now have Ariel SYSid, TEF, TEF Spiral, EASE, Hyperception, Mathcad, DesignCAD 3D, or any of the many other programs on the hard disc - all active at the same time with just a key stroke between them.

What is Success?

Syn-Aud-Con's success, and we define success as the rapid acceptance by the majority of our grads of each new idea that had merit within itself is based on over 8,000 grads to date.

Maybe everyone does not support the ideas, but look at the supporters: Take Fred Fredericks, a silver star winner in Korea, a Command Sergeant Major later a Major in Vietnam with 1200 hours of combat flying and six air medals, a man capable of providing military communications in sixty different countries chooses to support Syn-Aud-Con. V M A Peutz, literally a legend in his own lifetime, has and continues to support Syn-Aud-Con's search for the truth about speech intelligibility.

The list is seemingly endless, so what is the point? The point is that Carolyn and I are just as caught up in the mental atmosphere called Syn-Aud-Con as those of you who can't wait to get to the next class or workshop.

Syn-Aud-Con has taught all of us, a little like Jonah, that we don't and can't play 'God' with ideas. We can only receive them if we are receptive and follow where they lead. It's a very special brother and sisterhood.

Our Poet Laureate - Jim Carey

We have not seen much of our poet Laureate as we would like in recent months, but he and Betty were present at NSCA and he bestowed this epistle on us.

Jim Carey is but a shadow of his former self (discipline and starvation we are told) but his sense of humor is undiminished even if we can't find him when he is turned sideways. There was a sound contractor from Wheeling, Who while stringing wire 'cross a ceiling; Hit a wire that was hot, Now his nerves are all shot; An' his push-pole is no longer appealing! "Literal Re-Creation of Music" 1919

"Lazzari has made this test before more than ten thousand music-lovers and representative music critics. This test proves beyond all question that the voice of Lazzari, as **RE-CREATED** by the New Edison, is absolutely indistinguishable from her voice as heard on the stage of the Metropolitian Opera House in New York."

Seventy-two years later we are still trying to live up to the above claim!

In the high fidelity business, it's axiomatic that if the person you are talking to is technical, talk music. If he's musical, talk technical.

There is also the "cultural elite" type of hype as well as the "let us now praise famous men" approach.

The sole distinction between man and other carbon-based organisms is the ability to think. To abdicate that ability through laziness, awareness altering substances, or surrender to mind manipulators is a sin.

This Edison advertisement back in 1919 appealed to all of the above: the famous artist, reference to "the golden horseshoe of the Metropolitan, official Laboratory model," and best of all, "if you tell a lie, tell a big one because only a few of those who take the trouble to try to duplicate your claims will know what a liar you are." Finally, "Could Edison tell a lie?"

When you get too much of this kind of thing an excellent antidote is to read Mark Twain's A Connecticut Yankee in King Arthur's Court.





Lawyer Jokes - The



List Grows ! !

- Q: Why is it that New Jersey got all the toxic waste dumps and California got all the lawyers?
- A: New Jersey had first choice!
- Q: What do you get when you cross a lawyer with a Godfather?
- A: An offer you can't understand!
- Q: Why have medical researchers turned to using lawyers rather than rats?
 - 1. There are more of them,
 - 2. You're less likely to become attached to one,
 - 3. You can get lawyers to do things rats would never do,
 - 4. They breed faster, and
 - 5. The only problem that arises is extrapolating the results to human beings.
- Q: How can you tell when a lawyer is lying?
- A: His lips are moving!

A:

- Q: Why do they bury lawyers in graves thirty feet deep?
- A: Because, down deep, they're really nice people!
- Q: How do you tell the difference between a dead lawyer in the road and a dead rattlesnake in the road?
- A: There's skid marks in front of the rattler!
- Q. Why don't you see lawyers on the Beach?
- A. The cats keep covering them with sand.

Changing lawyers is like changing to another deck chair on the Titanic.

General contractor's reply to a sound contractor who asked if he should bring his lawyer when you come on site; "If you see a man up to his neck in wet cement, that's my lawyer; and we just ran out of cement."

As the lawyer came out of the anesthetic after surgery, he asked "Why are all the blinds drawn doctor?" The doctor replied, "There's a big fire across the street and we didn't want you to think the operation was a failure."

A lawyer, a banker, and used car salesman were attending a funeral when one of them proposed giving moncy to the departed for use "over there". The banker dropped in a \$100 bill. The car salesman did the same. The lawyer reached in the coffin, took out the two \$100 bills and put in a check for \$300.

There were three doctors discussing patients. One said, "I only operate on engineers because all their parts are numbered." The second said, "I only operate on electrical engineers because their parts are numbered and color coded." The third doctor said, "I only operate on lawyers—they only have two parts—a mouth and a rear end and they're interchangeable."

There is a fence that separates Heaven from Hell, and the fence was in need of repair. So, Hell sent a telegram to Heaven, which read: "We have been informed, upon the advice of legal counsel, that it's your responsibility to repair the fence." Heaven, of course, telegrammed back, "Not having access to legal counsel, we accept responsibility."

There was the lawyer that stepped in a "cow pie," looked down and said, "My God! I'm melting."

"Shallow Ideas Are Easy to Assimulate"

Shared by Farrel Becker:

"Shallow ideas are assimilated; Ideas that require people to reorganize their picture of the world provoke hostility." from *Choad—the Making of a new Science* by Jeames Gleich.

The hostility expressed towards Dick Heyser's final manuscripts is a perfect example of the truth of this statement.



Mag-tags are 1/2" x 1" magnetic labels that are printed with the most commonly used fader designations found in live sound or studio mixing. They adhere to all metal surfaces and can be adapted to non-metal mixers with a magnetic adaptor set. Currently there are five printings available: "Church Set" (for specific needs of churches), "Contractor Set" (for the contractor's specifically for churches), "Original" (for studio and live use), "Broadcast Set" (for Radio stations), and "WC-9543" (with elaborate percussion & instrument labels). They may also be custom printed to your specifications. Write: MAG-TAGS, Inc., 2531 W. Tharpe St., Tallahassee, FL 32303. 800-677-TAGS or FAX 904-385-5710.

Radio Design Labs "Stick-on"™ Products

Line amps, power amps, distribution amps, gain control amps, preamps, controlled relay packages, microphone and passive products, all Stick-On 2.9"W x 1.5"D x 0.5"H.



Our grads tell us of products that they find helpful and suggest that others might like to know about them too. Such products are listed below.

CONTACT: Radio Design Labs, P. O. Box 1286, Carpinteria, CA 93014. Ph 805-684-5415, Fax 805-684-9316.

Toleeto Fasteners Cord-Lox

Cord-Lox will color code your cables, sort by size, length or type, and keep them neatly coiled for protection and safety. Cord-Lox are designed in such a way as to wrap them around the cords to keep them securely bundled and tangle free. There are currently 19 standard models available, to fit the



largest or smallest cords, as well as custom-built products to fit specialized needs. For an additional fee, your name or logo can be directly imprinted on the Cord-Lox. CONTACT: Toleeto Fasteners International, 170 Mace St. E-6, Chula Vista, CA 92011, 619-426-3725-Fax 619-422-2084.

Polytronics Multi-Function Wire Analyzer

SureTest Pro is a multi-function wire analyzer that can help pinpoint some problems common to electrical circuits. SureTest Pro is a portable handheld device that tests for current carrying capacity with a built-in 15 ampere load. Using unique circuitry, SureTest applies the load and determines if the voltage drop is less than 5%. SureTest also checks circuits for voltage level, ground resistance, neutral ground leakage, false grounds, wiring connections and operation of ground fault circuit interrupter.



25

One Man's

Choice

by

Don Davis

The material reproduced here was written last year. It has stood the test of a year's hindsight and we can now add the following.

Because the two measurement systems, TEF and Ariel SYSid, were DSP-based, we could employ Hyperception with ease to listen to unbuilt rooms. If we had chosen a non-DSPbased system, we would not have been able to do this.

At the present time, lunch box 486-33s sell for about what a 386-33 cost one year ago. It's remarkable to realize that computer, TEF, Hyperception, and EASE can all be acquired for under \$10,000.



We have convinced ourselves here at Syn-Aud-Con that instrumentation intended to be used in conjunction with personal computers is our best choice.

As a result we have been using an IBM clone 386-33 with 4 MB of RAM with caching, a 100 MB Conner hard drive, a math coprocessor along with 5-1/4 inch and 3-1/2 inch floppies -- all in a tower configuration. A Paradise VGA card drives a Sony multiscan HG monitor. A Suntouch numerical pad keyboard makes control easy.

Because of our highly satisfactory experience with TEF analyzers over the past eight years, the choice of the TEF 20 as the first instrumentation add-on came without undue worry The TEF 20 is easily the king of the hill for two-port measurements.

We also require a two channel FFT for single port measurements. Initially, the marketplace seemed flooded. We knew from experience that we wanted: a DSP-based unit; to work with a manufacturer capable of fully supporting the basic engine we would buy; a unit, hopefully, that would be compatible with the TEF 20; a system that would be likely to receive software support from the better academicians such as Dr. Greiner, Dr. Patronis and Dr. Humes; and men like V. M. A. Peutz.

Once these criteria had been articulated, the choice narrowed rapidly to the Ariel SYSid plug in card and accompanying software.

The Ariel SYSid uses the same DSP as the TEF 20. SYSid came out of Bell Labs and we can rely on their integrity in acquiring the real and imaginary parts of the analytic signal. We sincerely hope and expect that Techron and Ariel cooperate so that measurements made on each can be processed, when desired, on the other.

Most of our electronic audio meas-

urements will be made on the Ariel SYSid and our two-port acoustic measurements will be made on the TEF.

Both the TEF 20 and the Ariel SYSid are extremely user friendly and we already know that third party programming is in advanced stages due to the integrity of their basic DSP chips. The TEF20 is a small external box. The Ariel SYSid is a plug-in card (full length). With our PC and these two inexpensive add-ons (if you don't believe they are inexpensive, price some of the all-in-one-box professional analyzers) we can perform any audio and acoustic measurement worth doing at an accuracy equal to or, in many cases, better than any other analysis system available at any price. In the future it may be that both Techron and Ariel will make both one and two-port analysis systems.

The acquisiton of new tools is followed rapidly by new questions which, in turn, produces new answers to old problems.

Colleges teach subjects that are teachable, subjects that can be arranged in an orderly manner, subjects for which there are recognized text books and questions and answers that are able to be solved and graded by professors who have had years to master the subject. Most meaningful measurements don't fall in that category, and what we are measuring today and what we are measuring with won't reach academia in a manner suitable to them for another decade. One time I asked a friend who was teaching a college class that was remarkably advanced for its time and place if the faculty was behind him. He replied, "Yes, way behind me."

There are a few individuals, and they are "individuals," ready and willing to share their hard won knowledge with you. Seek them out and pay attention.

If your ear-brain system is excited by good sound and annoyed by poor sound, get involved in the computer measurement age. You will learn fast, have fun, and learn your fundamentals from a new viewpoint

Classified Ads

Free: A former grad/subscriber to Syn-Aud-Con, but no longer active in the business would like to donate a large amount of Syn-Aud-Con materials to someone. CONTACT: Chris Hood, 5 Harrison Street, Crafton, Pittsburgh, PA 15205.

For Sale: 34' Itasca Suncruiser Class A Motorhome, basement model with gen., 2TVs, VCR, 2 AC, 3 yrs. old, customized interior, meticulously maintained—\$35,500. Contact: Ernie or Vivian Pence at 812-995-8212.

Wanted: IE-30 Contact John Murray, 4443 Old Mill Rd., Springfield, OH 45502.

Professional Services

Acoustical Consultants may list their cards on this page. There is no charge. The only requirements are that you are a full-time consultant, that you have attended a Syn-Aud-Con seminar, and have an active subscription to the Syn-Aud-Con Newsletter. If you would like to be on our Consultants page, send in four (4) business cards for our file.









SYN-AUD-CON SPONSORS

Syn-Aud-Con receives tangible support from the audio industry. Nineteen manufacturing firms presently help underwrite the expense of providing sound engineering seminars. Such support makes it possible to provide the very latest in audio technology while maintaining reasonable prices relative to today's economy and to provide all the materials and continuing support to all graduates of Syn-Aud-Con.

Personnel from these manufacturers receive Syn-Aud-Con training which provides still another link in the communications circuit between the ultimate user and the designer-manufacturer of audio equipment. They are "in tune" with what a Syn-Aud-Con grad needs.

Their presence on this list as a Syn-Aud-Con sponsor indicates their desire to work cooperatively with you in professional sound.



IRP—Professional Sound Products **Innovative Electronic Designs** Intersonics, Inc. JBL Professional/UREI Electronics **RPG Diffusor Systems, Inc. Renkus-Heinz Inc.** Shure Brothers Inc. **TOA Electronics** West Penn Wire Corp.







