

Vibration and Shock Testing, Measurement, Analysis and Calibration, also ESS, HASS and HALT : An Excerpt

The following is an excerpt from Chapter 29 (of 31) of Wayne Tustin's forthcoming text "Vibration and Shock Testing, Measurement, Analysis and Calibration, also ESS, HASS and HALT". Wayne describes the book as "A minimal-mathematics introduction," and says it "has applications in the fields of aeronautical, automotive, seismic and shipboard testing". This will be Wayne's first text since his widely read 1984 opus "Random Vibration in Perspective", long out of print.

Adjacent chapters are 28 "Measuring and Quantifying Mechanical Shock" and 30 "Mechanical Shock Testing". Further details are available from tustin@equipment-reliability.com.

After a long career including time at Boeing/Seattle and MB Electronics/New Haven, CT (now MB Dynamics/Cleveland) Wayne sold Tustin Technology Institute (TTI) and retired in 1990. He soon tired of retirement and motorhome cruising with his wife Shirley. In 1995 they commenced Equipment Reliability Institute and moved back to Santa Barbara, CA. Information on Wayne's short courses can be found at <http://www.equipment-reliability.com> and at <http://vibrationandshock.com> Wayne's "bio" is at <http://www.vibrationandshock.com/wayne.htm>.

Chapter 29 is entitled "SRS - The Shock Response Spectrum". This month we bring you sections 29.0 "Time domain review", 29.1 "Why do we need SRS?" along with 29.2 "Designer and test lab use SRS" and 29.3 "History of SRS". In February, sections 29.4 "Studying earth motion"

and 29.5 "Early studies of shipboard shock". In March, sections 29.6 "Understanding the SRS" and 29.7 "The maximax spectrum". Finally, in April, we'll bring you section 29.8 "Electronic SRS analysis".

Chapter 29 SRS - the Shock Response Spectrum

- 29.0 Time domain review
- 29.1 Why do we need SRS?
- 29.2 Designer and test lab use SRS
- 29.3 History of SRS

29.0 Time domain review Consider (in Figure 29-1) the undamped SDoF system. Its natural frequency f_n is 10 Hz (that is, its period T is 0.1 second). Subject it to input x - three pulses. All three pulses are half sine, all are equally high. However, they have durations of

- 1 second,
- 0.1 second and
- 0.01 second.

Observe that only when shock pulse duration is close to a mechanical system's period T is the response (y) likely to be damaging.

That statement is easy to understand for the ultra-simple SDoF system of Figure 29-1 subjected to those three ultra-simple shock pulses. But how does a designer (of vastly more complex structures) proceed if he is told that his product must survive

field shocks represented by the vastly more complex-looking pulses at bottom?

He much prefers to think about simple-appearing pulses. So (for many years) have writers of test standards. Unfortunately, "real world" shocks are much closer to the figures at the bottom.

29.1 Why do we need SRS? Do we need SRS? Engineers functioned for many centuries without SRS. Why was SRS invented, around the middle of the 20th century?

Thus far in Chapter 29 we have only examined shock pulses in the time domain. We learned in Chapter 11 and others, that the time domain is not sufficient; we need the frequency domain. This statement also applies to mechanical shock. To get into the frequency domain, we have two possibilities: the

continued on page 5

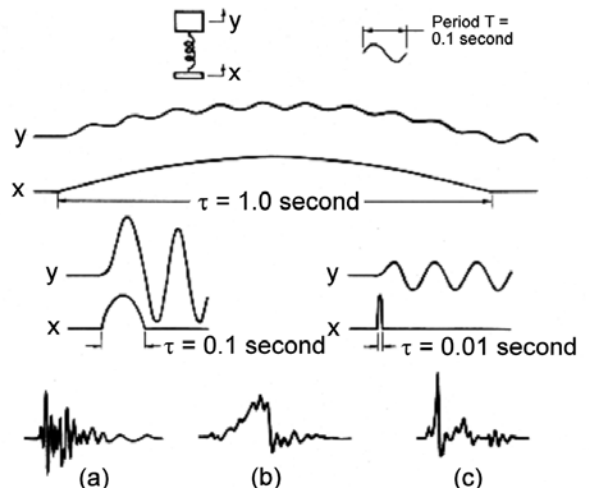


Figure 29-1 SDoF response to classical shock

Modern Protective Structures * July 14-18, 2003

a Penn State engineering short course for engineers, architects, and safety and security managers
Catastrophic events such as the embassy bombings in Kenya and Tanzania, the destruction of the federal building in Oklahoma City, the attacks on the World Trade Center and the Pentagon, blasts in London's financial district, and explosions in petrochemical plants are becoming all-too-frequent occurrences. In today's world, knowledge of modern protective structures is vital.

The course gives engineers, architects, and safety and security managers practical background information relating to the performance and design requirements for hardened facilities. Comprehensive reviews and advanced research and development topics are designed to augment the technical capabilities of hardening and forensic engineers and scientists. In addition, a review of Blast Damage Assessment (BDA) issues provides forensic and rescue personnel with additional background information.

Additional features:

- Hands-on guided analysis and design activities
- Case-study, problem-solving approach
- Simulations and projects
- One-on-one contact with instructors for individual assistance
- Open computer lab sessions for extended analysis and problem solving

Take-aways:

- Computer disk with programs for analysis and design of protective structures
- Extensive design manual and reference materials

You will examine these topics:

- Fortification science and technology
- Analysis, design, assessment, and retrofit
- Industrial explosive safety
- Antiterrorist design
- Hazard sources
- Physical security
- Blast damage assessment

About the Instructor

Dr. Theodor Krauthammer, Penn State professor of civil engineering and director of the University's Protective Technology Center, is an internationally recognized researcher in enhanced structural performance and safety and has more than thirty years of experience in protective structures. He has served as a technical consultant to government and industry in the United States and abroad and is the former chairman of the American Concrete Institute (ACI) Committee 370 on Short Duration Dynamics and Vibratory Load Effects, a member of five technical committees of ACI, a member of the American Society of Civil Engineers (ASCE) Task Committee on Structural Design for Physical Security, and a member of the ASCE Committee on Shock and Vibratory Effects.

Continuing Education

Penn State is a Registered Provider with the AIA Continuing Education System. This program qualifies for 32 hours of Health, Safety, Welfare (HSW).

Fee and Registration

The fee covers all instruction, course materials, refreshment breaks, and lunches. Registrants are responsible for all other meals and lodging. The fee may be paid by check, money order, or purchase order (made payable to Penn State), or by major credit card (American Express, MasterCard, VISA, or Discover). An additional charge of \$30 will be added to all walk-in registrations.

To register, go to <http://www.cde.psu.edu/C&I/protectivestructures/> and complete the printable registration form, and return with fee to Penn State by June 24, 2002. Or complete and submit the online registration form. Fax registrations must be accompanied by credit card payment information. You may also register with your credit card by calling 814-863-5162 or 800-PSU-TODAY (778-8632; toll free within the United States). You will be notified promptly of any cancellations or schedule or program changes. Conferences and Institutes will confirm your enrollment in the program and provide information on travel, accommodations, final registration, and parking.

Refunds

All cancellations must be received in writing by mail or fax. Full refunds will be made for cancellations received by June 21, 2002. Refund requests made after that time will not be honored, and the participant or sponsoring organization is responsible for the fee. Anyone who is registered but cannot attend may send a substitute.

University Policies

Access--Penn State encourages individuals with disabilities to participate in its programs and activities. If you anticipate needing special accommodations or have questions about the physical access provided, please contact the conference planner at 814-863-5100 before your visit.

Cancellation--The University may cancel or postpone any course or activity because of insufficient enrollment or other unforeseen circumstances. If a program is canceled or postponed, the University will refund registration fees but cannot be held responsible for any other related costs, charges, or expenses, including cancellation/change charges assessed by airlines or travel agencies.

For More Information

About program content

Dr. Theodor Krauthammer
Director Protective Technology Center
The Pennsylvania State University
3127 Research Drive
Cato Park
State College PA 16801 USA
Phone: 814-865-3102
Fax: 814-865-9630
E-mail: tedk@psu.edu

About registration

Janet Patterson
Senior Conference Planner
The Pennsylvania State University
225 The Penn Stater Conference Center
Hotel
University Park PA 16802-7005 USA
Phone: 814-863-5123
Fax: 814-863-5190
E-mail: jrp1@outreach.psu.edu

Solutions to last month's puzzle:

1	4	2	7	2	3	1		4	4	7	5	2	
7	8	9		8	5	0		0		9	6	0	
	9		10	6	0			11	9	6		0	
13	8	4	4	0				15	7	6	16	4	0
		3										0	
17	4	9	18	19				20	1	9	0	22	1
	4		23	5	0			24	1	6			9
25	4	8		27	1	0		0		28	6	1	
29	1	0	0	0				30	4	8	2	9	



from the
S AVIAC
Team!

We wish you a happy &
healthy 2003!!

Announcement for International Short Course on

Response of Marine Structures to Underwater Explosions

February 18-21, 2003

Monterey Beach Hotel
2600 Sand Dunes Drive, Monterey California 93940

Course Lecturers:

Professor Thomas L. Geers	Dr. Young S. Shin
Dept. of Mechanical Engineering	Shock and Vibration Research
University of Colorado	Monterey, California 93940
Boulder, Colorado 80309	

Course Objective & Overview

Course Objective: The purpose of this course is to provide engineers, scientists, and naval architects a discriminating review of underwater explosion phenomena, structural response analysis, fluid-structure interaction, shock spectrum concept, and shock-induced vibration analysis of shipboard equipment.

Course Overview:

1. UNDERWATER EXPLOSION PHENOMENA: Sequence of Underwater Explosion Events, Hydrodynamic Relations, Underwater Acoustic Waves, Air-Water Interface, Shock Wave Parameters, Bubble Behavior and Bubble-Pulse Loading, Bulk and Local Cavitation, Scaling
2. ELEMENTS OF STRUCTURAL DYNAMICS: Analytical Dynamics, Classical Linear Oscillator, Two-Degree-of-Freedom System, Finite Element Discretization and Modeling, Finite Difference Time Integration
3. FLUID-STRUCTURE INTERACTION: Athwartship Response of Submarine, Vertical Response of Surface Ship, Submerged Plate Oscillator

4. DAA-BASED ANALYSIS: Submerged Spherical Shell, FE/BE Fluid-Structure Interaction, USA-DYNA, USA-NAS-TRAN, etc.
5. FLUID VOLUME DISCRETIZATION: Fluid Cavitation, Validation of Computer Codes
6. MODELING AND SHOCK SIMULATION: Three Dimensional Ship Shock Analysis, Modeling and Approaches
7. SHOCK QUALIFICATION OF SHIPBOARD EQUIPMENT BY DESIGN ANALYSIS: Shock Spectra, Normal Mode Analysis, Response of a Multi-DOF System to Shock Motion
8. DYNAMIC DESIGN ANALYSIS WORKSHOP: Dynamic Design Analysis Method (DDAM), DDAM Step-by-step Analysis Procedure, Design Criteria of Shipboard Equipment Using DDAM
9. APPLICATION TO SHIPBOARD EQUIPMENT USING DESIGN ANALYSIS: Application Problems

Course Organization

REGISTRATION FEE

The following registration fee includes the cost of all sessions, coffee breaks, and the course notes.

\$ 1,350 --- if paid by February 1, 2003.
\$ 1,500 --- if paid after that date.

ACCOMMODATION

A block of rooms has been reserved at special rates for short course attendees at the Monterey Beach Hotel (Rates \$75 single & 95 double). To qualify for these special rates, you must mention that you are attending the "Shock and Vibration Seminar". Attendees should contact the hotel directly to make reservations. The rooms at the special rates will only be held until February 1, 2003.

COURSE LOCATION

The course will be conducted in Monterey, California, USA;
Monterey Beach Hotel
2600 Sand Dunes Drive, Monterey, California 93940
Phone: (800) 242-8627 or (831) 394-3321
Fax: (831) 393-1912

FOR FURTHER INFORMATION, CONTACT:

Shock and Vibration Research
10150 Blue Larkspur Lane
Monterey, California 93940, USA
Phone/Fax (831) 375-4999
email: yshin99@aol.com

Call For Papers

74th Shock and Vibration Symposium

October 27-31, 2003
Red Lion Hanalei Hotel
San Diego, CA

Planning for the 74th Shock and Vibration Symposium is underway, with the selection of NSWC/Crane and SPAWAR as the Government Featured Organizations, Endevco as the Commercial Featured Organization, and the Red Lion Hanalei Hotel in San Diego as the location.

The Shock & Vibration Symposium is the oldest continuously held meeting dealing specifically with the structural dynamic behavior of air, sea, space, and ground vehicles and structures. The Symposium was established as a mechanism for the exchange of information among Government activities, private industry, and academia on current work and new developments. Presentations on work in progress are encouraged. Separate sessions are held for presentation of classified or limited-distribution material.

Presentations in the following subject areas are welcomed:

Active Vibration Control	Environmental Databases	Product Announcement/Facility
Ballistic Shock	Finite Element Analysis	Description
Biodynamics	Fluid-Structure Interaction	Pyrotechnic Shock
Blast Design	Ground Shock	Shock Characterization
Combined Environments	Seismic Shock	Shock Hardening
Computational Structural Dynamics	Impact/Penetration Mechanics	Simulation Methods
Crash Dynamics	Instrumentation	Specifications and Standards
Damage Identification	Isolation Systems	System Identification
Damping	Large Structures	Test Criteria
Data Analysis	Live Fire Testing	Test Tailoring
Dynamic Analysis Methods	Machinery Diagnostics	Underwater Shock Testing
Dynamic Measurement	Machinery Vibration	Vibroacoustics
Dynamic Scale Modeling	Material Dynamic Properties	
Dynamic Testing	Modal Analysis and Testing	

Two categories of presentations will be accepted: full papers, suitable for publication in the Symposium Proceedings; and short discussion topics, consisting of viewgraphs with no written paper. Full papers will have a 15 minute technical presentation time plus 5 minutes for questions, while short discussion topics will have a 10 minute presentation time with no question period.

Presentations will be accepted on the basis of their abstracts, which must be submitted by May 30, 2003. You are encouraged to submit online at www.saviac.org, click on 74th S&V Symposium Abstract Submittal. The Program Committee will review the abstracts during the June Program Committee meeting and authors will be notified of acceptance by June 26, 2003. The full paper presentations must meet the following standards: They must be previously unpublished and unrepresented, must be appropriate to community interests and must not be overtly commercial, except for papers in the Product/Facility session. Standards for short discussion topics are similar except that they may include previously presented or published material.

The Proceedings will be published on CD-ROM.

The paper due-date is October 17, 2003.

Questions should be directed to Joel Leifer, 301.596.0100 or joel.leifer@saviac.org.

continued from page 1

Fourier transform and SRS, the Shock Response Spectrum.

The Fourier transform provides us not only magnitudes at the various frequencies that are present but also phase information at those frequencies.

Because a shock's Fourier transform contains phase information, it is possible to recreate the original pulse

Today, however, almost everyone focuses instead on SRS, the Shock Response Spectrum. Because SRS does not contain phase information, it is not possible to recreate the original pulse. Indeed, a given SRS can result from many different shock pulses. Remember this last statement in Chapter 30, when we discuss SRS shock testing on shakers.

Please remember that vibration spectra in g^2/Hz give us the average (over time) vibration intensity (dimensionally equivalent to power) in each of many frequency windows. SRS is different -- SRS gives us the peak response in each frequency window over a time interval --- no averaging.

29.2 Designers and test labs use SRS The SRS is popular because it helps engineers quickly visualize the effects of shock on a physical system and it offers them two popular and useful benefits:

1. A designer gets a concise indication of the maximum dynamic loads (though not how many cycles) on various parts of his product, as a function of frequency. This helps him predict damage potential.

2. SRS gives test engineers a sensitive technique for insuring that the effects of their shock tests are repeatable.

Remember that the Shock Response Spectrum, SRS, is purely imaginary. It is not

a time history of any shock input

nor of any responses.

Here is what it does for you: it bounds the peak responses of all possible SDoF systems to a particular transient.

The situation we saw in Figure 29-1 (idealized undamped SDoF system and three idealized half sine pulse) is easy to analyze. It's been "studied to death".

So let's "get real".

More complex structures having more than one critical f_n .

More complex shock pulses, possibly resembling the pulses shown at the bottom of Figure 29-1.

Consider three questions:

- (1) given a complex shock pulse, how does a designer select his dynamic load factors?
- (2) how do test labs develop test specifications?
- (3) how can we demonstrate that we conducted a specified test?

SRS can help us answer all three questions.

29.3 Beginnings of SRS Before we "dig into" SRS, let's examine its history.

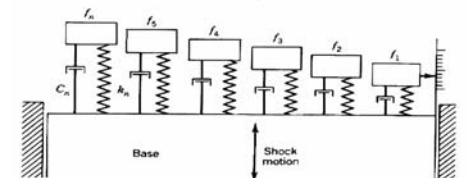
Around 1930, M. A. Biot sought a method for determining the resistance of California buildings to earthquakes.

Rather than worry about the time history of a wide variety of input shock pulses, he considered the responses of systems (buildings and bridges) ... the effect of earthquakes.

Biot buried (at many California locations) a reed gage something like Figure 29-2, although not intended for viewing. Biot intended to produce a permanent record of each earthquake at numerous locations. Look ahead at the array of SDoF systems in Figure 29-13, then come back. (Recording

oscillographs, computers, etc. were 'way off in the future.) Biot fastened needles, all lightly touching a piece of smoked glass, to each of the reeds (which had various natural frequencies). When the reeds were excited, each scribed a line on the smoked glass.

After an earthquake, Biot would go to each of his gages and dig it up. He would put in a new piece of smoked glass, ready for the next earthquake, then rebury the gage. Back in his lab, Biot measured the responses ... the lengths of the scribed lines on the smoked glass. With displacements plotted against f_n , he had the first SRS!



Would you like to comment on this article?

E-mail your comments to admin@saviac.org and, if appropriate, SAVIAC will publish them in an upcoming issue of *Current Awareness*. Please include "Tustin Excerpt" in the subject line of your e-mail.

Announcement & Call For Papers

Sessions on Computational and Experimental Structural Acoustics at the 74th Shock and Vibration Symposium

October 27-31, 2003
San Diego, CA

The Shock and Vibration Symposium represents a unique opportunity for researchers from academe, industry, and government laboratories to discuss their work. Because both classified and unclassified sessions are held at the Symposium, topics for presentation are not limited to those suitable for public release. Of equal importance, public, academic work with implications for government researchers can be presented in a venue where both academic and government researchers are in attendance.

Historically, structural acoustics and vibration have been an important part of the Symposia. For the upcoming meeting in October, we plan to hold classified and unclassified sessions on new work in structural acoustics and vibration, both in applications and in new experimental, analytical and computational methodologies. Topics include (but are not limited to):

- Finite element methods for structural acoustics
- Other advanced computational methods for acoustics
- Experimental studies of vibrating systems
- Noise suppression and control technologies
- Aerospace and Naval applications
- Transient analysis
- Visualization of acoustic phenomena
- Design methodologies for acoustic systems
- Verification and validation of computational and analytical tools
- Modeling methods for acoustic systems
- Computational studies of vibrating systems

Two categories of presentations will be accepted: full papers, suitable for publication in the Symposium Proceedings; and short discussion topics, consisting of viewgraphs with no written paper. Full papers will have a 15-minute technical presentation time plus 5 minutes for questions, while short discussion topics will have a 10-minute presentation time with no question period. Researchers are also encouraged to propose discussion groups or panel sessions to be held at the Symposium.

Presentations will be accepted on the basis of their abstracts, which must be submitted by May 30, 2003. You are encouraged to submit online at www.saviac.org (click on 74th S&V Symposium Abstract Submittal). The Program Committee will review the abstracts during the June Program Committee meeting and authors will be notified of acceptance by June 26, 2003. The full paper presentations must meet the following standards: They must not have been previously published or presented, must be appropriate to community interests, and must not be overtly commercial, except for papers in the Product/Facility session. Standards for short discussion topics are similar except that they may include previously presented or published material. The Proceedings will be published on CD-ROM. The paper due-date is October 17, 2003.

This preliminary announcement will be followed by more details when available. The abstracts may be submitted online at www.saviac.org or sent to:

Jeffrey Cipolla
ABAQUS, Inc.
jeffrey.cipolla@abaqus.com

Joel Leifer
SAVIAC
joel.leifer@saviac.org
(301) 596 0100

Questions should be directed to Joel Leifer.

Industry News

Endevco Working with National Instruments to Lead Development of Open Standards with "Plug and Play" Sensors Program

SAN JUAN CAPISTRANO, Calif. - December 9, 2002 - Endevco today announced a collaborative initiative with National Instruments to promote widespread adoption of IEEE P1451.4. The Plug & Play Sensors Program aims to create an open sensors standard, giving systems integrators and end users the ability to automatically configure measurement and automation systems for sensors. Systems integrators and end users will be able to simplify sensor setup, use, and maintenance; automatically obtain calibration data; and eliminate manual data entry and error.

IEEE P1451.4 proposes that sensors include an embedded, low-cost memory chip containing standardized transducer electronic data sheets (TEDS). TEDS store important sensor information and parameters for self-identification and self-description, eliminating the need to manually input this data when configuring a system. NI has made a TEDS library for LabVIEW available free and downloadable from its web site at ni.com.

Through participation in the IEEE 1451.4 working group, Endevco is working with NI to establish a standard TEDS format that industry suppliers can use to develop sensors, instruments and software. Endevco will be providing technical papers and seminars to support its work with NI. These learning strategies will encourage measurement professionals to experiment with this new technology and see how minimal the trade-offs of this new technology can be.

As part of the program, the companies are also exploring how to expand plug and play capability to legacy sensors. Through a proposed online database of sensor vendors' model data on ni.com/sensors, users will be able to download TEDS binary files, or Virtual TEDS, to their systems, instantly enabling legacy sensors with plug and

play capabilities. Virtual TEDS provides a smooth transition to the next generation of measurement and automation systems by allowing engineers to leverage new sensor technology with their existing measurement hardware. As the manufacturer of the smallest TEDS single axis and triaxial accelerometers, Endevco will provide engineers with practical advice on their use.

Miniature Model 7268C Piezoresistive Accelerometer Designed for Crash and Flutter Testing Applications

SAN JUAN CAPISTRANO - January 8, 2003 - Endevco's new Model 7268C is a miniature piezoresistive accelerometer (10 x 10 x 13 mm) that employs advanced micro-machined (MEMS) sensors with integral mechanical stops for ruggedness and years of reliable service. This 3-axis accelerometer is designed for applications that require minimal mass loading, such as crash testing and flutter testing, and meets SAE J211 specifications for anthropomorphic dummy instrumentation. The Model 7268C's broad frequency response extends down to DC (steady state) acceleration, allowing it to measure both long duration transients and short duration shocks.

Based on Endevco's proprietary sensor design, the Model 7268C offers high output and high resonance frequency. The sensor has minimum damping, thereby producing no phase shift over the useful frequency range. An operating temperature of 0F to +150F (-18C to +66C) ensures high performance even under the harshest testing conditions. Two active arms and two internal precision fixed resistors provide shunt calibration, while internal diodes furnish electrostatic discharge protection. A 12 wire integral cable is also included. The Model 7268C is the replacement for the Model 7268B and is available in two acceleration ranges, 500g or 2000g full scale.

Model 482B Transducer Signal Conditioner Designed for Multi-Channel Applications

SAN JUAN CAPISTRANO, Calif. - January 8, 2003 - Endevco Corporation, a leading designer and manufacturer of dynamic instrumentation, announced the availability of the enhanced Model 482B rack-mounted signal conditioner. The eight-channel amplifier card communicates with newly developed SMART ISOTRON® (IEEE P1451.4 TEDS) accelerometers, yet provides backwards compatibility for use with other Integral Electronic PiezoElectric (IEPE) transducers and Remote Charge Convertors (RCC). The 482B is designed for multi-channel modal testing on large structures such as airplanes, spacecraft, automobiles, bridges and heavy machinery.

Endevco's enhanced signal conditioner is part of the company's Optimal Architecture Sensor Interface System (OASIS 2000) product line. OASIS 2000 allows the interface of multiple sensor types by using the 400 Series family of signal conditioner cards, all housed in a 16-slot, 19" rack (Endevco Model 4990). 400 Series cards can be mixed or matched in any combination, giving maximum flexibility to customize any system configuration. Specifically, up to 16 Model 482B cards can be used in the Model 4990 rack, providing a powerful 128 channels of flexible, intelligent signal conditioning at a low per-channel cost.

The combination of SMART ISOTRONS and intelligent electronics make the 482B ideal for use in modal test labs. TEDS accelerometers contain all pertinent data, which is automatically loaded into a software database at the click of a button. Data entry errors are virtually eliminated and signal conditioning setup time is minimized. Each Model 482B card also has an independent microprocessor, providing the fastest means of data transfer possible with increased reliability.

The signal conditioner features a pro-

continued from page 7

grammable gain of 0 to 100 with an accuracy of +0.5% at 1 KHz for gains greater than 1. The 482B also has built-in, selectable Butterworth 2-pole low pass filter corners at 100Hz, 1KHz, 5KHz and broadband. In addition to an Open/Short ISOTRON Sensor fault detection, the signal conditioner has gain autoranging, digital electronic output channel identification, and a frequency response of 0.015 Hz to 100 KHz (-3dB corners).

Sensor-specific digital read/write data is in the form of the PIEEE-1451.4 Transducer Electronic Data Sheet (TEDS). TEDS data includes model number, serial number, transducer sensitivity, manufacturer, and date of last calibration. Endevco's Model 4990 rack provides the communication link (Ethernet or RS-232) between the PC and the Model 482B card. The system controlling program is a Windows® based application software providing an extremely user-friendly interface.

Products for Acoustic Measurement

January 6, 2003, Depew, NY - The Vibration Division of PCB Piezotronics, Inc., has recently introduced a new line of products for acoustic measurement applications. The addition of acoustic measurement products to PCB's extensive line of accelerometers allows the company to provide a greater range of sensor solutions to customers making sound and vibration measurements.

PCB's acoustic product line includes precision and array microphones, traditional and ICP preamplifiers, a-weighting filters, dual channel microphone power supply, acoustic calibrators, pistonphones, and related accessories.

Prepolarized microphones operate from low-cost, constant current (2 to 20 mA) ICP sensor power. Array microphones will also function with any ICP sensor power supply to provide a cost-effective method for large channel count sound pressure measurements. A probe microphone is available for measurements in small enclosures and in close proximity to the sound source.

PCB's acoustic measurement products are backed by the company's Total Customer Satisfaction Guarantee. For additional information, contact the Vibration Division of PCB Piezotronics, Inc., toll-free, at 888-684-0013; E-mail: vibration@pcb.com; or fax at 716-685-3886. For other PCB products, contact PCB directly at 716-684-0001, or visit our web site at www.pcb.com.

Dynamic Strain Sensor Monitors Machinery Forces

January 6, 2003, Depew, NY - The Force/Torque Division of PCB Piezotronics, Inc., announces the release of the Model 240A01 Dynamic ICP Strain Sensor. The device measures dynamic and quasi-static stress on stationary and moving machinery and offers a simple technique for monitoring processes and detecting inconsistencies or upsets. A single screw easily installs the unit in a non-invasive manner on the machinery surface. Ideally positioning the device in the direction of maximum strain permits an indirect measurement of forces on such devices as mechanical presses, machine tools, fast-running production machinery, and automatic assembly machines.

The Model 240A01 utilizes piezoelectric sensing elements that are structured in an acceleration compensated configuration. Its robust construction, integrated microelectronic signal conditioning, and solid-state design stands up against harsh industrial environments and interfaces easily to process monitoring and data acquisition systems.

For additional information, contact the Force/Torque Division of PCB Piezotronics, Inc., toll-free at 888-684-0004; E-mail: force@pcb.com, or fax 716-684-8877. For other PCB products, contact PCB directly at 716-684-0001, or visit PCB's web site at www.pcb.com.

Industrial Pressure Sensors

January 6, 2003, Depew, NY - The Pressure Division of PCB Piezotronics, Inc. is pleased to announce a new series of

SAVIAC Current Awareness page 8

industrial grade dynamic pressure sensors. The Series 121A20/30 industrial, dynamic ICP pressure sensors are offered in a variety of full-scale ranges from 100 psi to 5000 psi and feature all-welded, stainless-steel construction and a 1/4 NPT pressure fitting (straight metric M14 thread is optional). The units contain built-in microelectronic circuitry to deliver a clean, voltage output signal. Electrical case isolation provides shielding from electromagnetic fields and eliminates ground loop problems. All units conform to CE directives.

The series is available with either a 2-pin military connector or an integral, molded, submersible cable assembly. The hermetically sealed stainless steel construction protects against contamination and permits use in harsh industrial applications. The devices offer the unique ability to detect very small pressure fluctuations in the presence of high static background pressures. Typical applications include detection of dynamic pulsations, surges, water hammer, cavitations, and spikes in liquid delivery systems, paper slurry systems, pumps, and compressors.

for additional information on these sensors, contact the Pressure Division of PCB Piezotronics, Inc., toll-free at 888-684-0011, Email: pressure@pcb.com, or Fax 716-686-9129. For other PCB products, contact PCB directly at 716-684-0001 or visit our web site at www.pcb.com.

Highlighting the latest Developments in Dynamics and Impact Mechanics Research and Practice

Title: Advances in Dynamics and Impact Mechanics
Editors: C.A. BREBBIA, Wessex Institute of Technology, UK and G.N. NURICK, University of Cape Town, South Africa
Availability: Immediate
ISBN: 1-85312-928-3

Price: US\$165.00 / UK pounds sterling 107.00 / Euros 174.14

This new WIT Press title contains invited chapters by internationally
continued on page 9

Shock & Vibration Seminar

SAVIAC invites you to attend a FREE seminar on Shock & Vibration. The course will be held on Tuesday, February 11, 2003 at Club Lakeview, on the grounds of NSWC/Crane in Crane, IN and will coincide with the Winter TAG Meeting. SAVIAC and the featured experts in their disciplines have organized this seminar to introduce you to the SAVIAC community, while providing a valuable educational experience.

AGENDA

8:00 - 8:15	Registration & Continental Breakfast	
8:15 - 8:30	Introduction to SAVIAC	Joel Leifer, SAVIAC
8:30 - 9:00	Using SAVIAC to Address Your S&V Problems	Joel Leifer, SAVIAC
9:00 - 9:30	Stress, Strain & Fracture: An Perspective of Low Cycle Fatigue Systems & Issues	Eric Kathe, US Army, TACOM-ARDEC Benet Labs
9:30 - 10:00	Random vs Sinusoidal Vibration	Dan Gregory, Sandia National Labs
10:00 - 10:15	Break	
10:15 - 11:15	Navy Shock Qualification Process	Kurt Hartsough, NAVSEA Phila
11:15 - 11:45	Shock Testing	Jeff Morris, Hi-Test Laboratories
12:00 - 1:00	Lunch (no host)	
1:00 - 1:30	Finite Elements in an Analysis Context	Jeff Cipolla, Hibbitt Karlsson & Sorensen
1:30 - 2:00	Accelerated Life Testing	Jeff Blankenship, NAVSEA, Coastal Systems Station, Panama City, FI
2:00 - 2:30	TBD Presentation	TBD
2:30 - 2:45	Break	
2:45 - 3:15	Test Fixture Design	Jeff Morris, Hi-Test Laboratories
3:15 - 3:45	NE/NASTRAN-Technical Briefing on DDAM Analysis	Tony Abbey, Noran Engineering, Inc
3:45 - 4:15	Wrap-up & Questions	All

Please forward this invitation to anyone you know who may be interested in attending this program.

The seminar is free, but you must register to attend. Please RSVP to Lauren Yancey, (301) 596-0100 or lauren.yancey@saviac.org to assure your space and note packet. For more information about SAVIAC and directions to NSWC/Crane, please visit our website at www.saviac.org.

continued from page 8

renowned researchers in dynamics and impact mechanics and covers a wide range of topics, including both experimental and theoretical studies. The book includes many comparisons between computer results and experimental measurements. Readers will find a wealth of up-to-date information on many different aspects and applications of impact mechanics.

Inspired by and dedicated to Professor Norman Jones of the University of Liverpool, UK, the volume acknowledges his outstanding contribution to the field of structural impact over four decades as both a teacher and researcher.

Advances in Dynamics and Impact Mechanics is volume 1 in WIT PressAEs Impact and Damage on Structures series.

Available in North America from Computational Mechanics, Inc., 25 Bridge Street, Billerica, MA 01821 Phone: 978-667-5841; Fax: 978-667-7582
E-mail: info@compmech.com; URL: www.compmech.com/acatalog/9283.html

and outside North America from WIT Press, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK Phone: 44 (0) 23-80-293223; Fax: 44 (0) 23-80-292-853
E-mail: marketing@witpress.com
URL: www.witpress.com/acata-

log/9283.html

Would you like
SAVIAC to e-mail
Current Awareness
to you?

If you would like to receive the electronic version on Current Awareness each month, please send your name and e-mail address to Lauren Yancey at lauren.yancey@saviac.org.

Conference Announcements

For a summary of upcoming conferences for 2003, visit www.saviac.org/upcoming_events.htm

IMAC-XXI

Society for Experimental Mechanics, Inc.

February 3-6, 2003

Hyatt Orlando, Kissimmee, FL

IMAC-XXI will feature a theme that focuses on the new and innovative approaches to making and processing structural dynamic data. We invite developed sessions and individual papers on emerging technologies such as laser transduction techniques, camera methods, interferometric approaches, embedded fiber-optic strain gages, wireless sensors, MEMS devices and rotational accelerometers. Also, innovative structural health monitoring techniques and sensing, micro-controller applications and nanotechnology topics will be welcomed under this theme. For more information visit www.sem.org.

Ninth International Conference on Urban Transport and the Environment in the 21st Century

Wessex Institute of Technology, UK

March 10-12, 2003

Crete, Greece

Urban Transport 2003 is a major annual event in the urban transport calendar with papers on both transport and the inter-related environmental issues which are of so much concern in our cities. Broad topic areas include urban transport systems, traffic control, accessibility and mobility, control and simulation, finance, air quality and noise, social issues and safety. For

details visit www.wessex.ac.uk/conferences/2003/urban03/

Sixth International Conference on Computational Methods and Experimental Measurements in Contact Mechanics

Wessex Institute of Technology, UK

March 12-14, 2003

Crete, Greece

Contact Mechanics 2003 is the sixth international conference in this successful series on the application of Computational Methods and Experimental Measurements in Contact Mechanics. Modern engineering design has led to the realisation of the importance of contact problems in many technological fields. They are complex and inherently non-linear due to the moving boundary and the existence of friction along contact surfaces. Until a few years ago, researchers were engaged only in the fundamental concepts of contact problems. Today, due to substantial improvements in computer technology and experimental methods, it is possible to solve many complex practical problems accurately and efficiently. Contact Mechanics 2003 will discuss papers on Mechanical Models, Numerical Aspects, Experimental Measurements and Engineering Applications as well as other topics related to the theme of the meeting. There will be particular emphasis on the application of advanced theories; participants will be

encouraged to critically review existing ideas and to explore new research ideas.

8th International Symposium on Plasticity and Impact Mechanics

Indian Institute of Technology Delhi

March 16-19 2003

New Delhi, India

The IMPLAST 2003 is the eighth Symposium in a series of meetings on Large Deformation. The aim is to provide a forum for scientists, engineers and designers in universities, scientific laboratories and industry to share their research findings in fundamental and applied aspects of the mechanics of large deformations of metallic, composite and cellular materials and structures at low, medium and high rates of deformation. The Symposium will honour Prof. NORMAN JONES on his 65th birthday. The programme will consist of invited lectures, special sessions and contributed papers. The proceedings will be published prior to the symposium. The following topics will be covered during the symposium. The list is only indicative and not exhaustive. Constitutive Relations, Theories of Plasticity, Applications of the Theory to Structural and Manufacturing problems, Structural Crashworthiness and Failure, Stress Waves in Solids, Penetration and Perforation, Fire and Blast Loaded Structures, & Earthquake Loading. For details visit www.iitd.ac.in/implast/index.html

Check your 2003 SAVIAC
calendar for upcoming events

To receive your FREE copy call Lauren at (301) 596-0100 or
e-mail lauren.yancey@saviac.org

Be sure to include your name and address

Short Course Announcements

Response of Marine Structures to Underwater Explosions

Tom Geers & Young Shin

February 18-21, 2003

Monterey Beach Hotel

Monterey, CA

Registration Fee: \$1350 before Feb 1.

The purpose of this course is to provide engineers, scientists, and naval architects a discriminating review of underwater explosion phenomena, structural response analysis, fluid-structure interaction, shock spectrum concept, and shock-induced vibration analysis of shipboard equipment. For more details contact Prof Young Shin, 831 375-4999, yshin99@aol.com.

Practical Shock Analysis & Design

MFPT

March 3-7, 2003

Wingate Hotel

Winchester, VA

Registration Fee: \$1200

Participants in this course will have an opportunity to increase their knowledge and understanding of the analyti-

cal and experimental tools that are available for shock design and qualification particularly with respect to requirements that are imposed for shipboard equipment. The lectures will provide a basic review of vibration and shock theory and will present the analytical and experimental methodology in the context of particular design applications. Analytical lectures will emphasize the physical significance of the results. Examples and case histories will be used as illustrations of design approaches; workshop problems that involve class participation will be used to advantage throughout the course. Class members will be encouraged to propose real design problems. The instructors will provide guidance for solutions or the problems may be used as class exercises. For more details visit <http://www.mfpt.org/mshocktrainingcourse.htm>

Modern Protective Structures Course

The Pennsylvania State University

July 14-18, 2003

Penn State's course on Modern Protective Structures is aimed at addressing a broad range of technical issues dealing with mitigating the severe loading effects associated with blast, shock, and impact. Registration brochures and the web site will be available in late-January, www.outreach.psu.edu/C&I/ProtectiveStructures. For information about content: Ted Krauthammer, Director, Protective Technology Center & Professor, Civil and Environmental Engineering, Tel: (814) 865-3102; Fax: (814) 865-9630 E-Mail: tedk@psu.edu, URL: <http://www.ptc.psu.edu>. For information about registration: Janet Patterson Senior Conference Planner, Conferences & Institutes, The Pennsylvania State University, 225 Penn Stater, University Park, PA 16802 USA, Tel: (814) 863-5123, Fax: (814) 863-5190, E-Mail: jrp1@outreach.psu.edu

People in the News

The following was taken from a letter received by SAVIAC.

SAVIAC would like to take the opportunity to extend our condolences to the family of Bob Young.

Dear Friends,

It is with great sadness, that we tell you that Bob Young, a prominent acoustician and long time Standards volunteer, passed away. Many of you knew Bob, whose record of attendance and involvement at both ASA and International Standards meetings was legendary. Bob joined the Acoustical Society in 1929, almost as soon as it was founded. At the time of his death on November 24, 2002, he was the longest tenured member of ASA. Among many other honors, Bob was a past President of ASA and an Honorary Fellow of the Society.

Right up until the end of his life Bob enjoyed reviewing draft standards. In his last months he was able to continue this activity through the assistance of his wife, Evelyln, who monitored the e-mails and downloaded the documents.

Bob's wife, Evelyln, has suggested that donations in Bob's memory be made to ASA Standards in his name. We think this is very fitting and appropriate. Although we will notify Evelyln of receipt of your gift, we know that she also would enjoy receiving a note directly from you - even if you only knew Bob from his towering reputation.

Mrs. Young's address is:

Mrs. Robert W. Young
710 West Thirteenth Avenue, E-6
Escondido CA 92025

Email: exy2@worldnet.att.net

Memorial donations should be made to the "Acoustical Society Foundation" with a note that it is for the Robert Young Memorial Fund. The address of the Foundation is:

Acoustical Society Foundation
c/o Robert D. Frisina
11 St. Ebbas Drive
Penfield, NY 14526-8629

Your gift will be acknowledged in writing to you and is tax deductible to the extent allowed by law. ASA is a 503(c) 3 organization.

With deepest regrets,

Paul D. Schomer
 Standards Director



Pre-Sorted
First Class
U.S. Postage
PAID
Permit No. 1906
Southern, MD

SAVIAC / HI-TEST Laboratories Inc.
5136 Celestial Way
Columbia, MD 21044
DO NOT FORWARD. ADDRESS CORRECTION
REQUESTED. RETURN POSTAGE GUARANTEED.

In the January 2003 Current Awareness Newsletter

Vibration and Shock Testing, Measurement,
Analysis and Calibration, also ESS,
HASS and HALT: An Excerpt

***74th Shock & Vibration Call for Papers
Industry News***

FREE Shock & Vibration Seminar

Conference/Symposia Announcements

Short Course Announcements

People in the News

The Current Awareness newsletter is published by the Shock and Vibration Information Analysis Center, which is operated by HI-TEST Laboratories, Inc., under contract to the U.S. Army Engineer Research and Development Center.

Program Manager
Joel Leifer
(301) 596-0100
joel.leifer@saviac.org

Marketing & Events Planner
Lauren Yancey
(301) 596-0100
(703) 892-0060
lauren.yancey@saviac.org

Manager of Technical Services
Henry Pusey
(540) 678-8678
henry.pusey@saviac.org

SAVIAC/HI-TEST Laboratories Inc.
5136 Celestial Way
Columbia, MD 21044
(301) 596-6400 (fax)

SAVIAC Director
Dr. Charles Robert Welch
US Army Engineer Research and
Development Center
Vicksburg, MS 39180
saviac@wes.army.mil