

SCANFAX

May 1998

Volume 50, Issue 5



IEEE

Networking the World™

A publication of the
Institute of Electrical & Electronics Engineers
— Chicago Section —

Advances in Energy Storage

U.S. POSTAGE PAID
NON-PROFIT ORG
Permit No. 53
Columbus, Wisconsin

POWER FOR RENT

- Cat® Generator Sets (sound-attenuated): 10 - 1,750 kW
- Olympian™ Generator Sets (sound-attenuated): 30 - 250 kW
- LeRoi® Air Compressors (including oil-free): 100 - 1,600 CFM
- Allmand Bros. Light Towers & and Maxi-heaters
- Acme Dynamics™ Pumps: 4 inch to 12 inch self-priming



24-Hour Service
(800) RENT-121



615 West Lake Street • Elmhurst, Illinois 60126
6400 Indianapolis Blvd. • Hammond, Indiana 46320



Weldy/Lamont & Associates

Manufacturers Representative
Engineered Products and Services

AC distribution equipment 600V thru 35KV (50 or 60Hz)

- Transformers
- Distribution switchgear
- Busway
- Automatic transfer switches (mechanical and static)
- Metering

DC power systems

- Switching Controlled Ferro, Mag-amp and SCR rectifiers
- DC to AC inverters
- Free standing rack systems
- Batteries

Uninterruptible Power Supplies and Frequency converters

- Rotary and static type

Variable Frequency Drives

Weldy/Lamont Assoc., Inc. / 1008 East Northwest Hwy, Mount Prospect, IL 60056 / 847-398-4510



IEEE
Networking the World™

A publication of the
Institute of Electrical & Electronics Engineers
— Chicago Section —

<http://ieeefnal.gov>

Chairman

Irwin C. Smiley, P.E.
CTE Engineers
303 E. Wacker Dr., Ste. 600
Chicago, IL 60601
312-938-0300
i.smiley@ieeefnal.gov

Editor

Adrienne Novick
ahnovick@lucent.com

Publisher

Barbara Slack
Slack Attack Advertising

Art Director

Nancy Rudd
Slack Attack Advertising

Advertising Sales

Beth Vander Grinten
Slack Attack Advertising
608-222-7630

Printed By

Town & Country Printers
Columbus, WI

SCANFAX (ISSN #0018-1297) is a monthly publication (except July and August) of the Chicago Section Institute of Electrical and Electronics Engineers, 1919 Swift Dr., Ste. 121, Oak Brook, IL 60521-1502, (800) 898-4333 or (630) 575-8045. It is published by Slack Attack Advertising, 6400 Gisholt Dr., Suite 203, Madison, WI 53713, (608) 222-7630. Printing is by Town & Country Printers, Columbus, WI 53925. For advertising information, contact Slack Attack Advertising.

Subscriptions included in IEEE membership dues; non-member subscriptions: \$25 per year.

Address corrections should be sent to the IEEE office, 1919 Swift Drive, Suite 121, Oak Brook, IL 60521-1502.

©Copyright 1998 by the Chicago Section Institute of Electrical and Electronics Engineers. Permission to reprint must be secured in advance of publication and credit given to author and SCANFAX.

May 1998

Volume 50, Issue 5

SCANFAX

Features

3 Advances in Energy Storage

A look at one of the U.S. Department of Energy's largest research centers.

Departments

2 Chairman's Message

9 Calendar of Events

UPCOMING EVENTS

9 Microwave Theory and Techniques Chapter and Antennas and Propagation Chapter

MICROMACHINED MILLIMETER-WAVE STRUCTURES FOR CHARGED PARTICLE ACCELERATORS AND RELATED APPLICATIONS / May 5, 1998

10 IAS/IES Joint Meeting with Northwest Subsection STAND-BY CO-GENERATION, AND PEAK SHAVING SWITCHGEAR APPLICATIONS / May 13, 1998

10 Power Engineering Society TURBO GENERATOR: A CATALYST FOR THE DISTRIBUTED GENERATOR MARKET / May 13, 1998

11 ED/CAD/SSC ADSL: WHAT IT IS, WHY WE NEED IT, WHAT THE ISSUES ARE May 19, 1998

11 Magnetics/Nuclear and Plasma Science Joint Chapters CONTEMPORARY ISSUES IN COMPUTATIONAL ELECTROMAGNETICS / May 19, 1998

12 Fox Valley Subsection and The Computer Society TELEPHONY OVER THE INTERNET / May 27, 1998

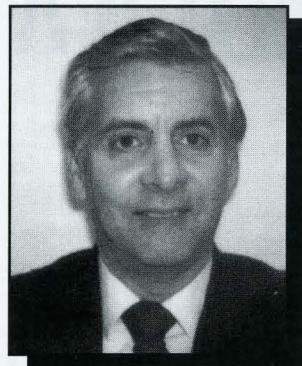
12 Employment Opportunities

13 Professional and Business Directory

On the cover: Energy to light the future may come from electricity stored efficiently in a superconducting flywheel Argonne is developing with Commonwealth Research Corp. Photo courtesy of Argonne National Laboratory.

Statements or opinions expressed herein are those of the author's and not necessarily those of the IEEE Chicago Section, its members, officers, or staff, or the editors of this publication. Readers using any information or materials described in this publication do so at their own risk. In no event will IEEE Chicago Section, its members, officers, or staff be liable for any damages resulting from use of this material and hereby expressly disclaim such liability. The publication of any advertisement is not to be construed as an endorsement of the product or service offered unless the advertisement specifically states that there is such an endorsement or approval by the organization.

Chairman's Message



Irwin C. Smiley, P.E.

IEEE Chicago Section, Chairman

We continue to attract more new advertisers to our SCANFAX publication! I personally want to thank these advertisers for their support. Please give our advertisers an opportunity to be a part of your projects. Support is a two-way street!

Our new SCANFAX continues to be well received by the IEEE Chicago Section membership. Many members have expressed their appreciation for this quality publication. I don't want to sound like a broken record, but... this quality costs money to produce and mail! The Executive Committee is counting on advertising dollars to support SCANFAX. However, our ad dollars continue to fall far short of our goals.

The Executive Committee will have to make some difficult decisions regarding SCANFAX if the advertising revenue does not meet our goals. In all honesty, this quality publication cannot continue without more financial help. **Please, please, we need your support!**

In keeping with my April column, I want to share some additional information and points presented in February at the IEEE Region 4 meeting by IEEE president, Dr. Joseph Bordogna. The subject is IEEE's role in fostering technological innovation.

1. IEEE is a major force in disseminating information about technology.

2. IEEE produces 30% of the world's literature on electro- and information-technology topics.

3. IEEE conferences, meetings, and other technical activities spur members' creativity.

4. IEEE provides programs and services through periodicals, books, standards, conference proceedings, electronic products and mixed media, and other sources of information.

5. IEEE has quick and interactive access to other technical literature.

6. IEEE has 300 annual conferences that provide first-hand information on technical innovations, product developments and research.

7. IEEE members have the opportunity to participate in more than 700 standards development groups and 37 societies/councils.

In a nutshell, IEEE members have many valuable resources and opportunities available to them to aid in technological innovation. Take advantage of them!

On another note, thank you for taking the time to vote for the IEEE Chicago Section officers and committee chairs. The results will be listed in the June issue of SCANFAX.

We continue to look for new editorial themes for our feature stories. Please contact us with your suggestions or submit a paper for consideration.

Again, thank you to our advertisers and to all those who take the time to provide leads for advertisers. This is a magazine for our members, and we need our members to make it work. ■



**Now's the Time for Supply and Demand
And *You're* in Demand!**

CAREER FAIR

IT/IS/MIS & ENGINEERING

**Mon & Tues, May 11 & 12
3-7pm both days**

**Rosemont Suites Hotel (O'Hare Int'l)
5500 N. River Road • Rosemont, IL**

Wed, May 13 • 3-7pm

**Embassy Suites Hotel
1939 Meachum Road • Schaumburg, IL**

■ **If you have 2 or more years experience in IT/IS/MIS, Software, Hardware, or Engineering**, take advantage of this opportunity to meet face to face with hiring managers from Chicago's leading companies. **They're demanding to see you!**

■ **See our ad** in the *Chicago Tribune* Employment Section under "Job Fairs" on Sunday, May 10 for a list of participating companies or visit our Career Site at www.lendman.com

■ **No Cost. No Obligation.**

■ **For advance distribution** to participating companies please submit your resume (Attn: 5CHT-IEEE) on-line: www.lendman.com, fax: 757-490-7448, or mail: The Lendman Group, 141 Business Park Dr., VA Beach, VA 23462. **You must attend to take advantage of this service.**

■ **Questions?** Call Candidate Development: 888-765-4473 or visit us at www.lendman.com

■ **Companies interested in participating call 800-288-2890**

Produced by:
THE
LENDMAN
GROUP

www.lendman.com

Sponsored by:
IEEE
The Institute of Electrical
and Electronics
Engineers, Inc.

Advances in Energy Storage

by Christine M. Sloat, P.E.

At their January meeting, the IEEE Chicago Section Computer Society Chapter and Fox Valley Subsection toured Argonne National Laboratory. Apparently, El Nino was on a coffee break that evening, as the approximately 35 members who visited the Chicago facility remember it as one of the coldest days of the winter! Regardless of the weather outside, those in attendance report an excellent educational experience. The tour started in the visitor's center with an overview of the history of the facility. Attendees then browsed through the Argonne Museum and finished the morning with tours of various lab facilities and discussions on Argonne projects.

Argonne is one of the U.S. Department of Energy's (DOE) largest research centers and is operated by the University of Chicago. It is also the nation's first national laboratory, chartered in 1946. Currently, the organization employs approximately 4500 people, including about 1775 scientists and engineers. Argonne actually occupies two sites. The Illinois site is located about 25 miles southwest of Chicago's loop. This site also houses the U.S. Department of Energy's Chicago Operations Office. Argonne-West, home to most of their major nuclear research facilities, is located about 50 miles west of Idaho Falls in the Snake River Valley.

Argonne research falls into four broad categories:

• **Basic Science** includes experimental and theoretical work in materi-

als science, physics, chemistry, biology, high-energy physics, and mathematics and computer science, including high-performance computing.

• The laboratory designs, builds and operates sophisticated **scientific research facilities** that would be too expensive for a single company or university to build and operate. They are used by scientists from Argonne, industry, academia and other national laboratories, and often by scientists from other nations.

• **Energy Resources** programs help insure a reliable supply of efficient and clean energy for the future. Argonne scientists and engineers are developing advanced batteries and fuel cells, as well as advanced electric power generation and storage systems. They are also working to improve the safety and longevity of both American and Soviet-designed nuclear reactors.

• **Environmental Management** includes research on alternative energy systems; environmental risk and economic impact assessments; hazardous waste site analysis and remediation planning; electrometallurgical treatment to prepare spent nuclear fuel for disposal; and new technologies for decontaminating and decommissioning aging nuclear reactors.

One of Argonne's significant characters is industrial technology development, an important activity in moving benefits of Argonne's publicly funded research to industry to help strengthen the nation's technology base. Most of Argonne's projects are funded by U.S. DOE, however a portion of the research

Continued on page 4.

Electri-Agency

123 King St., Elk Grove, IL 60007
847-439-5030 / 800-323-6575

www.electri-agency.com

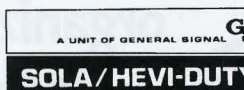
— Representing —



Anaconda Seal-Tite

crescent
LIGHTING

a GENLITE company



Chicago Section Executive Committee Meeting

May 12, 1998 @ 7:15pm

DeVry, 1221 N. Swift Rd.,
Addison, IL

is labeled "work for others." Under this scenario, industry and other private concerns wholly fund particular research projects of interest and benefit to their respective operations. Since 1984, Argonne has been the source of more than 30 spin-off companies. Also, Argonne's Division of Educational Programs provides a wide range of educational opportunities for faculty and students ranging from leading national universities to local junior high schools.

One of the Argonne projects reviewed during the January tour involves super-

conductive flywheels which will be utilized to store energy during low electric usage periods (late at night and early morning). The stored energy will then be available for use during peak demand periods. The theory is similar to pumped-storage power generation, without the need for large quantities of waters and substantial heads. This superconductive flywheel research is an example of "work for others," funded through the Commonwealth Research Corp., a subsidiary of Unicom. Research outcomes will become the sole intellectual proper-

ty of Commonwealth. Because of this relationship, most of the current research is not available for public review. Argonne representatives were, however, able to provide some basic insights and historical information about the project.

In simple terminology, a flywheel spins. Argonne is testing flywheels that reach rim speeds greater than 2,000 miles per hour.... That's just a bit greater than a spinning top! It is actually greater than a speeding bullet and about three times the speed of sound! The flywheel rotor is a rapidly spinning disk attached to a permanent magnet ring that floats above high-temperature superconducting material. The superconductor generates a magnetic field "cushion" when it is cooled to minus 321 degrees F (77 K). This cushion allows the flywheel rotor to hover above the superconductor without touching it. The entire assembly — a high speed rotor with this superconducting magnetic bearing combined with an efficient motor/generator — is called a flywheel energy storage system.

Early developments with a prototype system have been promising, and larger energy storage systems are envisioned. With further development, this system could dramatically change the way energy is produced and supplied to consumers. During the day the spinning flywheel would release energy to meet the increased demands of electricity, and at night, the disk would act as a storage system. It would provide a consistent stream of electricity, avoiding the usual peaks and valleys of electrical demand during a 24-hour period. The system could also be used as a backup energy supply during power outages.

Reduced frictional drag is the key to the efficiency of the flywheel energy storage system. The flywheel is contained in a vacuum chamber, to eliminate air friction. Because the magnetic bearing floats above the superconductor, frictional drag is one-tenth that of any conventional bearing system. Argonne holds the world record for least friction created in a magnetic bearing. Researchers continue to improve the low-friction system, using larger rotors, greater speeds and improved superconducting materials.

Commonwealth's flywheel project is only a portion of Argonne's research into the realm of superconductivity. High-temperature superconductors are ceram-

ic materials that carry direct electrical current without resistance. They lose their electrical resistance when submerged in liquid nitrogen and cooled. More powerful and compact motors and transmission lines can be built with superconductors. Using superconducting material in electrical wires, generators and storage systems offers the potential to power industrial plants and cities without the inefficient loss of electrical energy. New methods continue to be developed by Argonne scientists to understand energy loss in superconductors. Numerical computer simulations demonstrate the motion of individual vortices, the swirling clouds of electrons that control the energy loss. Accurate measurements of the behavior of electrons in superconducting materials confirm the importance of a technique called "single crystal alignment" to prevent energy loss inside these materials.

Research on high-temperature superconductors has advanced rapidly, and one of Argonne's contributions has been the development of techniques for fabricating wire and tape from ceramic superconductors — in particular, the longer

lengths needed for practical applications. Argonne is transferring these techniques to the private sector under joint research agreements through its High-Temperature Superconductivity Center. The Center is supported by DOE's Office of Energy Efficiency and Renewable Energy, Advanced Utility Concepts.

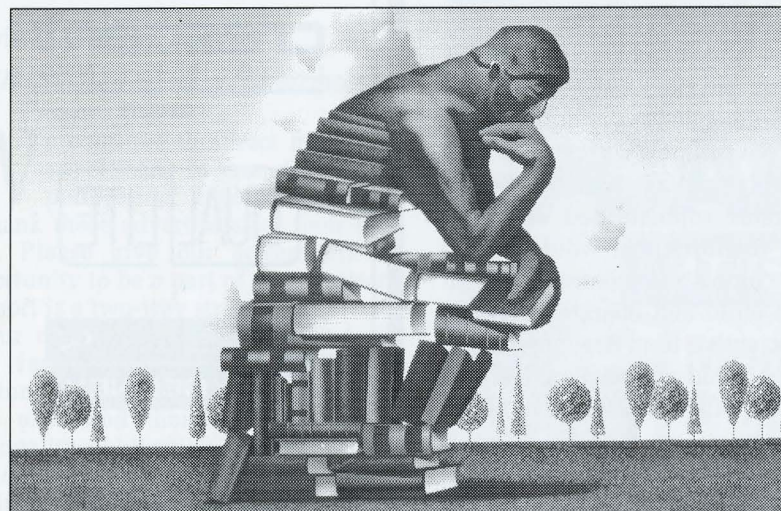
Argonne researchers not only have increased their understanding of the mechanisms of superconductivity, but they can now "map" the exact location of electrical flow interruptions. Argonne developed the first instrument to precisely image electrical flow through superconductors. This technology could be key to developing materials that carry current 10 times greater than previously possible.

Superconductivity is, by far, not the only research being conducted at Argonne Labs. In mid-March, the Department of Energy announced awards totaling \$7.8 million for four research projects at Argonne. The projects range from developing near-frictionless carbon coatings for auto engines to finding more efficient ways to make

hydrogen peroxide. The awards cover four multi-year, joint research projects in partnership with industry. The U.S. Department of Energy will provide \$3 million in funding for Argonne and the industrial partners will provide nearly \$4.8 million to fund their own participation.

"This research is of value both to industry for its eventual commercial applications and to the Department of Energy with its broad range of mission needs," said Secretary Peña. "By working together, we will all be able to benefit from the sharing of both our unique and complementary research facilities and expertise." Peña's announcement of funding for programs at Argonne was part of a larger announcement of 16 joint-research projects involving five DOE laboratories. Total DOE funding for the 16 projects was nearly \$12 million.

With more than 200 different programs in basic and applied research, Argonne is one of the nation's largest federally funded scientific laboratories. For ongoing information about Argonne's research activities, visit their web site at <http://www.anl.gov/>. ■



For all your educational and organizational needs, think DeVry Inc.

DeVry. It's your one source resource.

Our Institutes of Technology turn out graduates who are highly skilled in a variety of fields: computers, business, telecommunications, electronics and accounting.

Our Keller Graduate School division produces skilled Masters level graduates in Business Administration (MBA), Project Management, Human Resource Management, and Telecommunications Management.

And Keller's Corporate Educational Services provides customized training to meet the managerial and technical

needs of companies like yours.

Our Becker CPA/CMA Review prepares individuals for certification in public and managerial accounting. Since 1957, over 210,000 CPAs have come from Becker's review course.

For more information, visit our Web site at <http://www.devry.com> or call the number that fits your needs.

DEVRY

A higher degree of success.®

DeVry/Addison
(630) 953-1300

DeVry/Chicago
(773) 929-7837

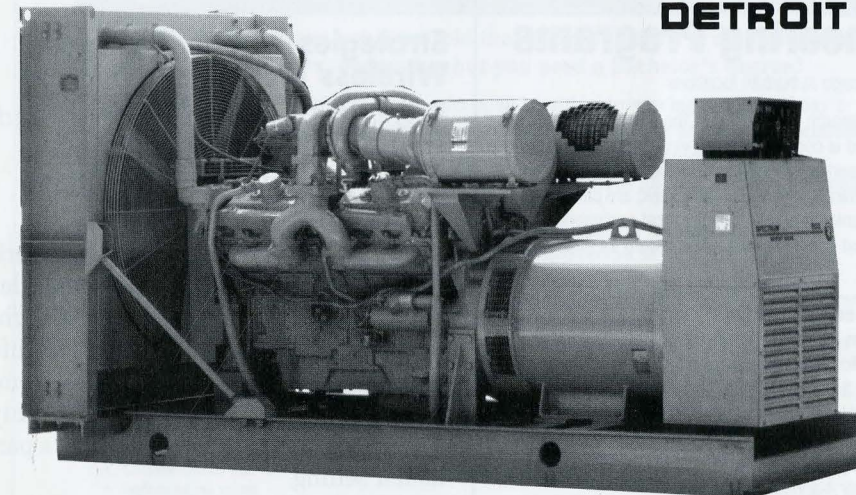
DeVry Inc. Becker CPA Review Keller/CES
www.devry.com 1-800-868-3900 ext.94 (630) 571-1818

©1997 DeVry Inc. DeVry Institute, Keller Graduate School of Management and Becker CPA Review are separate operating divisions of DeVry Inc. (NYSE:DV). U.S. DeVry Institutes and Keller Graduate School of Management are accredited by the North Central Association of Colleges and Schools, 30 N. LaSalle Street, Chicago, IL 60602, 800-621-7440.

RIGHT CHOICE FOR POWER GENERATION

SPECTRUM®

DETROIT DIESEL



- MICROCOMPUTER CONTROLLER
- ONE STEP LOAD ACCEPTANCE
- SUPERB MOTOR STARTING CAPABILITIES
- SUSTAINED SHORT CIRCUIT PROTECTION

One source responsibility for the complete emergency industrial system—generator, controller, engine and transfer switch.

For more information contact
Inland Detroit Diesel-Allison

Main: 210 Alexandra Way
Carol Stream, IL 60188

800-236-9559

FAX 630-871-8997

2601 E. 15th Ave.
Gary, IN 46402

800-616-8371

FAX 219-883-0441

13015 W. Custer Ave.
Butler, WI 53007-0916

800-236-6667

FAX 414-781-0357

Video Tutorials Available from IEEE

Visual Communications — Three-part Modular Course

Prepares Engineers for the Telecommunications Revolution

Visual communications is the key element in modern information systems. Spurred on by developments in VLSI technology and the telecommunications revolution, digital documents and video processing are becoming commonplace in our everyday lives.

To prepare engineers for the explosion in visual communications, the Institute of Electrical and Electronics Engineers, Inc. (IEEE), has produced a video series in image and video compression, and transmission algorithms.

Grouped under a common title, *Visual Communications*, the series consists of three parts:

- **IMAGE CODING**
- **VIDEO CODING**
- **IMAGE AND VIDEO TRANSMISSION**

A broad audience of engineering professionals can benefit from watching the Visual Communications series. For example, engineers, engineering managers and researchers responsible for visual communications from fax to video

will find this series to be a useful educational tool. Network managers and engineers who want a greater understanding of basic enabling image and video compression methods, as well as transmission engineers responsible for transmitting compressed data from source to destination will also find the videos pertinent and informative.

The first in the series, **IMAGE CODING**, introduces the basic theory of image coding. It covers concepts of information, entropy, scalar and vector quantization. In addition, it discusses transform and subband/wavelet coding. The viewers will learn the underlying principles of compression algorithms that enable modern image communications such as fax, lossless and noisy coding. Dr. William A. Pearlman of the Rensselaer Polytechnic Institute's Center for Image Processing Research and ECSE in Troy, NY, is the presenter.

The **VIDEO CODING** module concentrates on video signal processing including spatial and temporal filtering, digital video standards, motion estimation, and compensation. The viewers will learn underlying compression algorithms of modern video communica-

tions. Information on video standards from video phone to HTDV is also discussed. IEEE fellow, Dr. John Woods, also of Rensselaer Polytechnic Institute, instructs this module.

The third part of the Visual Communications series focuses on **IMAGE AND VIDEO TRANSMISSION**. It presents the effects of channel errors, including channel and network modeling, modulation and channel coding schemes, an information theory perspective, and joint source and channel coding. The audience will learn how to transmit images and videos on wired and wireless channels, as well as on ATM and packet computer networks. In addition, they will learn how to mitigate the effects of channel errors and lost packets. Dr. James W. Modestino who is a professor at the Rensselaer Polytechnic Institute presents the information. Dr. Modestino is also an IEEE fellow.

Educational Activities is now offering Continuing Education Units (CEUs) for video tutorials. The whole series is worth 1.5 CEUs, while each individual module is worth 0.5 CEU. The run time of each module is:

Image Coding — 6 hours, 30 minutes

Video Coding — 5 hours, 30 minutes

Image and Video Transmission — 4 hours, 30 minutes

Each module consists of four videotapes and is accompanied by a set of notes, a text and a final exam.

The videos can be purchased as a whole series or separately.

Strategies & Planning for a Wireless Technology System

*Engineers Learn How To Design And
Plan Digital Wireless Networks,
Specify Appropriate Technologies
for Particular Environments*

Digital wireless technology is experiencing an explosion. From cellular phones to digital media, wireless technology is used in every walk of life becoming the principle method of communication. It is convenient, but only with capabilities that fit the need of a particular setting.

To help those who design, plan, implement, and specify digital wireless networks, the Institute of Electrical and Electronics Engineers, Inc. (IEEE), has produced a video tutorial, *Strategies &*

Planning for a Wireless Technology System.

This tutorial will cover critical issues in planning a network, architectural issues in designing a wireless network, and regulatory knowledge. After completing the course, viewers will be able to evaluate alternative wireless services and determine which aspects of wireless technology are suitable for adoption. The students will also be able to recognize the relative merits and drawbacks of competing services.

The tutorial serves as great educational resource for engineers, managers, and executives who need an overall understanding of modern wireless technology. Presenter Dr. Dhadesugoor R. Vaman suggests that the individuals participating in the course should have prior, general understanding of networks and Open Systems Interconnection (OSI) principles. Dr. Vaman recommends that viewers continue with additional courses in order to learn in more detail about wireless, digital network protocols, performance analysis, and system configuration for a real environment.

Educational Activities is now offering Continuing Education Units (CEUs) for video tutorials. Those who successfully complete the final exam that follows the tutorial will be awarded 0.25 CEU and a certificate of achievement. This course consists of two videotapes, references,

and hard copies of the visuals and runs three hours and 13 minutes.

Dr. Vaman is a professor of Electrical and Computer Engineering at the Stevens Institute of Technology, Hoboken, NJ. He also is the founding director of the Advanced Telecommunications Institute (ATI) that was established in 1994 by the US Navy as a center for telecommunications excellence. Dr. Vaman conducts research on such topics as ATM, network management, and digital compression of multimedia signals. He has published numerous articles on the topic of wireless, digital networks. Dr. Vaman is also the chair of the IEEE 802.9 Integrated Services LAN Standards Committee.

ORDER INFORMATION

The Visual Communication Series

To order the entire Visual Communications Series use IEEE NTSC product number: HV6983. PAL number: HV6984. Member price: \$899.00. List price: \$949.00.

IMAGE CODING; use IEEE NTSC product number: HV6996. PAL number: HV6997. Member price: \$399.00. List price: \$449.00.

VIDEO CODING; use IEEE NTSC product number: HV6999. PAL number: HV7000. Member price: \$349.00. List price: \$399.00.

IMAGE & VIDEO TRANSMISSION; use IEEE NTSC product number: HV7002. PAL number: HV7003. Member price: \$325.00. List price: \$379.00.

Strategies & Planning for a Wireless Technology System

NTCS number: HV7005. PAL number: HV7006. Member price: \$449.00. List price: \$499.00.

Order from the IEEE Customer Service, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855-1331. Make checks payable to IEEE. For single sales, call 1-800-678-IEEE; for company or institutional sales, call 1-800-701-IEEE; or fax 732-981-9667.

Please add the following shipping and handling charges: for orders totaling \$1.00 to \$50.00, add \$4.00; \$50.01 to \$75.00, add \$5.00; \$75.01 to \$100.00, add \$6.00; \$100.01 to \$200.00, add \$8.00; over \$200.00, add \$15.00. Call for overseas Air Freight charges. Credit card orders (MasterCard, Visa, American Express, and Diner's Club) are accepted.

IEEE videos include tutorials, short courses, distinguished speaker lectures and conference video proceedings. Topics are at the advanced undergraduate or graduate levels and include published learning objectives, as well as booklets that contain visuals and other information developed to enhance the learning experience. All video products are available in either NTCS or PAL standard. To order, one must select the standard that is used in the country where the tape will be played. If the individual is unsure about the video standard used in a particular country, he or she can call IEEE customer service.

Teach Electronics Engineering!

DeVry Institute of Technology is seeking a full-time Assistant Professor for the Electronics Engineering Technology department at our Chicago campus. We are a leader in providing quality career-oriented higher education in business and technology.

Reporting to the department chairperson, responsibilities include teaching fundamental electronics, microprocessors, math, physics, and computer applications to a diverse student population. May involve some evening teaching.

Candidates are required to have a Master's of Science in Electronics, or a Master's of Science in a closely related field. College-level teaching experience required, plus minimum 3 years' related engineering experience.

DeVry offers a salary commensurate with experience, plus a full benefits package. For confidential consideration, please send your resume and salary history to: DeVry Institute of Technology, Attn: Human Resources/MM, 3300 N. Campbell, Chicago, IL 60618. Fax: 773/348-1780.

DeVRY

An Equal Opportunity Employer m/f/v/h

UIC University of Illinois at Chicago

Off-Campus Graduate Engineering Programs

accommodating working adults with evening classes at Chicago suburban locations

The University of Illinois at Chicago (UIC) is one of the top graduate research universities in the country. UIC annually awards approximately 200 doctorates and 1,300 master's degrees and is committed to serving the educational needs of the entire metropolitan area. The Off-Campus Graduate Engineering Program accommodates working adults by scheduling evening classes at suburban locations. These classes, offered one evening per week, are particularly suited to working students. MS and PhD* degrees are offered in mechanical engineering, electrical engineering and computer science, and civil and materials engineering. Reasonable cost has long been the standard for Illinois residents at state-supported universities such as UIC.

* Some restrictions apply.

Planning to take a graduate course this fall?

File the application for admission by June 1, 1998, for degree admission or by July 15, 1998, for nondegree admission.

Fall Semester 1998: August 24 – December 11, 1998

ME 441	Optical Methods in Mechanical Engineering
ME 504	Computer-Aided Analysis of Multibody Systems
EECS 417	Digital Signal Processing
EECS 460	Computer Algorithms
EECS 465	Digital Networks
CEMM course	To be arranged

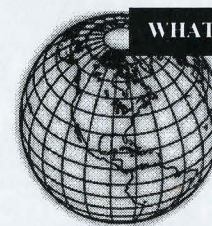
Visit our Website at <http://www.uic.edu/depts/enga/> for information on UIC programs.

This schedule is subject to change without notice. For more information, contact the Coordinator, Off-Campus Engineering Programs (MC 160), 851 South Morgan Street, Room 808, Chicago, Illinois 60607-7050.

Phone: 312/996-2311

Fax: 312/413-7950

E-mail: cmk-ob@uic.edu



WHAT'S STOPPING YOU FROM MOVING UP IN THE WORLD?

Have you been told that you would be a great candidate for a promotion but you need a bachelor's degree?

Getting the right education is critical to moving ahead in today's competitive environment. However boosting academic credentials while fulfilling personal and professional commitments is a challenge. Returning to class full time is just not possible for many adults.

DeVry, a leader in education for over 60 years, understands the needs of working adults. To meet those needs we have designed two degree completion options with you in mind:

- **Bachelor of Science in Technical Management**
Designed to help adults with technical associate's degrees develop their business knowledge
- **Bachelor of Science in Electronics Engineering Technology**
Designed to broaden the technical skills of adults with electronics associate's degrees

DeVry is sensitive to the needs of adult students

- day, evening and weekend options
- Convenient, flexible, scheduling
- Accelerated courses available for those who qualify
- Courses offered year round
- Scheduled lab access
- Curriculum taught by faculty with professional and technical experience

Our programs are designed to assist mature experienced adults in closing the gap between the jobs they have and the careers they want.

Get started moving up in the world by calling: Mike Bennett at 773.929.6550 or e-mail us at jsanchez@chi.devry.edu

DeVRY

Learn to design your product to avoid frustration during EMC testing



Chicago Area
Introduction and Design Seminar on
Electromagnetic Compatibility (EMC)
including a free review of your product



EMC Introduction to Design Practices

Hilton Hotel - Northbrook, IL. **July 16 & 17**

Learn: A working knowledge of EMC fundamentals.
An understanding of EMC components.
Ways of controlling noise entering and leaving your product.
Ways to reduce radiated and conductive noise.

Design Techniques for Controlling Radiated Emissions

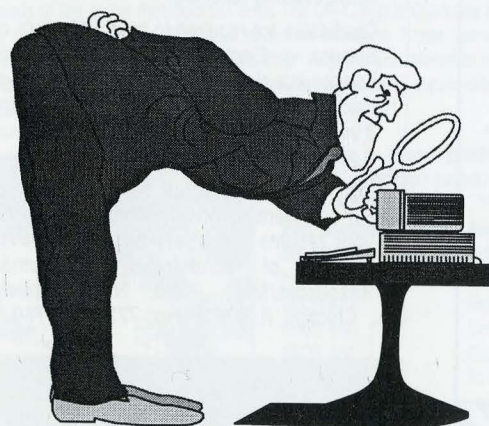
Hilton Hotel - Northbrook, IL. **July 20 & 21**

Learn: A simple mathematical/graphical approach to predict and adjust designs for controlling radiated EMI.
A step by step design approach to achieve EMC.
Trouble shooting strategies.

Free 45 Minute Review of Your Product*

D.L.S. Electronic Systems, Wheeling, IL. **July 18 or 22**

Meet with an EMC consultant to review your product.
Apply what you have learned during the class.



Instructor - Donald L. Sweeney

More than 26 years experience in the field of EMC.
Professor of EMC at University of Wisconsin for more than 10 years.
Consults for companies throughout the world.
President of D.L.S. Electronic Systems, a Chicago area test facility.
Chair of Chicago IEEE EMC Society.
Chair of US Council of EMC Laboratories (USCEL).

For additional information or to register for seminars and your free product review, call 847-537-6400 today.
Space is limited.

Visit our web site at <http://www.dlsemc.com>

*Free 45 min. product review is for those attending the seminar.

DLS 
ELECTRONIC SYSTEMS, INC.
1250 Peterson Drive, Wheeling, IL 60090

Calendar of Events

DATE	EVENT
May 5, 1998	Microwave Theory and Techniques Chapter and Antennas and Propagation Chapter MICROMACHINED MILLIMETER-WAVE STRUCTURES FOR CHARGED PARTICLE ACCELERATORS AND RELATED APPLICATIONS
May 12, 1998	IEEE Chicago Section EXECUTIVE COMMITTEE MEETING
May 13, 1998	IAS/IES Joint Meeting with Northwest Subsection STAND-BY, CO-GENERATION, AND PEAK SHAVING SWITCHGEAR APPLICATIONS
May 13, 1998	Power Engineering Society TURBO GENERATOR: A CATALYST FOR THE DISTRIBUTED GENERATOR MARKET
May 19, 1998	ED/CAD/SSC ADSL: WHAT IT IS, WHY WE NEED IT, WHAT THE ISSUES ARE
May 19, 1998	Magnetics/Nuclear and Plasma Science Joint Chapters CONTEMPORARY ISSUES IN COMPUTATIONAL ELECTROMAGNETICS
May 27, 1998	Fox Valley Subsection and the Computer Society TELEPHONY OVER THE INTERNET

DINNER MEETING

Dr. Yoon W. Kang, Accelerator Division, Advanced Photo Source, Argonne National Laboratory

About the topic:

Micromachining techniques have been increasingly used in various high frequency applications related to microwaves and antenna designs, since the techniques offer solutions for precision, compact, and high performance designs. Effort has been made to develop high aspect ratio millimeter-wave structures using DXL (Deep X-ray Lithography) or LIGA (German acronym for Lithographie, Galvanoformung, Abformung) technique in the Advanced Photon Source (APS) of Argonne National Laboratory (ANL). The APS is a 7-GeV synchrotron x-ray light source. The DXL process consists of X-ray mask fabrication, x-ray exposure, developing, and electroplating. The thickness of the structure can be several mm. The technique can be used for fabrication of devices and systems in ~ 30-300 GHz frequency range. Copper structures for various millimeter-wave applications have been investigated in the APS with emphasis in accelerator application. For charged particle accelerators, higher frequency can provide higher accelerating electric field gradient in the cavity structure. The structure can be small in size, and monolithically incorporated into planar system design. This talk will focus on the development of micromachined millimeter-wave accelerating structures for ~100 GHz.

About the speaker:

Dr. Yoon Kang joined the Accelerator Systems Division of the Advanced Photon Source Project in Argonne National Laboratory as a research staff in 1991. He had worked as an RF engineer at the GE Medical Systems Division on Magnetic Resonance Imaging and as a technical staff for Microwave/Antenna Engineering at the GE Astrospace during 1986-1991. His main contribution has been made to the design and construction of the RF systems of the APS. He graduated from University of California at Santa Barbara and University of Massachusetts at Amherst with his M.S. and Ph.D. degrees, respectively.

Location: Advanced Photon Source, Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439

Time: Tour: 6:00pm.
Dinner: 6:30pm.
Meeting: 7:00pm.

To register: If you are interested in attending, RSVP to myron.fanton@andrew.com. Otherwise a last-minute pass may be negotiated at the gate by mentioning Dr. Kang and the IEEE meeting. Attendees who are not US citizens should take special care to RSVP and bring formal identification to avoid complications at the gate. Dinner will be \$15-25 in the Argonne Guest house. There will be a tour of the Advanced Photon Source and the 7-GeV Synchrotron X-ray Light Source at the ANL.

MICROWAVE THEORY AND TECHNIQUES CHAPTER AND ANTENNAS AND PROPAGATION CHAPTER

Micromachined Millimeter-wave Structures for Charged Particle Accelerators and Related Applications

**Tuesday,
May 5, 1998**



IAS/IES JOINT MEETING WITH NORTHWEST SUBSECTION

**Stand-by,
Co-generation,
and Peak
Shaving
Switchgear
Applications**

**Wednesday,
May 13, 1998**

Final Meeting of the 1997/98 Program

**POWER
ENGINEERING
SOCIETY**

**TURBO
GENERATOR:
A Catalyst for
the Distributed
Generator
Market**

**Wednesday,
May 13, 1998**

IAS/IES DINNER MEETING

*Samer Abughazaleh, Senior Project Manager, Zenith Controls—
Paralleling Switchgear Division*

About the topic:

An informative and educational presentation comparing the differences in switchgear application and technology for stand-by and parallel with utility applications such as co-generation and utility peak shaving. Mr. Abughazaleh will discuss applications for circuit breakers, automatic transfer switches, relays, PLC's, and metering in addition to load control, synchronizing and optimization logic.

About the speaker:

Mr. Abughazaleh received his B.S. degree in Electrical Engineering Technology from Bradley University and brings to us 13 years of pertinent industry experience. Samer has performed various industry roles including design engineer, field engineer, electrical consultant, project engineer and project manager with companies such as Custom Controls and ASCO and is currently Senior Project Manager with Zenith Controls. Samer is co-author and consultant on various

industry articles, a member of IEEE and the Midwest Co-Generation Association.

Location:

Como Inn, 564 N. Milwaukee Ave,
Chicago, IL

*Directions: The Como Inn is located on
Milwaukee Avenue just off the express-
way on the east side of 90/94.*

Time: Social: 5:30pm.
Dinner: 6:00pm.
Presentation: 7:00pm.

For reservations:

Cost: \$20 includes the presentation and your choice of chicken or pasta for dinner. Please call the IEEE Business Office at (800) 898-IEEE or (630) 575-8045 with your entree preference.

NOTE: Attendance at IEEE Technical Meetings is acceptable as one PDH (Professional Development Hour) per meeting, where continuing education is required for renewal of the P.E. licenses.

LUNCHEON MEETING

William K. Clark, Marketing Project Manager, Unicorn Energy Services

About the topic:

Distributed generation products and their related services play an essential role in the future of the electric energy industry. There are several DG technologies becoming commercially available from the automotive, defense and aerospace industries. Many of these new DG technologies are small self-contained generating systems bringing the benefits of DG to a new class of end users. However, to cost effectively apply these systems they must integrate easily into existing customer, electric utility and gas LDC infrastructures. An excellent example of these new technologies is the AlliedSignal Turbo Generator, a self contained, multi fuel, environmentally friendly 75kw generating system. Unicom Energy Services will be a major distributor of these technologies in the Midwest. Being the first marketing partner for AlliedSignal has allowed Unicom Energy Services to become involved in defining the applications and resulting operational characteristics of the TurboGenerator, therefore assuring easy integration and use of this technology by small commercial and light industrial customers.

About the speaker:

Bill Clark received his BS in Electrical Engineering Technology from Purdue University in December of 1977. He started for Commonwealth Edison in 1978 holding a variety of engineering and testing positions in transmission and distribution protection systems. In 1992 he was made the Project Manager of all co-generation and transmission customer projects for ComEd. In July of 1997, he was made Project Manager for the business and application development of Unicom Energy Services entry into the distributed generation market resulting from the AlliedSignal TurboGenerator alliance.

Location: Chicago Bar Association, 321 Plymouth Court (near Jackson & Dearborn), Chicago, IL 60604

Time: Social: 11:30am.
Lunch: 12:00pm.
Presentation: 12:15pm.

For reservations:

Lunch tickets can be purchased in the lobby (\$10.50). Please call the IEEE Business Office at (800) 898-IEEE to make your reservation.

ED/CAS/SSC

**(Electron Devices/
Circuits and Systems/
Solid State Circuits)**

**ADSL:
What it is,
why we need it,
what the
issues are.**

**Tuesday
May 19, 1998**

**MAGNETICS/
NUCLEAR AND
PLASMA SCIENCE
JOINT CHAPTERS**

**Contemporary
Issues in
Computational
Electromagnetics**

**Tuesday,
May 19, 1998**

**Presentation: 6:30pm
Optional dinner: 8:00pm**

EVENING MEETING

Carl R. Posthuma, Lucent Technologies, Bell Labs

About the topic:

While ethernet and other technologies allow for fast access within a building or group of buildings, fast access to home or small business is still needed. With the surge of interest in the Internet and the desire to maximize bandwidth to the home, the interest in cable modems and DSL technologies has exploded. The talk will cover the fundamentals of the various xDSL technologies including HDSL, ADSL, and VDSL. Mr. Posthuma will address the differences between CAP and DMT as well as the difference between ADSL and ADSL Lite. He will also cover some hurdles that DSL must still overcome.

About the speaker:

Carl Posthuma is currently a member of the Architecture & Performance Department at Lucent Technologies. He is working on Access and Switching Systems Architectures focusing on ADSL and hardware. Currently Carl is

an active member of the ADSL Forum, ITU-T Study Group 15, ANSI T1E1, and the Universal ADSL Working Group (UAWG). Carl received his BSEE and MSEE from the University of Michigan before joining Bell Labs in June of 1982.

Location:

Lucent Technologies, Bell Labs,
2000 N. Naperville Rd., Naperville, IL.
Main Auditorium (630) 979-2000
*DIRECTIONS: Lucent Technologies is located at the
northwest corner of Warrenville and Naperville
Roads. When you enter the building, company secu-
rity will provide you with a visitor's badge and direct
you to the meeting place. Non-Lucent latecomers
may have trouble getting past security after 7:30PM.*

Time: Social: 7:00pm.
Presentation: 7:30pm.

For reservations:

Please call the IEEE Message Center at (800)898-IEEE or (630)575-8045 by 1PM Monday, May 18th. For information about the meeting, call Norm Phoenix at (847)523-1078.

DINNER MEETING

Bill Trowbridge, Co-founder, VectorFields Inc.

About the topic:

Computational Electromagnetics (CEM) is now a mature subject practiced by a large international community serving science and industry. The major developments of the subject have been chronicled in the literature. The lecture will examine the current situation in numerical field computation, especially the role of educational and training in developing new ideas to meet the demands of industry.

Computer modeling is used at all stages in the design of electromagnetic devices. The application of Electromagnetics is widespread in industry, national laboratories and in academia and with the production of vast amounts of computer code. This activity continues unabated but has become better focused on the needs of industry. In order for this to be maintained developers must address the needs of industry by not only utilizing technical advances and critical selection of developments but also addressing industry requirements. Unfortunately, this is only part of the story as the creation of new systems require people and their training needs are crucial.

About the speaker:

Bill Trowbridge is a graduate of London University and a Fellow of the Institute of Electrical Engineers. He is a Senior Member of the IEEE, has been awarded a

DSc (Eng) from the University of London and was the first chairman of the COM-PUMAG conference series. He is co-founder and chairman of Vector Fields Ltd and President of Vector Fields Inc and in 1992 he was elected to the Royal Netherlands Academy of Arts and Sciences as a foreign member and also received the IEEE innovation medal. In the 1993 New Year Honours he was appointed by HM Queen Elizabeth II an Officer of the British Empire (OBE) for services to science. In 1995 he was awarded an Honorary Doctorate by the University of Graz, Austria and is currently a visiting professor at Kings College In London and President of the International Compumag Society.

Location: Fermi National Laboratory, Batavia, Illinois. Wilson Hall Building, Main Auditorium.

For reservations: Reservations are recommended for the optional dinner. Details will be posted on the IEEE Chicago Web Site (<http://ieeefinal.gov>) approximately a week before the meeting and will also be given at the meeting. The dinner will take place in a local restaurant. Expected approximately \$15.00 per person.

For information contact Dr. Jean-Francois Ostiguy, Chair Chicago Magnetism/NPS Chapter, email: ostiguy@fnal.gov, Tel: (630) 840-2231 or Dr. David Carpenter, Vice-Chair Chicago Magnetism/NPS Chapter, email: dcarpenter@vectorfields.com, Tel: (630) 851-1734

FOX VALLEY SUBSECTION AND THE COMPUTER SOCIETY

Telephony Over the Internet

Wednesday
May 27, 1998

Charles Byers, Lucent Technologies

About the topic:

We are currently in the midst of the next major change in the way telephone calls are carried and switched. It is now possible to carry excellent quality voice connections over packet based networks (such as the Internet). By combining the voice services with data, image and video over the same network infrastructure, many new and commercially interesting features are possible, and the overall cost to deploy and use the full suite of telecommunication services is greatly reduced.

This talk will discuss some of the properties of Internet telephony, and the construction of systems to support it. There will be a brief introduction to packet networks and the Internet, an overview of the standards that govern Internet telephony, and an overview of some of the network elements needed to provide Internet telephony service. The talk will conclude with some analysis of the Internet telephony marketplace, and an overview of some of the major commercial players.

About the speaker:

Chuck Byers is a Distinguished Member of Technical Staff at Lucent Technologies Bell Laboratories in Naperville, Illinois.

DINNER MEETING

During his twelve year career with Bell Labs, he has been involved in electronic design at the chip, board and system level, as well as system architecture and marketing. He is currently working on advanced Internet access products in the Broadband Switching Concept Department.

Chuck has a BS in Electrical and Computer Engineering, and a MS of Electrical Engineering, both from the University of Wisconsin at Madison.

Location:

Lucent Technologies, Bell Labs,
2000 N. Naperville Rd., Naperville, IL.
Main Auditorium (630)979-2000
DIRECTIONS: Lucent Technologies is located at the northwest corner of Warrenville and Naperville Roads. When you enter the building, company security will provide you with a visitor's badge and direct you to the meeting place.

Time: Networking social: 6:00pm.
Dinner: 7:00pm
Presentation: 8:00pm.

For reservations:

Dinner cost is \$12 per person. Presentation is free. Please call the IEEE Business office at 1-800-898-IEEE, no later than Monday, May 25th to make your reservation. For more information contact Arup Bhuyan at (630) 713-7759.

Employment Opportunities

Motorola is seeking engineers at all levels who have experience drawn from the following areas for its knowledge-based software engineering efforts:

- Program transformation
- Compiler theory
- Programming language theory
- Lisp and other high-level languages
- Real-time, embedded software
- Abstract Data Types
- Expert systems
- Specification language

If you are interested in working in a dynamic and highly productive environment, please send your resume to:

Motorola—Career Transition Services

Attn: LMPs Research — STC
1301 E. Algonquin Road #1234
Schaumburg, IL 60196
E-MAIL: CLS040@email.mot.com
FAX: 847-576-1961



Motorola is an Equal Opportunity / Affirmative Action Employer. We welcome and encourage diversity in our workforce.

Nationwide engineering firm is expanding its Chicago office. We are seeking both entry level and experienced **ELECTRICAL ENGINEERS** to assist us in our growth. Must have BSEE and excellent communication skills. PE or EI would be a plus.

Experienced Electrical Engineer position requires background in 480-volt power distribution for motors, equipment, and lighting systems integral to water, wastewater, commercial, and transportation projects. Experience in SCADA controls and instrumentation systems is helpful.

We offer an attractive salary, professional growth potential, immediate ESOP eligibility, no-interest computer loans, and other outstanding benefits. If you are interested in working with a dynamic, professional team, send your resume to:

Consoer Townsend Envirodyne Engineers, Inc.
303 E. Wacker Drive, Ste. 600
Chicago, IL 60601
Attn: Human Resources, Dept. S.A.
EOE Or fax to: (312) 938-1109 M/F/D/V

For advertising information contact:

Beth Vander Grinten **608-222-7630**

Professional and Business Directory

Support these fine businesses that support SCANFAX.



Rockwell Automation

7055 High Grove Boulevard
Burr Ridge, IL 60521-7593

Allen-Bradley

630.654.6889 FAX: 630.325.6870
E-MAIL: mimartina@ra.rockwell.com
WEBSITE: <http://www.ab.com>



ARCHIBALD & HAMEL, INC.

Manufacturers Representatives

537 Wrightwood Ave., Elmhurst, IL 60126
Tel: 630-833-7377
Fax: 630-833-6279
E-mail: ahijefc@aol.com

Automatic Switch Company

ASCO

CHICAGO DISTRICT SALES OFFICE
2500 W. Higgins, Suite 1165
Hoffman Estates, IL 60195

TEL: (847) 885-1800
FAX: (847) 885-0800

Consoer Townsend Envirodyne Engineers, Inc.

303 East Wacker Drive, Suite 600 • Chicago, Illinois • (312) 938-0300

a professional consulting services firm...

- ✓ Transportation Engineering
- ✓ Site Engineering
- ✓ Construction Management
- ✓ Architecture
- ✓ Environmental Engineering
- ✓ Water/Wastewater
- ✓ Industrial & Hazardous Waste
- ✓ Solid Waste & Resource Recovery



Transportation Engineers

411 South Wells Street, Suite 800, Chicago, IL 60607

Tel (312)922-1700 Fax (312)922-3311



MOTORS • GENERATORS • SWITCH GEAR

IDEAL ELECTRIC CO.

Setting the standard for 95 years

Mansfield, Ohio
TEL: 419-522-3611
FAX: 419-522-9386

Chicago District Office
TIFFIN & ASSOCIATES
TEL: 815-886-8825



JOSE DE AVILA AND ASSOCIATES
MECHANICAL AND ELECTRICAL ENGINEERS

6611 W. North Ave. Suite 101
(708) 383-3030

Oak Park, Illinois 60302-1005
Fax (708) 383-5971



LEE BUTTER & ASSOCIATES
ELECTRICAL MANUFACTURERS REPRESENTATIVES

1125 W. LUNT AVE. PAGER (630) 255-4340
ELK GROVE, IL 60007 RES (630) 837-0733
847/437-7600 FAX (800) 323-1802
FAX (847) 437-7609

LEHMAN COMPANY

Electrical Manufacturers Representative

PHONE: 630-942-1900

FAX: 630-942-1955



Line Associates, Inc. Lighting Design

Complete Lighting Design Services
State of the Art 3-D CAD and Graphics Systems

Layouts, Specifications, Control Systems,
Multi-Axis Photometry Plots, Energy Evaluations,
Calculated Color Renderings, Project Supervision
Telephone (630) 834-4993 Fax (630) 834-4864
World Wide Web www.LineAssociates.com



Panatrol Corporation

- Engineered Process Control Systems
- Data Acquisition
- Electrical Design
- Color Graphics
- Control Panels
- UL LISTED / CSA CERTIFIED

7481 SOUTH SAYRE AVENUE
BEDFORD PARK, IL 60638
24 HOUR PHONE:
(708) 496-3080
FAX (708) 496-0426



Planned Lighting, Inc.

REPAIR • MAINTENANCE • ENGINEERING

3223 North Western Avenue PHONE: 773-296-0999
Chicago, Illinois 60618 FAX: 773-296-0009
E-MAIL: www.plannedlight.com



S&C ELECTRIC COMPANY

Specialists in High-Voltage Switching and Protection

Chicago Sales Office Telephone: (847) 266-1912 • Fax: (847) 266-1910
E-mail: aeagen@sandc.com • Web Site: www.sandc.com

T&D / Products, Inc.

Manufacturers Representatives - Transmission & Distribution Electrical Equipment

10 South Riverside Plaza, Suite 756
Chicago, IL 60606

Phone: (312) 258-4310
Fax: (312) 258-4314

ABB Power T&D Company Transformers, Switchgear, Breakers, Relays
ABB Control Capacitors, Harmonic Filters
Shallbetter Inc. MV Capacitor Banks, Enclosures
Cyberex Inc. UPS Systems, Static Transfer Switches
Technibus Bus Duct Systems
Byram Labs Meters, Transducers, Signal Conditioners



ZENITH CONTROLS, INC.

Leader in Power Switching Since 1923

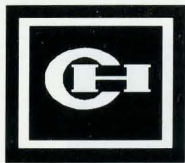
Providing a complete line of transfer switches
and custom tailored power control systems

Worldwide Headquarters
830 W. 40th St
Chicago, IL 60609 USA

Call us at
773 247-6400 or
visit our website at
www.zenithcontrols.com

Advertisers Index

Cutler Hammer.....	BC
DeVry Institute of Technology	7
DeVry Institute of Technology—Chicago	7
DeVry Inc.	4
DLS Electronic Systems, Inc.	8
Electri-Agency, Inc.	2
Inland Detroit Diesel	5
Lendman Group, The	2
Patten Power Systems	IFC
University of Illinois	6
Weldy/Lamont Associates, Inc.	IFC

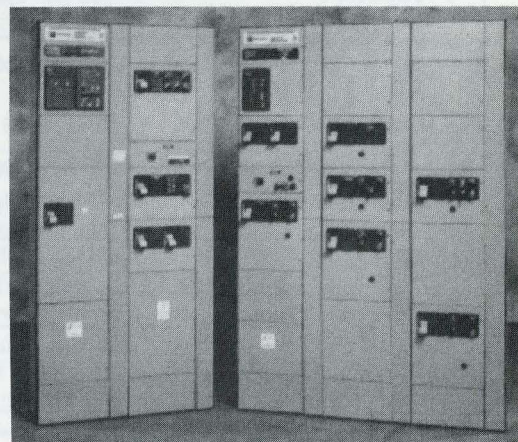
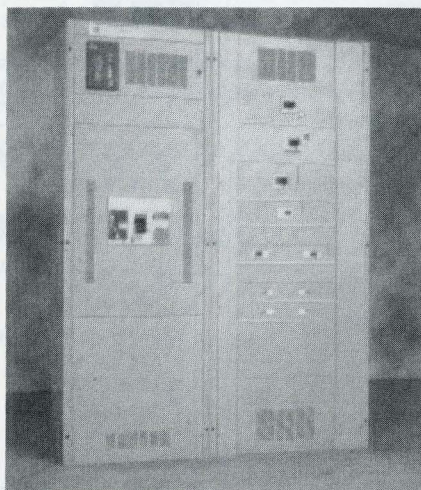
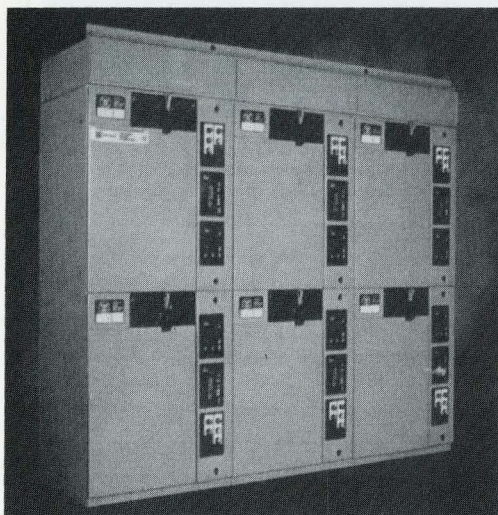


Cutler-Hammer

EAT•N

YOUR CHICAGO HEADQUARTERS

- Switchboards
- Motor Control Centers
- Standard Panelboards & City of Chicago Listed Emergency Panels
- Enclosed Circuit Breakers
- Medium Voltage Control



**All Equipment Meets Local Code Requirements.
Utility Company Approved and UL® Listed.
CSA.**

***OUR CHICAGO ASSEMBLY PLANTS HAVE PROVEN TIME AND TIME AGAIN THAT
WE CAN MEET YOUR DEADLINES.***

**Panelboard
Switchboard
Assembly Plant**
(630)860-3500
Fax: (630)860-3569

**Motor Control
Center
Assembly Plant**
(847)299-1911
Fax: (847)299-0398

**Medium Voltage
Control
Service Center**
(847)593-2118
Fax: (847)593-3370

**Chicago
Sales
Office**
(630)789-5982
Fax: (630)789-4999