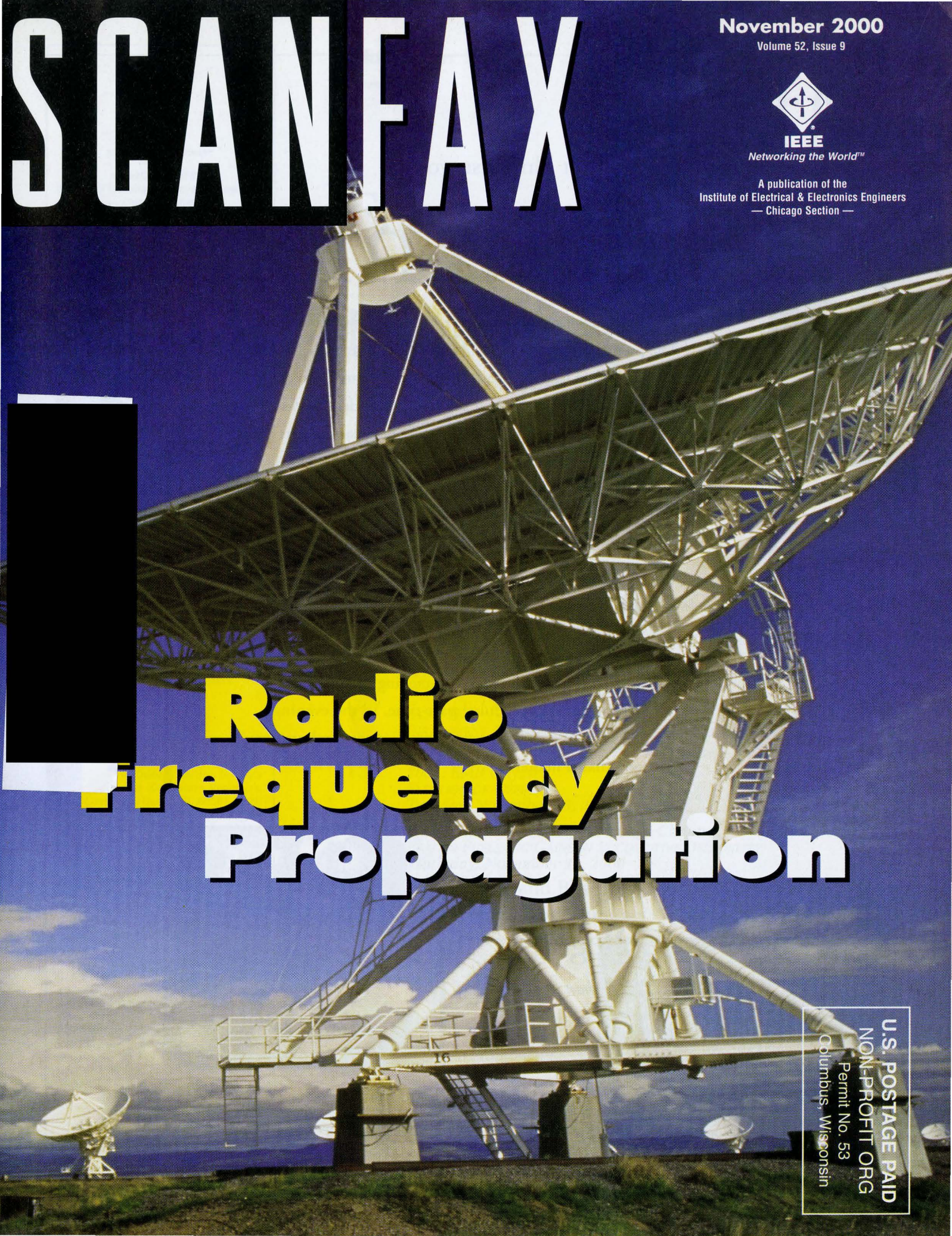
SCANFAX

November 2000
Volume 52, Issue 9

IEEE
Networking the World™

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



Radio Frequency Propagation

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

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November 2000
Volume 52, Issue 9

SCANFAX

Features

Departments

CHICAGO SECTION EXECUTIVE COMMITTEE MEETING
Tuesday, Nov. 14, 7:15 pm
DeVry DuPage, Room 230, 1221 N. Swift Road, Addison, Ill.
No Registration Needed

ATTENTION! IEEE Chicago Section Chapter Chairpersons

Meeting notices and schedules are published *FREE* in *SCANFAX!*

DEADLINES: October 25 for December Issue
November 25 for January Issue

Submit copy via e-mail to: bethv@slackattack.com

Chairman's Message

Patrick Murphy, E.E., P.E.
IEEE Chicago Section, Chairman

Hello again. I hope you enjoyed the timely article on older/younger workers that ran in the October issue in place of my article. I am recovered from the Kidney Stone that destroyed my concentration for about three weeks. It's good to be through with that problem. Thanks to those who wished me well and to those that handled IEEE responsibilities so well during that time.

This month I highlight declining membership participation. For several years the number of viable society chapters in the Chicago Section has been declining. This is evidenced by the declining number of meetings and shortage of volunteers for positions within the organizations. IEEE sets a criteria for recognition of the various categories of organizations. They ask a minimum of two meetings per year for Society Chapters and five per year for Subsections and Sections. For the past three years, the number of groups in the Section that meet those criteria has gone down. This year the trend has continued.

Chicago is not alone as a victim of this phenomenon. IEEE Region 4 has closed two Sections in the past two years and has assigned the members to other adjacent Sections. Our Section is the largest in Region 4. The membership exceeds 6,000 people. They are distributed into 16 Society Chapters and two Subsections and a number of members at large that are not associated with either Societies, Subsections or Affiliated Groups. A listing of the current organizations follows:

Sections: Chicago

Subsections : Fox Valley
Northwest

Society Chapters:
Antennae & Propagation/Microwave Theory & Techniques
Communications
Components, Packaging & Manufacturing Technology
Computer
Consumer Electronics/Signal Processing
Dielectrics and Electrical Insulation
Electromagnetic Compatibility
Circuits & Systems/Electron Devices/Solid State Circuits
Engineering in Medicine & Biology
Engineering Management/Professional Communication
Industrial Electronics/Industrial Applications
Magnetics/Nuclear & Plasma Sciences
Power Electronics
Power Engineering
Reliability
System, Man & Cybernetics

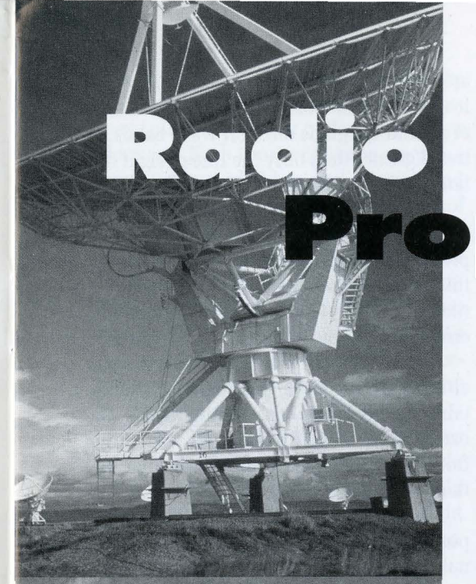
Affiliated Groups: Consultant Network

Several Societies are quite active, e.g., Industrial Applications, Power Engineering and Communications, while others have not held a meeting this year (at least not one they have reported). Subsections also have their own activities, e.g., Fox Valley holds joint meetings with the Computer and Communications Societies while Northwest holds joint meetings with IAS/PES Societies.

One consequence of declining participation is that several society officers' terms have extended beyond the normal one-year limit, also the holding of more than one position by the same person. Another consequence is the declining number of meetings as evidenced by the number announced in *SCANFAX* this season. Only three notices appeared in the September and October issues (including Section Executive Board meeting announcements). Review of the section affiliated Web Sites (Fox Valley/Computer) reveals no recent updates on old announcements.

The problem of declining attendance at Society, Subsection and Section functions does not seem related to the total num-

Continued on page 8



Radio Frequency Propagation

By Terri Biloff

Radio Frequency: An occurrence of communication within an electromagnetic range. In its most simplistic form, radio propagation occurs when radio wavelengths interact with infrared, visible, ultraviolet, x-ray and radiation surrounding the Sun and the atmosphere.

The atmosphere plays a critical role in the way in which radio waves travel around the earth. Without the atmosphere, it would not be possible for signals to travel around the globe on short wave bands, or travel greater than only the line of sight distance at higher frequencies.

One cannot discuss theories of propagation without first embracing historical moments associated with the invention of radio waves as we know them today.

Galvani & Edison may have been the first to witness electromagnetic waves as they were investigating the conduction of electricity, but James Clark Maxwell was the first to prove the existence of an electromagnetic wave, mathematically. He published numerous papers dating back to the 1870's. By the 1880's Maxwell's mathematical theories were proved with physical existence by Heinrich Hertz. His early transmitter consisted of a simple spark induction coil with a loop of wire acting as an antenna, while his receiver was simple and of the same size as the transmitter.

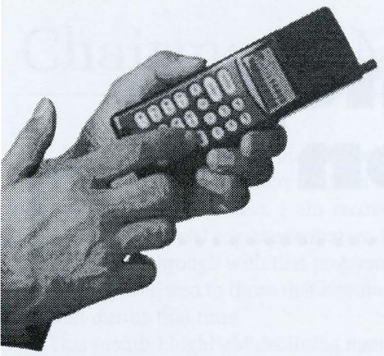
By the 1900's a Frenchmen by the name of Marconi was performing experiments with radio waves in his attic and eventually was successful in increasing his distance from just a few meters, to distances across the English Channel.

Guglielmo Marconi

By 1912 the first amplifier was built and demonstrated to AT&T, and by 1920 Marconi's company began broadcasting two daily programs. Although wide-band FM is widely used today, it took many years to improve its performance, but by 1940 over 150 applications for FM stations were submitted and by 1954 the BBC launched its first wide-band FM service.

Up until this time however, international communications relied on short-wave radio transmitter links, but Arthur Clarke introduced a system that used satellites in geo-stationary orbit where signals would be transmitted up to the satellite and would rebroadcast them back down to earth. This was a revolutionary finding and by 1957 the USSR launched the first satellite into orbit called the Sputnik.

Other satellites followed the Sputnik, however it wasn't until the Telstar was launched that live transatlantic television transmissions took place.



Radio Propagation Theories

Radio systems use propagation of electromagnetic waves through space to send information. Being an electromagnetic wave, the radio frequency wave has the same properties as visible light. The radio frequency wave however is of much lower frequency and therefore longer wave lengths.

Frequency, or number of cycles per second, is given the unit of the hertz (Hz), named after radio pioneer Henrich Hertz. Waves of visible light are short wave lengths ranging from the smallest visible wave-light for violet, about 40 millionths of a centimeter, to 75 millionths of a centimeter for red.

Radio waves are used in other applications such as television, telephone transmission, radar, navigational systems like GPS's and space communication. Electromagnetic waves travel in straight lines and because the earth's surface is spherical, long distance radio communication is made possible by the reflection of radio waves from the ionosphere.

These waves are then reflected back to earth, allowing the signal field to carry frequencies completely around the planet.

The Role of the Atmosphere in Radio Waves

The atmosphere plays a critical role in the way in which radio waves travel around the earth. Without the atmosphere, it would not be possible for signals to travel around the globe on short wave bands, or travel greater than only the line of sight distance at higher frequencies.

The atmosphere can be split into a variety of different layers, according to their properties. The lowest is the troposhere, this extends from ground level to an altitude of 10 km. This is the region that governs the effect of weather.

Above this layer is the stratosphere, with altitudes between 10 and 50 km. This contains the ozone layer. Rising above the ozone layer is the mesosphere, extending from an altitude of 50 to 80 km, then the thermosphere and ionosphere.

The refraction index of the air in the troposhere plays a dominant role in radio signal propagation. This depends on temperature, pressure and humidity. The ionosphere is usually thought of as an area where radio waves on the short-wave bands are refracted back to earth.

The ionosphere is an area where there is a very high level of free electrons and ions, these free electrons affect radio waves. Although there are lower levels of ions and electrons at all altitudes, the numbers start to rise when altitudes reach about 30 km. However, it is not until an altitude of 60 km is reached that it has a significant effect on radio signals.

When signals enter what's called the "D" layer (lowest level of the ionsophere), they transfer energy to the electrons and set them in motion, vibrating in line with the radio signal. As these electrons vibrate, they collide with other molecules, ions or electrons. Each time a collision occurs, a small amount of energy is dissipated and this manifests as a loss in the strength of the signal.

The loss of energy, depends on the number of collisions that take place. That's determined by the number of other molecules and frequency of the signal. As the frequency decreases, the displacement of vibrations increases, thereby increasing the number of collisions.

During the day when the "D" layer is most likely present, signals generally do not pass through it, and signals are only propagated via the ground wave. At night when the "D" layer starts to dissipate, signals are heard much clearer.

Other Factors Influencing Reception

No matter what receiver and antenna you have, as a short-wave listener we are all affected by the solar, seasonal and diurnal cycles of our Sun. As we approach solar cycles and encounter ionospheric storms and disturbances, even those with the best receiver and antennas will encounter times when short-wave reception is degraded.

The transmitting frequency, the sky-wave angle and length of the ground wave can effect reception as well as atmospheric conditions, but what about other sources of interference?

Natural Background Noise

An antenna not only picks up radio transmitters, but also background noise. Galactic noise, the Sun being the main source, atmospheric noise caused mostly by thunderstorms.

Man-Made Interference

This noise is caused by millions of electrical devices in use everyday. From washing machines to fluorescent lights, even if you live out in the suburbs, high tension power lines can act as giant antennas, broadcasting electrical noise which can be as high as 10 times stronger than atmospheric noise.

Solar-Wind

Solar wind leaves the Sun in all directions. At speeds reaching a million miles an hour, the temperature is so high that the gravity cannot hold the material within the Sun and it streams off.

Because of the rotation of the Sun, the streams of high-speed dense solar wind rotates, causing changes in the earth's magnetic field. These streams of materials are known as plasma and when the density and speed of the solar-wind increases, storms can be produced in the earth's magnetosphere and radio propagation can be affected. Daily propagation data is broadcast by the USA's standard frequency and time signal stations WWV and WWVH. This data is also available for those with computer via the internet at rec.radio.shortwave.newsgroups. ■

Next Month:
CONSUMER ELECTRONICS

Chairman's Message

Continued from page 4

ber of members but rather to declining participation by our members. Many explanations have been offered for this behavior.

1. Senior persons have retired early from their employment.
2. Engineers are being required to do more with fewer people. They are too busy to handle more activity.
3. Members with working spouses and families find little time to give for IEEE after hour activities.
4. Employers concerned with their companies' financial conditions do not support IEEE activities during company time (or other times).
5. Members not affiliated with a Society are unaware of Society activities.

Those are the problems and I would like any constructive input regarding them. You may contact me or another section officer or any Executive Board member with your input/suggestions. *(See partial list of contacts at right.)*

I believe the IEEE is important for most Electrical Engineers. It is a place to learn more about our profession, network with other Engineers that have similar interests and learn about leadership and service while contributing to the overall good of the profession.

Finally I want to wish you all a Happy Thanksgiving and Holiday Season to follow. ■

CONTACTS:

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Adrienne Novick	Fox Valley Chairman	
Chuck Nochumson	Northwest Chairman	nochucj@ch.etn.com
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Angeline Schaefer	PES Chairperson	aschaefer@owpp.com
Dr. Connie Kelly	EMB Chairperson	ckelly@megsinet.net
Frank Straka	Reliability Chairman	
George Thomas	History Committee Chair	gthomas@ccontrol.com
Peter Look	Student Activities Chair	

CHICAGO CHAPTER OF THE IEEE POWER ENGINEERING SOCIETY

ENERGY EFFICIENT TRANSFORMERS FOR COMMERCIAL BUILDINGS

Wednesday, November 8, 2000

LUNCH MEETING

Steve Wilmes, *Square D*

About the Topic:
Steve Wilmes will discuss the new NEMA TP-1 standard for energy efficient transformers. This standard is a result of a joint effort by manufacturers to develop a transformer design that minimizes transformer losses under actual real world application. The TP-1 standard has been adopted as required by some municipalities. K rated transformers will also be discussed in light of what was learned while developing the TP-1 standard.

About the Speaker
Steve Wilmes has a BSME degree from the University of Illinois in Urbana, Illinois. He is a registered professional engineer in Illinois. Steve has worked for Square D since 1980. His responsibilities include working with Chicago area consulting engineers.

Time:
11:30 a.m. Social
12:00 p.m. Lunch (optional)
12:15 p.m. Presentation
1:00 p.m. Adjourn

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

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

For more information, please visit the Chicago Chapter IEEE PES Web site: www.ece.iit.edu/~flueck/chicago_pes.

CHICAGO/ROCKFORD IEEE

CONSULTANTS' NETWORK MEETING

Monday, November 13, 2000

EVENING MEETING

The Chicago/Rockford IEEE Consultants' Network will be meeting on Monday, November 13, 2000, 7:30 - 9:00 p.m. at the Palatine Public Library, 700 North Court, Palatine, IL 847-358-1216.

Meetings are usually held on the last Monday of odd-numbered months. Preceding the meeting, we will be getting together for our group dinner. You are invited to join us for the optional informal dinner. We will meet at Bakers Square at 6:15 p.m. It is located at 270 E. Northwest Highway and North Court, just south of the library. We order individually from the menu.

We plan to finish dinner by 7:20 p.m. The meeting is two blocks from Bakers Square. Reservations are not required. There is no charge for attendance at the meeting.

In addition to networking and sharing leads and referrals, there is usually a guest speaker. In November our speaker will be Dr. Gary Blank, Chair, IEEE National AICN (Alliance of IEEE Consultants' Networks), and Chair, IEEE Chicago/Rockford Consultants' Network. He has been very successful in finding clients, and will be speaking on "How To Find Clients, Full-time or Part-time." This is a part of a seminar which Gary has presented internationally to audiences of consultants and those who would like to become consultants.

Members and non-members are invited to both the meeting and the optional dinner.

Information about the network can be obtained by e-mail: *g.l.blank@ieee.org* and at our web site http://www.drblank.com/coaction.htm

See you on November 13, and bring consultants and those who aspire to be consultants.

Sincerely Yours,
Dr. Gary L. Blank, Chairman

IEEE EMC CHICAGO SECTION

MEETING SCHEDULE

Wednesday, November 15, 2000

Wednesday, December 13, 2000
MODE STIRRED TECHNOLOGY

See our website for further details: **www.ewh.ieee.org/soc/emcs/chicago**

IEEE CHICAGO SECTION'S JOINT CHAPTER ON ENGINEERING MANAGEMENT AND PROFESSIONAL COMMUNICATION, CHICAGO SECTION, UNIFORUM-CHICAGO, THE ASSOCIATION FOR FACILITIES ENGINEERS (AFE) AND RELIABILITY SOCIETY CHAPTER

COMPUTER SIMULATION TOOLS FOR ENGINEERING MANAGERS

Wednesday, November 15, 2000

EVENING MEETING

Prof. Barry L. Nelson, *Professor and Director of Northwestern University's Master of Engineering Management Program (MEM)*

About the Topic:
Professor Nelson will speak on using, and managing the use of, computer simulation for risk and operations analysis. He will demonstrate some popular software for spreadsheet and systems simulation, and then present basic principles for managing a simulation study.

About the Speaker:
Professor Barry L. Nelson is Professor and Director of Northwestern University's Master of Engineering Management Program (MEM). He has a BA in Mathematics and Computer Science from DePauw University, as well as an MS and PhD in Industrial Engineering from Purdue University. His research and teaching interests focus on stochastic processes, computer simulation of stochastic systems, and on statistics.

Location: College of DuPage (COD) in Glen Ellyn, Ill. Room to be announced later (see below). At Lambert Road and 22nd Street, between Butterfield Road and Roosevelt Road.

Time: 7:00 p.m.

Cost: Free.

Reservations: None needed. But please call IEEE office at (800) 898-4333 during business hours to find out the exact meeting location at COD. In addition, the UniForum-Chicago officers will provide "UniForum" posters to guide you to the meeting room, particularly if there is any last minute change of rooms.

Information: For other information or travel directions, please send e-mail to Joe Feitler at j.feitler@ieee.org or call our IEEE office during business hours.

IAS / IES

INSTRUMENT TRANSFORMER SELECTION AND APPLICATION

Wednesday, November 15, 2000

EVENING MEETING

Joshu Patel, *Electrical Engineer, ABB*

About the Topic:
The presentation will review the topic of instrument transformer selection and application. Basic terms used when specifying current and potential transformers will be reviewed. These terms include metering burden, relaying burden, transformer ratio, metering accuracy, relaying accuracy, IEEE parallelogram, thermal rating and flux density. Line to line vs. line to ground connections and their corresponding VT voltage designations will also be discussed. In addition, various types of current transformers including window, bar and wound types will be presented. Finally, a comparison of IEEE vs. IEC requirements will be presented.

About the Speaker:
Jashu Patel received his BS in electrical engineering from the M.S. University of Baroda, India. He graduated in 1971 and worked as a power transformer design engineer for Voltamp Transformer. In 1980 he moved to the United States and worked as a power transformer design engineer at H.K. Porter in Lynchburg, VA. One year later he started working for the Westinghouse Small Power Transformer Division in South Boston, VA. In 1989 he transferred to the ABB Instrument Transformer Division in Pinetops, NC. There he worked as a design engineer for both low and medium voltage instrument transformers. He recently added marketing and training responsibilities to his position at ABB.

Location: The Como Inn is located at 564 N. Milwaukee Ave. in Chicago, just off the Kennedy Expressway (I-90/94) near Grand Ave. and Halsted St.

Time:
Social: 5:30 p.m.
Dinner: 6:00 p.m.
Presentation: 7:00 p.m.

Cost: Your cost includes the presentation and your choice of chicken ($25 IEEE member/$30 non-member) or pasta ($20 IEEE member/$25 non-member) four-course dinner. Valet parking is included with your meal.

Reservations: Please call the IEEE Business Office at (800) 898-IEEE or (630) 724-0200 with your entree preference on or before Nov. 8th.

Note: *For P.E. licenses that require continuing education for renewal, attendance at IEEE Technical Meetings is acceptable as one Professional Development Hour (PDH) per meeting.*

2001: EMB ODYSSEY

Meeting Schedule

November 28
Election of Officers

December 19
Christmas Social

EVENING MEETINGS

We survived Y2K, but will we survive HIPAA? Now that everyone has recovered from Y2K, its time to turn our attention to the next set of challenges down the road for healthcare technology: HIPAA

The Health Insurance Portability and Availability Act of 1996 has been lurking in the background waiting to pounce as soon as the Y2K bug was exterminated. There are both hardware and software ramifications so no one needs to feel left out. And just when we thought we had figured out the 187 page Act, Congress is threatening to "clarify" it. And if they don't someone else in DC will. The EMB Society in Chicago provided necessary information to area members years before the Y2K bug became a media darling. Get in on the ground floor of HIPAA response so you can be proactive not reactive.

Not everything is legislative! Advances in electrochemical "machines" may provide some of the major breakthroughs, especially in rehabilitative medicine. As microprocessors and wireless technology evolve, the possibilities are endless.

The EMB Society is looking forward to the real start of the new millennium with election of officers for the new term and setting the agenda for 2001. Elections will be held in November for Society Chair and Vice-chair, Secretary-treasurer. Other positions have been filled sporadically as needed. This is an excellent opportunity for professional growth and to participate in setting the direction of the organization.

Suggestions for 2001 meeting topics are needed. Without a national or international meeting to worry about this coming year (that we know of), we will have the flexibility to set the tone of topics for presentations. To get the best people, we need to start early with planning.

Students, getting involved is a great way to start networking. Make contacts with professionals that you may be dealing with after graduation.

Meetings will be held at the Addition Campus of DeVry Institute, 1221 Swift Road, from 7:15 to 9:15. Meeting Room information is not available, but will be posted in the lobby. (DeVry is located between Army Trail Road and Lake Street, adjacent to I355, next door to Dave and Buster's).

Address questions to Connie Kelly (847) 297-6610, (800) 406-8927–pager, ckelly@megsinet.net.

IEEE RELIABILITY SOCIETY

CHICAGO CHAPTER

FRACAS FUELS BIG GAINS IN LOCOMOTIVE RELIABILITY

Thursday, November 30, 2000

EVENING MEETING

Richard H. Hagedorn, P.E., *Senior Reliability Engineer, Electro-Motive Division of General Motors, LaGrange, IL*

About the Topic:
FRACAS has been successfully applied to failure rate reduction in modern diesel-electric locomotives. Unlike classical steam "engines", these work horses have AC motors for traction and microprocessors to manage the diesel engine, traction motor wave-form switching, braking, control, monitoring, diagnostics, and data logging functions. Reliability issues discussed in the design, operation, and maintenance of freight locomotives include a range of hardware and software problems. Failure rate reductions of 5 and 10 to 1 are achieved by concerted application of Failure Reporting and Corrective Action Systems.

Location: Wyndham Garden Hotel, 1200 North Mittel Blvd., Wood Dale, IL. Exit I-355 (IL53) at Thorndale Road, go East 2 miles and turn left onto Mittel Blvd. (Don't go to the Wyndham Hamilton Hotel, which is on Thorndale Road immediately East of I-355).

Time and Cost:
Social: 6:00 p.m. (cash bar)
Dinner: 7:00 p.m. ($20)
Presentation: 8:00 p.m. (free)

Entree: Chicken Marsala or Chicken Piccata or Beef Stroganoff or Vegetarian. All entrees include salad, dessert, etc. The $20 dinner cost includes gratuity and tax.

Reservations: Make your reservation and choice of entree by not later than noon, Monday, November 27, 2000. Call IEEE Message Desk at 800-898-4333!

For More Information: Call Ed Walbridge, Reliability Analysis Associates, Inc., 708-445-0117, reliability@nidus.com.

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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.

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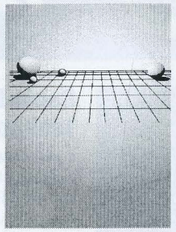

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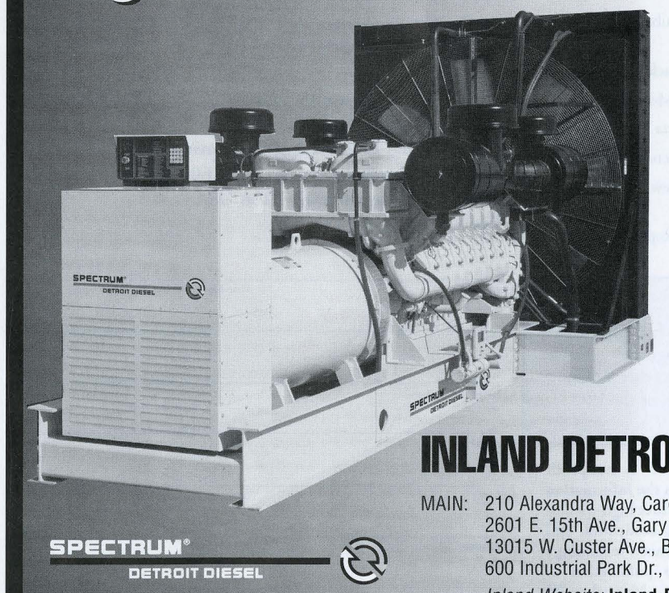

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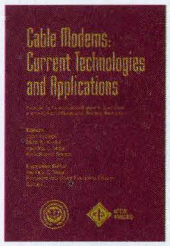

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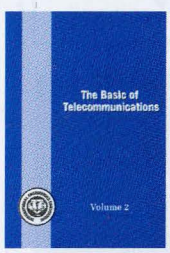

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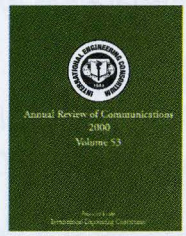

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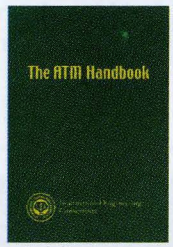

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