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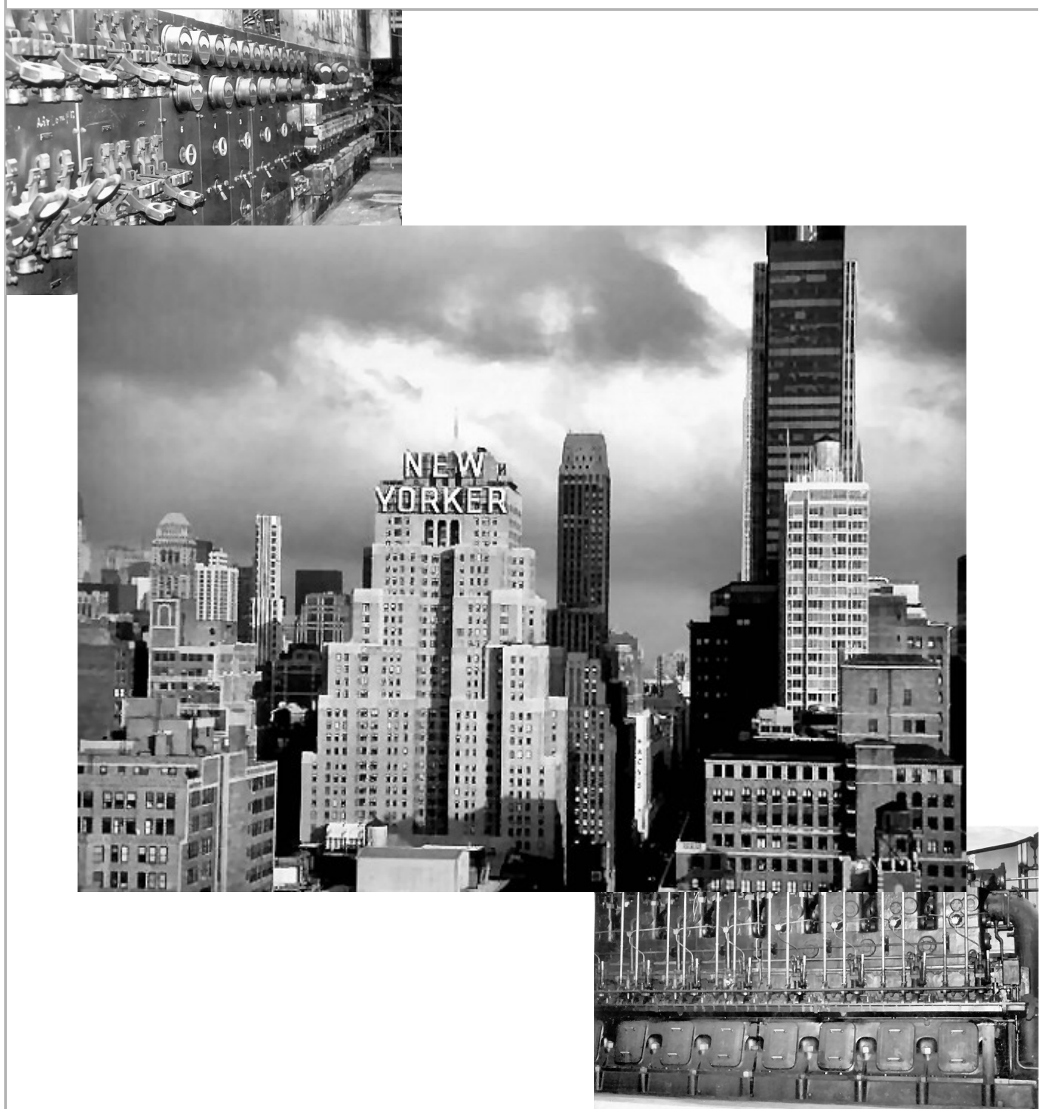

Powering the New Yorker Hotel

A Unique Direct Current (DC) System

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(ISSN 0164-9205)

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Contents

Calendar of Events

(mark your calendars)

Thursday, August 17, 2006

6:00 pm – 8:00 pm: 'Signals' Networking Mixer - WIE/GOLD
Discover opportunities within the IEEE NY Section by networking with local professionals, meet other IEEE NY members, including Executive Committee members, and enjoy the social setting! Hors d'ouvres will be provided.
Location: Proof Lounge, 239 Third Avenue (Bet. 19/20 Streets) New York, NY 10003
RSVP: gold-nyc@ieee--.org, Drivera938@ieee.org

Wednesday, September 13, 2006

5:30pm - 7:30pm: IEEE Communications Society NY Chapter Presentation
Presentation on **"Network Security"**
Location: Polytechnic University, 6 Metrotech Center, Brooklyn, NY 11201
By **Subway**: Jay Street-Borough Hall (A,C,F) Borough Hall (2,3,4,5)
For registration and last minute details, visit our website at http://www.comsoc.org/~nyc

Tuesday, September 19, 2006

Tappan Zee Sub Section Meeting
6:30 pm—8:00pm: Aaron Prazan, Engineer with Con Edison will give a presentation on "Stray Voltage Mitigation". (see ad on back cover)
For last minute details visit our website at http://www.ewh.ieee.org/r1/new_york/tz

Thursday, September 21, 2006

5:00 pm – 7:00 pm: PACE/GOLD
Professional & Educational Event/Activity - Possible Open House with IEEE student branch university.

October 2006

Date & Time: tba: Tappan Zee Sub Section Meeting
Indian Point Energy Center Tour
For updates, visit our website at http://www.ewh.ieee.org/r1/new_york/tz in the Fall.

November 2006

Date & Time: tba: Tappan Zee Sub Section Meeting
Robert Gezelter, Senior Member IEEE will give a presentation on "Safe Computing in the Age of Ubiquitous Connectivity".
For updates, visit our website at http://www.ewh.ieee.org/r1/new_york/tz in the Fall.

Thursday, November 9, 2006

6:00 pm – 8:00 pm: 'Signals' Networking Mixer - WIE/GOLD
Start the new season on the right foot and discover opportunities within the IEEE NY Section by networking with local professionals, meet IEEE NY Executive Committee members, and enjoy the social setting! Hors d'ouvres will be provided.
Location: Proof Lounge, 239 Third Avenue (Bet. 19/20 Streets) New York, NY 10003
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HOW GREAT BREAKTHROUGHS HAPPEN

By Kenneth Vought, NY Section Chair

According to Alan Lightman, PhD Massachusetts Institute of Technology, physicist, novelist, essayist, and lecturer, trusting a sudden intuition without too much skepticism often leads to the greatest breakthroughs in science.

His book *"The Discoveries: Great Breakthroughs in 20th Century Science"* presents examples of work such as: Werner Heisenberg's enumeration of the uncertainty principle, Barbara McClintock's revelation that genes can jump from one chromosome to another, and Henrietta Leavitt's development of a method for measuring the distance to the stars.

It was 1921 and Otto Loewi, a German pharmacologist, was looking for a way to determine how nerve cells communicate. Was the signal conveyed from one neuron to the next—or from a neuron to a muscle or organ—electrical? Or was it chemical?

The scientist awoke, jotted down his musings on a slip of paper, and went back to sleep. "It occurred to me at six o'clock in the morning that during the night I had written down something most important," he later recalled, "but I was unable to decipher the scrawl."

Fortunately, the idea returned the following night. That time, Loewi must have written more legibly, because he was able to carry out his Nobel Prize-winning experiment that day. He dissected the hearts from two frogs and placed them, still beating, into separate dishes of saline solution. Loewi then stimulated the vagus nerve he'd left attached to the first heart. As expected, the heart slowed its beating.

Now here's the elegant part. Loewi took some of the solution bathing the first heart and poured it over the second heart, from which he'd stripped the vagus nerve. This heart, too, slowed, proving that the message transmitted by the vagus nerve was chemical in nature. The compound, which Loewi called "Vagusstuff," turned out to be acetylcholine, a neurotransmitter found widely throughout the nervous system.

For Loewi, the experience suggested that "we should sometimes trust a sudden intuition without too much skepticism." The story illustrates how scientists think, and reminds us that science is a process of exploration carried out by human beings.

Over the years, Lightman has realized that scientists rarely read original research papers, perhaps because they view science as being all about the bottom line. If science is an explanation of the way that the world behaves, then you don't need to know how you got to that understanding, Lightman suggests, “You just need the facts.”

That view, although valid, is limited, Lightman explained. "You can read a textbook on the theory of relativity and you can understand relativity," he says. "But you don't understand the mind of Einstein. You don't hear his voice." To remedy that, Lightman has assembled a collection of 24 of great ideas and experiments in 20th century.

Lightman invited scientists: physicists, chemists, astronomers, and biologists to propose great ideas and then he winnowed down the resulting list to two dozen stories presented in his book. For each discovery Lightman provides the original paper along with an essay on the life and times of the scientist(s) involved. Among Lightman's stories that may interest IEEE WIE members is that of Henrietta Leavitt's development of a method for measuring the distance to the stars. Leavitt was hired in the late 1800s by Edward Pickering, director of the Harvard College Observatory, to pore over photographic plates and calculate the positions and brightness of thousands of stars. As one of the cadre of women that formed Pickering's low-paid battalion of human "computers," Leavitt was expected to work, not think. But some of the women disobeyed him, and Henrietta Leavitt was one of those. Through painstaking measurements, Leavitt uncovered a relationship between the periodicity and luminosity of the Cepheids, a group of stars that brighten and dim in predictable cycles that vary between three and 50 days. Leavitt found that the longer a star's period, the greater it's intrinsic luminosity, and that knowing how bright a star is allows one to calculate how far away from Earth it lies. Thus the Cepheids, which are scattered throughout the night sky, could serve as cosmic beacons by which astronomers could gauge distances in space.

Leavitt's work laid the foundation for many of the astronomical discoveries that would follow, including Hubble's determination that the universe is expanding. Yet she remained uncelebrated in her lifetime. In 1925, a representative of the Swedish Academy of Sciences wrote to Leavitt to propose nominating her for a Nobel Prize. Unfortunately, Leavitt had been dead for three years by then, rendering her ineligible for the honor. Most of his stories show how the researchers' personalities drive their discoveries. For example, Arno Penzias and Robert Wilson's detection of the cosmic background radiation—the persistent hum left over from the Big Bang. Both men were incredibly meticulous experimentalists. If they hadn't been so compulsive about the details, they wouldn't have been so certain that this residual hiss in their antenna was something worth investigating. But, they were so fastidious, so picky, and so careful that they methodically chased after the source of the noise. After they eliminated every possible thing they could think of, Penzias and Wilson concluded this was something worth writing about. Indeed, their almost comically understated paper, entitled "*A measurement of excess antenna temperature at 4080 Mc/s,*" formed the basis of their 1978 Nobel Prize.

In the end, Lightman himself discovered a general pattern while putting together his book. While he did not uncover any particular scientific temperament—scientists' personalities run the regular human gamut—Lightman did learn, regardless of the field in which they worked or how they came to their discoveries, all the scientists that he profiled were: *passionate about what they did, loved to solve puzzles, were independent thinkers, enjoyed challenging authority, and truly obsessed with their own field of science.* ■

WIE Honors Women Engineers - Report on January Meeting

By Darlene E. Rivera, WIE Chair

The IEEE WIE - Women in Engineering Society, was joined by the IEEE computer Society and the IEEE Communication Society in its January and February meetings respectively.

In its effort to promote women scientists and engineers as speakers for technical societies of IEEE's New York Section, WIE presented Dr. Mary Y. Lanzerotti of IBM in January and Dr. Evriclea Voudouri-Maniati of Manhattan College in February. Both events were well attended – among the attendees were students, professors, and employees of public and private industry. Both speakers were presented with an Award of Merit for their contributions to IEEE and WIE.

The January meeting, co-sponsored by the Computer Society was held on January 25, 2006. The speaker - Dr. Mary Y. Lanzerotti of IBM's Thomas J. Watson Research Center - is an IEEE Senior Member, an author and co-author of twenty-six refereed publications and; nineteen conference presentations. She is the holder of a patent and has several patents pending. She was Associate Editor of the Lasers and Electro-Optics Society newsletter - IEEE LEOS - from 1995 to 2000, and she has been its Executive Editor since 2001. In addition she served as an elected member of the IEEE LEOS's Board of Governors for a three-year term from January 1, 2003 through December 31, 2005.

Dr. Lanzerotti's preceded her presentation, "Connectivity in the Silicon", with a brief overview of her studies in Physics at Harvard University in Massachusetts, Cambridge University in the U.K and later at Cornell University in New York and the first part of her career when she joined IBM as a Research Staff Member in 1996. The following is a synopsis of her description of the complexities involved in Microchip design, the "physics" required to design a chip, and the "rules" involved.

Silicon Wafers

Today, most integrated circuits (ICs) are made of silicon. The first step in the transformation from silicon to circuit is the creation of a pure cylinder of silicon six to eight inches in diameter. The cylinders are then sliced into thin, highly polished wafers less than one-fortieth of an inch thick. The circuit elements (transistors, resistors, and capacitors) are built in layers on the silicon wafer. Hundreds of memory chips are etched onto each wafer, while for processor chips, perhaps only ten to 50 devices will fit on one wafer.

Work at IBM

Dr. Lanzerotti explained that microchip design is so complex that it takes a team of people, each working on a different part of the chip to complete a design. Today's circuit designers use Computer Aided Design (CAD) tools to help with the design process. The circuit may occupy an area of perhaps one square millimeter when it is fabricated and there can be as many as several million transistors on this area. IBM today designs microchips with over one billion transistors.

Rent's Rule

For thirty years the engineers at IBM have been using Rent's Rule for microchip design as explained in a 1971 publication by B. S. Landsman and R. L. Russo. Rent's rule pertains to the organization of computing logic, specifically the relationship between the number of external signal connections to a logic block (i.e. the number of "pins") with the number of logic gates in the logic block. This rule is attributed to E. F. Rent who in 1960, while working for IBM, published two internal memoranda describing the relationship.

Rent (1960)	*Our work**
Chassis	Functional unit
Card	Design
Circuit count	Gate count
Edge connector count	Used connection
Building block: circuit	Building block: logic gate

(Source: M. Y. Lanzerotti, G. Fiorenza, R.A. Rand, IBM Journal of Research & Development, Vol.49, No. 4/5, July/September 2005, pp.777-803.)

Dr. Lanzerotti pointed out that Rent's rule is an empirical result based on observations of existing designs, and therefore it is less applicable to the analysis of non-traditional circuit architectures. Dr. Lanzerrotti and her colleges, G. Fiorenza and R.A. Rand have developed a new interpretation of Rent's memos that is better applicable for today's components. The results obtained during this work show that the new interpretation of the two memos provides improved wire-length distribution models with better qualitative agreement with measurements and, more accurate estimates of wire-length distributions and wire-length requirements for current designs compared with prior methods.

After the presentation, Wilson Milian, Computer Society Chair presented Dr. Lanzerotti with an Award of Merit in recognition of her service to, and support of, the IEEE Computer Society in its mission to enhance the technical leadership and services provided to the world's computing professional.■

WIE Honors Women Engineers - Report on February Meeting

By Darlene E. Rivera, WIE Chair

Left to right: Warner J. Sharkey, Communications Society Chair, Dr. Evriclea Voudouri-Maniati, WIE Chair Darlene E. Rivera

WIE's February meeting was held on February 15 and was co-sponsored by the IEEE Communications Society. The speaker, Dr. Evriclea Voudouri-Maniati, is an Associate Professor with the Electrical and Computer Engineering Department at Manhattan College. She holds a Ph.D. in Electrical Engineering from the Polytechnic University of New York and has been at Manhattan College since 1982. She teaches in the areas of computers, communications, and digital signal processing.

Dr. Voudouri is an IEEE Senior Member, author and co-author of several IEEE publications and has participated in IEEE workshops on Signal Processing. She is also active in the Society of Women Engineers (SWE) and organizes events to encourage female high school students to study engineering.
Her research interests include Robust and Nonparametric procedures in Signal Detection with applications in Wireless Communications - CDMA and FH Spread Spectrum, Target Detection and classification in Sonar and Radar Systems, and Pattern Recognition.

Dr. Voudouri's presentation, "Radar and Sonar Systems: Robust Signal Processing Techniques" covered several robust and powerful techniques that exhibit near optimum performance in varying signal propagation and noise conditions, such as is exhibited in underwater communications systems. What follows is a synopsis of her presentation.

Introduction

Because of the application of radar and sonar in underwater communications, the environment ("nature") poses several challenges to the reliable operation of the system.

Trainable detectors/estimators have been developed to adapt to these environments.

Radar

Radar can be classified based on location (ground, ship-borne, air-borne, space-borne - satellite) or based on function (surveillance, tracking, reconnaissance, imaging and data links.) They can be used for various applications (air traffic control, aircraft navigation, ship safety, weather prediction, law enforcement and military applications.)

A radar system is composed of a transmitter, a receiver, a display, and antennas for transmitting—emitting (electromagnetic radiation) and receiving (energy deflecting.)

Sonar

Sonar uses acoustic waves to detect objects. This can be applied in underwater applications to navigate or detect other watercraft. There are two types of sonar; passive (listens without transmitting) and active (emits signal and echo is analyzed.) Passive sonar is usually analyzed using Fourier Transform to show the different frequencies that make up the sound. Passive sonar can also be analyzed using a process called Target Motion Analysis (TMA). In TMA, both the bearing and the incoming frequency of the signal reflected by a moving target are measured using a sensor installed on a moving observer, such as plane or a ship. The position and speed of the moving target are estimated from the captured measurements, including noise, with the assumption that the target moves linearly at a constant velocity. Active sonar works in a similar way as radar, the sonar creates a pulse of sound and the sensor listens to the reflection generated by any objects in its path.

Environment

Signals are subject to contaminated noise fields, scattering, multi-path propagation, Doppler spread and phase fluctuation. Additional concerns for underwater communications include fading, limited bandwidth and interference.

Existing techniques used to detect these narrow band signals in contaminated background noise with scattering and multi-path propagation were discussed, along with their drawbacks including: optimum parametric detectors, min-max detectors, robust and trainable detectors, sequential operation of the detectors to improve the time to decision for fixed error rate.

Proposed Solution

Dr. Voudouri's proposes a system, which uses the Generalized Quantile Test (GQT) as a parameter estimator and decoder. The proposed multi-user detection techniques based on the GQT:

- are powerful and robust to varying and contaminated noise environments.
- significantly outperform the linear multi-user decorrelating detectors.
- can adapt their optimum nonlinearities to changing conditions.

The techniques proposed can also be extended to include decentralized processing environments, non-coherent de-modulation, multi-channel processing for spatial diversity, rapid sampling, and error correcting coding.

After the presentation, Darlene E. Rivera, WIE Chair presented Dr. Voudouri with an Award of Merit in recognition of her service to, and support of, IEEE Women in Engineering in its mission to promote women engineers as speakers for active technical societies of IEEE's NY Section.■

Note: An interesting article on Sonar can be found in the April 2006 IEEE Signal magazine.

This article, the first of two on the subject, has been excerpted and edited by Melvin Olken from one, which appeared in the January/February 2006 issue of IEEE Power & Energy Magazine. The permission to do so has been granted by the original author T. Blalock and the Editor-in-chief of the magazine.

Powering the New Yorker Hotel

A unique direct current (DC) system

Figure 1 - The New Yorker Hotel, (Photo courtesy of the New Yorker Hotel Management Company, Inc.)

The direct current generating plant installed in the sub-basement of the New Yorker Hotel was, at the time of its construction in 1929 (hardly an auspicious year), the largest private generating plant in the United States. Upon its completion, it was said to be capable of supplying electric power sufficient for a city of 35,000 people. In an extensive series of articles describing this facility, *POWER* magazine referred to it as being a "fine example of modern hotel engineering." This article discusses this remarkable power installation.

Steam Engine and Diesel Driven Generators

The New Yorker Hotel (Figure 1) is located on Eighth Avenue between 34th and 35th Streets in Manhattan, and is still in operation today. It is a 43-story building which has, in addition, four basement levels. Originally, it contained 2500 guest rooms and was built at a cost of $22,500,000 (in 1929 "pre-depression" dollars).

What would be described today as a "co-generation" facility was incorporated into the design. Steam engines drive electric generators, and the exhaust steam from these engines is then used for heating as well as for other services such as hotel laundry. A cost analysis performed at that time showed a savings of $48,000 per year, compared to the cost of purchasing electric power.

The generating plant was constructed at the lowest (fourth basement) level of the building.

Originally, five dc generators were installed; four driven by reciprocating steam engines, while the fifth was driven by a large diesel engine. Steam was provided at a pressure of 175 psi by four coal-fired boilers located in an adjacent boiler room. The coal was delivered by truck, and ashes were disposed of by the same means. Natural draft for the boilers was provided by a 520-ft. high chimney that ran up through the building structure. Equipment located on the roof removed as much fly ash as possible so as not to be a nuisance to the surrounding neighborhood.

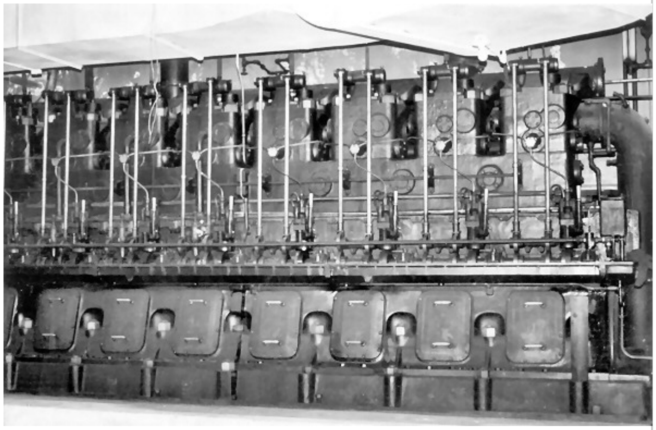

Figure 2 - 530-hp diesel engine direct-coupled to a dc generator.

The four steam engines were of the “Unaflow” type. Three were rated at 960 hp and each drove a 600-kW dc generator. The fourth engine was rated at 640 hp and drove a 400-kW generator. All the dc generators were of the three-wire type (supplying 125 V for lighting and 250 V for motors). Provision was made for the eventual installation of a fifth steam engine driven generator.

The eight-cylinder diesel engine (Figure 2) was rated at 530 hp. It drove a Westinghouse 375-kw three-wire dc generator. All of the generators were direct-coupled to their respective prime movers.

The original dc generating installation totaled 2,575 kW in capacity. The average electrical load for the hotel, however, was only about 850 kW. This huge discrepancy resulted from the fact that it had been anticipated that the hotel would sell surplus electric power to other buildings in the vicinity, a condition never realized.

The diesel generating unit was installed for two reasons. First, it could be utilized at times when not all of the exhaust steam from the steam engines was required for heating purposes in the hotel, generally during the summertime. As such, the steam engine units could be “throttled back” as much as possible so as to minimize the amount of exhaust steam which had to be vented to the atmosphere. The operation of the diesel unit to “pick up” some of the electrical load during these times increased the over-all efficiency of the plant.

A second reason for the installation of the diesel generating unit was to avoid the need for a “breakdown” dc service connection from the New York Edison Company (now Con Edison). Such services were common in large buildings that maintained their own generating plants for use in the event of a massive breakdown of the in-house plant. The base fee for having such a service would have been $36,000 per year, even if never used.

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(Continued on page 12)

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Figure 4 - The "totalizing" panel of the dc switchboard.

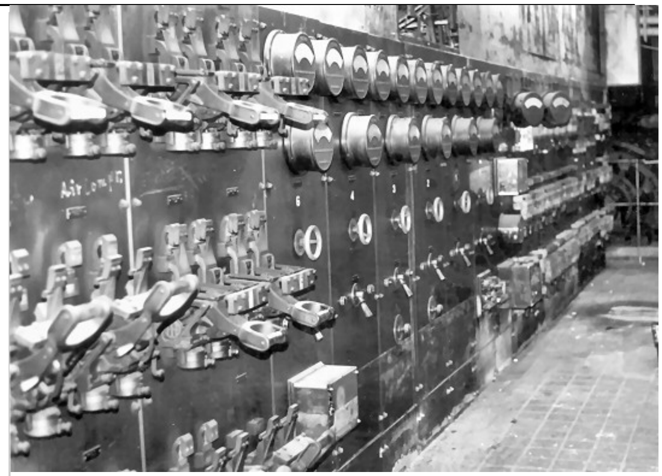

Figure 3 - View of the dc switchboard with "carbon" circuit breakers in the foreground.

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The Use of DC Power

By the late 1920s, when the New Yorker Hotel was being planned, the use of 60-Hz alternating current for general-purpose power distribution in New York City had been established. However, there was still a great deal of dc power used throughout the city. In fact, as late as 2001, Con Edison was still supplying dc power to over 4,000 customers in New York City. (Con Edison has since informed its remaining dc customers that dc will not be provided after 2005.)

The choice of dc generation at the New Yorker Hotel may have been the result of the slow operating speed of the reciprocating steam engines, as well as the fact that the use of dc power was still very common at that time. The engines operated at a speed of 150 rpm, and it would have been rather expensive to build 60-Hz alternators for such a low operating speed since

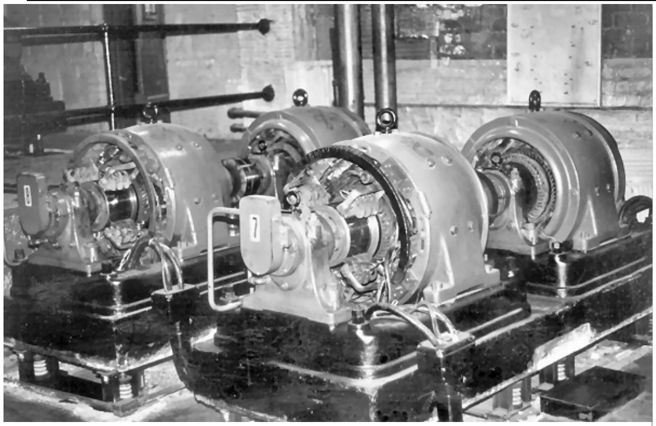

Figure 5 - 240-V dc to dc motor-generator sets for elevator voltage control

such machines would have mandated windings having forty-eight magnetic poles.

Originally, the hotel utilized over two hundred dc motors, which totaled 3,700 hp. Some of them are still in use today (now being supplied from solid-state rectifiers located in the old generator room). The largest of these motors were three 200-hp units which drove three of four chillers used in conjunction with the air-conditioning system. The fourth chiller was driven by a 200-hp steam engine.

Though lighting was at 120 V, the motors were operated at 240 V. Thus, the dc generators were basically 250-V machines. The three-wire feature, which enabled the supply of 125 V as well, consisted of additional connections to the armatures adjacent to the commutators. Slip rings and brushes were used to convey these connections to external reactance coils which, in turn, provided a "neutral" bus connection for the three-wire 120/240-V distribution system in the building.

A five-pole main circuit breaker was located adjacent to each dc generator unit. In addition to the positive, negative, and neutral connections to the distribution system, two "equalizer" connections were required because of the three-wire operation. The equalizers interconnected the generators in such a way as to insure the proper division of the total load among them (on both the positive and negative sides of the system).

The Switchboard

As with any early large generating installation of this type, a truly "monumental" switchboard was provided to control the generators and the distribution of power. Shown in Figure 3, it consisted of a total of twenty-one seven-foot high vertical panels of black insulating material. The total length of this "board" was over sixty feet.

Six of the switchboard panels controlled the six generators which were eventually in use, and a seventh "totalizing" panel (Figure 4), was provided to meter the total output of the generating plant. There were separate watt-hour meters for the lighting load and the motor load. A third metering device produced a chart that kept a record of total kW demand on the positive and negative sides of the system. This served to indicate how well the two sides of the system were balanced at various times of the day and of the week.

One of the major dc motor loads was the complement of elevators in the hotel. There were 23 elevators in all, 12 of which were main passenger elevators for use by guests. In addition, there were six service elevators, two freight elevators, and three special purpose elevators (one for the hotel ballroom, one from an adjacent subway station, and one for access to a bank facility within the building). Since voltage control was necessary for the dc elevator traction motors, special motor-generator sets were provided which actually consisted of 240-volt dc motors driving 240-volt dc generators. Two of these motor-generator sets are shown in Figure 5.■

(to be continued in the next issue)

In Memoriam

Carole Ellen Ruchelman

The horrific bus accident in the Chilean Andes on 23 March that resulted in the deaths of 10 US tourists has cast a pall over the IEEE New York Section because of the personal nature of this tragic event. One of the victims was the wife of Harold Ruchelman who has been an officer of the Section and of its Power Engineering Society Chapter.

Carol Ruchelman was 63 years old at the time of her death. She was born in New York City, the eldest of three children. She and Harold were married for 41 years and, to all who knew them, were truly soul mates. They raised three children who formed a devoted and loving family. Today that family consists of son Evan and his wife Ann, daughter Suzanne and her husband Howard, daughter Andrea and grandchildren Rebecca, Sami, Jordan and Dean. Her siblings, brother Roger and sister Robin, also survive her.

To all who knew her, Carole was the glue of her family, the role she considered the most important of her life. That family, and the legion of friends who knew and loved her, will always remember Carole.

Harold Ruchelman has served the IEEE New York Section in many roles and for many years. Among the positions he has occupied are Chair of the PES Chapter, Chair of the Section, Editor of the Monitor, and Webmaster for the Section and for Region 1.

The New York Section offers its deepest sympathy to the Ruchelman family on their tragic loss.

'Signals' Networking Mixer

Proof Lounge

239 Third Avenue (Bet. 19/20 Streets)
New York, NY 10003
RSVP: gold-nyc@ieee.org , Drivera938@ieee.org

Thursday, August 17
6:00 pm – 8:00 pm

WIE/GOLD

Discover opportunities within the IEEE NY Section by networking with local professionals, meet IEEE NY Executive Committee members, and enjoy the social setting! Hors d'oeuvres will be served.

Tappan Zee Subsection Meeting

Aaron Prazan

on

Stray Voltage Mitigation

Tuesday September 19 2006

Polytechnic University, Westchester Graduate Center

40 Saw Mill River Road, Hawthorne, NY 10532

Refreshments 6:30pm - Presentation 7:00pm to 8:00pm

Aaron Prazan, Engineer with the Secondary System Analysis group of Con Edison, has been tracking and studying stray voltage on the underground system for two years. He will discuss Con Edison's 5-point approach to Stray Voltage Mitigation. The Company's efforts to learn about the root causes of stray voltage and electric shocks in its secondary network system have led to advances in detection technology, better understanding of the real hazards present, and dramatic reductions in the number of electric shocks in the last two years.

"Advanced Registration is Recommended for Security Reasons!".

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For last minute details please visit website http://www.ewh.ieee.org/r1/new_york/tz