IEEE ELECTROMAGNETIC COMPATIBILITY GROUP

NEWSLETTER

ISSUE NO. 92 WINTER 1977 EDITOR: ROBERT D. GOLDBLUM

EDWIN (ED) L. BRONAUGH

EMCABS RESUMES

The Information Retrieval Committee of the IEEE EMC Group is being started again, and EMC Abstracts (EMCABS) will once again be published and distributed to the EMC Group membership. The present plan is to publish and distribute the abstracts as a part of this newsletter each quarter.

The new chairman of the committee is Edwin L. (Ed) Bronaugh, Manager, EMC, Southwest Research Institute, P.O. Drawer 28510, San Antonio, TX 78284, Tel., 512-684-5111, Ext. 2792. The following EMC Group members have graciously consented to be members of the committee:

Lawrence C. Babcock
Jacqueline R. Janoski
G. Robert Redinbo
James S. Hill
Milton Kant
Richard B. Schulz
Ralph M. Showers

However, we will need more committee members! The committee will only be successful if there are enough members to distribute the work load so that each member has only a small part to carry. We need at least five more members. If you are willing and able to commit a small amount of your time for the benefit of all EMC Group members, please contact me.

We need other assistance also. What would make these abstracts more valuable to you, the user? What publications should be revised for abstracts? If you have thoughts on these or any other questions concerning the abstracts, please send them to me. Presently, we are considering the following as possible sources of abstracts:

IEEE Publications
SAE Publications
Records at Symposia
Government Documents
Trade Journals & Techincal Magazines
AEES, CBEMA, EIA Publications
ANSI, CISPR, etc. publications
Amateur Radio Publications

We plan to start with current information, and expect to have some abstracts to publish in the next issue of the Newsletter. If there is sufficient interest and we have enough help, we plan sometime in the future to work back from the present to fill in the gap in abstracts since the last ones were published several years ago.

But for now, we need more hlep. Please volunteer, if you can.

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WAGE BUSTING BILL

Recently proposed legislation to help prevent wage busting by protecting engineers under the Service Contract Act continues to meet with mixed reactions from the major engineering societies. Blue-collar and, more recently, white-collar technical people are now covered by the Act, while engineers remain on the bargaining table, with their services bouncing to the lowest bidder. The bill to extend the protection of the Service Contract Act to include engineers never survived the last session of Congress. While there are close to 15 Congressmen supporting the HR 15228, its late introduction forced its postponement until the next session. The bill is expected to come up again in January; however, little hope remains that the major professional societies, like IEEE and NSPE, will come to an agreement on procedures even then. NSPE has been advocating a change in the procurement law, rather than an extension of the Act to include engineers by establishing a minimum salary level, based on the U.S. Department of Labor's National Survey of Professional, Administrative, Technical and Clerical (PATC) pay scale.

It has been suggested that, perhaps, the members of both IEEE and NSPE will have to become more vocal in letting the hierarchies of their societies know what they individually feel will help the working engineer.

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MEETINGS & EVENTS

GROUP BEING FORMED FOR TRIP
TO MONTREUX EMC SYMPOSIUM

June 28-30, 1977

montreux 1977
june 28-30

As in 1975, a group is being formed to take advantage of special group fares. This package trip has been prepared to offer the least expensive air and land rates available and thus attract as many members and spouses to this event as possible. Two options are offered: one with transportation on Swissair, the other on TWA for those who are required to travel on a USA flag carrier. A post-symposium offer is included in order to qualify the use of a 14 day GIT air-fare. The land arrangements of hotel, meals, transportation and rental car are the same for either option.

The itinerary is arranged to depart New York (JFK) on Saturday, June 25, 1977 and return on Saturday, July 9, 1977. The tour price includes:

- Economy-class air ticket, New York/ Geneva, Zurich/New York based on 14/21 day GIT fare (minimum 15 passengers)
- Transfers by private motorcoach from Geneva to Montreux upon arrival and to hotel in Geneva at end of EMC Symposium
- Five nights at Eurotel in Montreux
- Continental breakfast and dinner
- Taxes, tips and service charges
- Twin-bedded rooms and bath
- Half day sightseeing tour of Montreux
- Overnight in Geneva at Hotel d' Auteuil
- Continental breakfast
- Pick up car in Geneva with 7 days unlimited mileage or a one-week first class rail pass with unlimited rail transportation on the Swiss Federal Railway network or a Eurailpass with unlimited first class rail transportation in 13 western European countries.
- Seven nights at an inn, at one location in Switzerland
- Cars will be turned in at the Zurich Airport.

The cost is for tour with car	$894
with Swiss rail pass	$892
with Eurailpass	$926

These rates are per person with two people sharing a room and car, or rail pass.

The single supplement is about $100.

The costs are based on current estimations and are subject to currency fluctuations and possible changes in air fare. The costs are somewhat greater than last year because of the scheduling of the Montreux EMC Symposium in the high season for air fares and hotel rates. However, the tour is an extremely good value when compared with the non-group air fare and land accommodations.

Those interested in joining the group should send in the coupon for additional details on the itinerary with travel folders on Montreux and points of interest in Switzerland.

2nd Symposium & Technical Exhibition on:

electromagnetic compatibility

JIM HILL
6706 Deland Dr.
Soringfield, VA 22152

Dear Jim:

Please put my name on your mailing list for detailed description of the EMC Group trip to the Montreux Symposium and illustrated brochures on Montreux and Switzerland. I would prefer to travel

☐ SWISSAIR ☐ TWA

NAME (print)_____

COMPANY_____

STREET ADDRESS_____

CITY_____ STATE_____ ZIP___

PHONE NO._____

3

1976 WROCLAW SYMPOSIUM ON EMC

The third Wroclaw Symposium on EMC was conducted on September 22-24, 1976, organized by the Association of Polish Electrical Engineers (SEP), the Wroclaw Technical University and the Institute of Telecommunication. Co-sponsors included the IEEE, URSI and CISPR. Unfortunately, your editor does not know anyone who attended this meeting and, thus, cannot report on it. However, we would appreciate receiving and will publish a report submitted by anyone who was there.

We have been advised, however, that the Wroclaw Symposium Record is available at the cost of Cena zl 55, - from Ars Polona, Krakowskie Przedmiescie 7, 00-068, Warszawa or Or Pan, 00- 901 Warszawa, Pkin, Poland. The Record consists of over 490 pages and the Table of Contents is as follows:

38. J. Bigu-del-Blanco, C. Romero-Sierra - The Role of Electromagnetic Radiation and Fields in Man and His Environment
39. E. Grudzinski, W. Wadowski - Probes for Radiation Hazard Measurements
40. W. Russiewicz - Observations on the Lienty Interference for ISM Radio Frequency Equipment
41. G. Myer - A Broadband Measuring Line for the Generation of Homogeneons EM-Fields
42. A Pralat - Measurements of EM Field Intensity in Mine Galleries with Metallic Installation
43. L. Dardanoni, V. Torvegrossa, C. Tamburello, L. Zanforlin, M. Spalla - Biological Effects Millimeter Waves at Spectral Singularities
44. A. Kalmakov, B. Kiselgaf - Analysis of Statistical Parameters of the Output Voltage of the CISPR Quasipeak Detector Caused by Discontinuous Interference
45. D. Lifchic, D. Chernomordik - Dependence Between EMI Power and EMI Field Intensity of the Source of Radio Interference
46. Y. Polozok - Analysis of EMC for Continuous, Harmonic Interference
47. Pevnitsky, N. Ermakov - Stochastic Model of Man-Made Noise Caused by Cars on the Routes of Land Mobile Radio Services
48. K. Sukhomlin, G. Rubinseein, L. Asnin - Results of Man-Made Noise Measurements for Investigation of Work Conditions of Land Mobile Radio Services
49. A. Kalmakov, B. Siselgof - Probability Distribution of the Output Voltage of the CISPR Quasipeak Detector Caused by Discontinuous Interference
50. Ju. Abramson, V. Sapitonov - Electromagnetic Environment on Power Line Routes and Limits for Radio Reception Protection in the Frequency Range of 0.15 to 1000 MHz
51. V. Leonov, G. Ilkaev, Ju. Abramson - Some Problems of Man-Made Noise Standardization in USSR
52. L. Kozlova, T. Morozova, D. Chernomordik - Method of Controlling of Local Oscillator Radiation in Broadcast Receivers for the UHF Range
53. N. Kombakov, A. Slavinsky, N. Nikoolov - Method and Circuitry for Pulse Interference Analysis
54. A. Slavinsyy, B. Balabanov - The Possibility of Error Correction in MDS Method of Interference Power Measurement
55. M. Tyni - The Transfer Impedance of Coaxial Cables with Broided Outer Conductor
56. E. Paolini - Measurements of Actual Radar Cross-Sections on Model by the EM Similarity

1977 IEEE International Symposium ON ELECTROMAGNETIC COMPATIBILITY

Olympic Hotel Seattle, Washington August 2, 3 & 4

P. O. Box 88062
Seattle, Wa 98188

CALL FOR PAPERS

The 1977 IEEE International Symposium on EMC, under the theme, "EMC - An Exchange of Views," will attempt to span the broad range of technical areas that can be combined under the term EMC. The Symposium will be held on August 2-4, 1977 in Seattle, Washington.

The program is going to be very energetic and with this CALL FOR PAPERS, the committee is actively soliciting the support of all IEEE, SAE, EIA or AIA members in either writing or encouraging other qualified individuals to write technical papers on EMC in the following subject areas:

Electro-Optics
RF Coupling
EMP
EW
Lightning
Susceptibility
EM Specifications
Filters/Gaskets/Shielding
Computer Prediction
EM and the Environment
System and Subsystem Analysis
Spectrum Utilization

Antennas
Isolation
Bio-Electronics
Instrumentation
Composites
Lasers
CB

Abstracts are due no later than January 15th. Papers are due March 15, 1977. Again, your cooperation and support in making this symposium one of the best is requested by the committee. Send your abstracts to: W. W. Cooley, Papers Chairman, P. O. Box 88062, Seattle, WA 98188; Tel.: 206-773-9290.

WORKSHOP ON GROUNDING AND LIGHTNING PROTECTION

The Fourth Annual Grounding and Lightning Protection Workshop will be held on the campus of FIT, Melbourne, Florida on April 19-21, 1977 under the co-sponsorship of the Federal Aviation Administration and the Florida Institute of Technology with the cooperation of Georgia Tech, NASA and IEEE Canaveral Section.

Areas of interest include, but are not restricted to, measurement methods, power system ground design and performance, signal grounds and grounding, surge arrestor properties, design of surge protection circuitry (power, control and signal lines), EMP grounding and protection (unclassified only) and others.

For additional information, contact Mr. H. Denny, Eng. Experiment Station, Georgia Tech, Atlanta, GA 30332; Tel.: 404-894-3536.

DELEGATES SOUGHT

Headquarters is seeking delegates to attend the 1977 U.S.S.R. Popov Society Congress as part of its annual exchange. The four-day Congress will take place in Moscow in late May 1977. Its theme will be "Significance of Radio Technology, Electronics and Electrocommunications to Increase the Effectiveness of National Economy and Quality of Production." Plans are for the IEEE delegation to stay in the U.S.S.R. about two weeks, attending the Congress and visiting several Soviet cities where the delegates will tour research centers, educational institutions, and operating installations.

Interested members should submit applications, together with a biography, to their Group or Society President as soon as possible. Applicants will be expected to provide their own funding for the trip, perhaps by their own institutions or companies. In making nominations, the Group and Society Presidents will give precedence to applicants who are interested in the topics of the Congress, who are likely to be known by their Soviet hosts through professional achievement and/or positions, and who speak Russian. Final choices will be made by a subcommittee of the Intersociety Relations Committee (ISRC). Further information may be obtained from A. L. van Dort, Secretary to the ISRC, at IEEE Headquarters.

IEEE SEEKING DELEGATES TO ATTEND 1977 USSR POPOV SOCIETY CONGRESS

The IEEE is seeking delegates to attend the 1977 USSR Popov Society Congress as part of its annual exchange. Members are requested to submit applications, together with a biography, to their respective Group or Society presidents as soon as possible.

The Popov Society has advised that its four-day Congress will take place in Moscow in the latter part of May 1977. The theme of the session,"Significance of Radio Technology, Electronics and Electrocommunications to Increase the Effectiveness of National Economy and Quality of Production," focuses emphasis on the whole program, which includes plenary meetings and scientific sessions on such topics as Antenna and Waveguide Devices; Quantum Electronics; Microelectronics and Semiconductor Devices; Networks and Electrocommunication Automatization; Automatized Systems of Control, Designs, Quality and Computer Devices; Scientific-Technical Information (Retrieval, Storage and Dissemination of Information); Broadcasting, Electroacoustics and Recording; Radiomeasurements and Quality Control; Television; Theory and Technique of Discrete Signal Transfer and Information Theory; Electron Microscopy; Electronics.

Plans are for the IEEE delegation to stay in the USSR about two weeks, attending the Congress and visiting several Soviet cities, where they will tour research centers, educational institutions, and operating installations.

Applicants will be expected to provide their own funding for the trip. As a rule, the delegates have been funded by their own institutions or companies. However, in past years, a limited number of delegates from academic institutions have been funded by the National Science Foundation, but this number has been small and it would be to your advantage to try to obtain your own funding.

Nominees will be recommended to the Subcommittee on Cultural and Scientific Exchanges of the Intersociety Relations Committee (ISRC) from applications made to the Group and Society presidents. The ISRC Subcommittee will recommend to the ISRC those nominees whose interests best coincide with the sites and topics suggested by the Popov Society. In making nominations, it is expected that the Group and Society presidents will give precedence to applicants who are interested in the topics of the Congress; those who are likely to be known by their Soviet hosts through professional achievement and/or positions; and, to those who speak Russian.

Further information may be obtained from A. L. van Dort, Secretary to the ISRC, at IEEE Headquarters (212-644-7896).

FCC RULES

FCC REORGANIZATION

H.R. 8014 introduced by Representative R. H. MacDonald (D-MA) proposes the restructure of the FCC. In effect, the changes would allow the Commission to be more independent of the White House and would also make the FCC more available to the public and Congress. One major change would be to reduce the number of Commissioners from seven to five and increase their terms of office from seven to ten years. Staff assistance would be increased.

MEDICAL DEVICES

Congress has voted to give its final approval to legislation establishing the federal government's clear-cut power to oversee the safety and effectiveness of medical devices. The legislation spending in Congress for over ten years updated laws written many years ago.

A 1970 study documented 10,000 injuries and more than 700 deaths caused by unsafe medical devices during a ten-year period (not all electrical or electronic). The White House supports the Bill. HEW has begun the process of classifying devices into regulatory categories.

ENGINEERING RESEARCH INITIATION GRANT

The Engineering Foundation has announced the availability of 1977-78 Engineering Research Initiation Grants of $10,000 in each field represented by a Founder Society. The Technical Activities Board has been designated by the IEEE Executive Committee to evaluate and rank order proposals to be submitted by the IEEE to the Engineering Foundation.

The deadline for proposals is February 1, 1977. For additional information, contact Dr. Richard M. Emberson, Staff Director, IEEE, 345 E. 47th St., New York, NY 10017, or call 212-644-7890.

HOME COLOR TV GAMES MEET TOUGH FCC RULES

Designing a home color TV game is a lot different than designing digital systems. Meeting the FCC radiation specifications for the Adversary game turned out to be extremely difficult for the National Semiconductor Consumer Products Div., Santa Clara, CA.

"To keep the cost down, a plastic, molded case is used," Vurich explains. "This requires appropriate shielding to prevent radiation. As a result the PC board has more copper than open space, and both sides of the board contain as much ground plane as possible. We had to redo the board a half-dozen times to get radiation levels within specifications. Also, there is about a 1-inch high copper shield surrounding much of the circuitry."

Another way radiation is minimized is through the use of a special cable from the game to the TV set. It consists of about a foot of 75-ohm transformer and a short length of 300-ohm twin line that attaches to the color TV set's antenna terminals. Vurich points out that lower impedance and shielding make the coax cable superior to 300-ohm twinline, from a radiation standpoint. In addition to the difficult design, testing the game to see if it met the FCC regulations turned out to be "interesting," Vurich recalls. Besides performing the task at National, two local test labs were initially used to measure radiation. Just getting the right instruments to do the testing wasn't easy because there isn't much equipment available that will work at very low radiation levels," Says Vurich. "Even using a screen room didn't provide an adequately 'quiet' environment at all times of the day. One of the local test companies did not concur with our results, so we went to Heathkit and enlisted their aid in the testing. Finally, we came up with what we felt was a 'clean' design and submitted it to the FCC. Our perseverance paid off because we had no trouble getting through the FCC tests the first time."

EMC PERSONALITY PROFILES

by William G. Duff

A. H. SULLIVAN, JR. (SULLY)

"Sully" has participated in professional activities since his undergraduate days at Cornell where he got his E.E. degree. He was a long-time member of both AIEE and IRE and continues to be active in the present day IEEE of which he became a Fellow in 1969. He has been Chairman of the Washington Chapter of the Group on Electromagnetic Compatibility, later National Chairman of the Group from 1965 through 1967, and Editor of the IEEE Transactions on Electromagnetic Compatibility, 1962 to 1969.

In the period 1964-1967, he served as a member of JTAC (Joint Technical Advisory Committee) of IEEE/EIA, Subcommittee 63.1 (Electromagnetic Compatibility) which performed an extensive study of radio spectrum utilization resulting in the publication in 1968 of a report (requested by the Special Assistant to the President for Telecommunications) titled "Spectrum Engineering - The Key to Progress." This report was both broad in scope and penetrating in depth, and recommendations resulted in a number of major changes and new initiatives in Government spectrum utilization programs.

He has participated in EMC Symposia in 1960, 61, 66 and 67 as a member of the Steering Committee, or as an Advisor. Most recently, he has been Vice Chairman and Program Chairman of the 1976 IEEE International Symposium on Electromagnetic Compatibility. Due to the unavoidable absence of the Chairman abroad during 1976, he acted as Chairman in the final planning stages and during the Symposium itself. At the Symposium in July 1976, he was awarded Honorary Life Membership in the EMC Group.

Sully has chaired a number of sessions on spectrum utilization at IEEE Conventions and has presented papers at other technical meetings such as the International Conference on Communications in 1969. In 1968, he was the invited guest luncheon speaker at the G-EMC Symposium in Seattle and in his presentation "Our Crowded Environment: Compatibility Crisis 1968" covered aspects of the rapidly worsening problems, not only of the electromagnetic spectrum, but also of air and water pollution and its effects on flora and fauna, including man. His interest in the environment has continued since that time and he has frequently urged the membership of G-EMC to take a broader interest in compatibility of the entire environment.

Sully has been active in communications-electronics technology since 1932 when he obtained his first "ham" license as WSIDY. He received a First Class Radio telephone license in 1939.

He became a 2nd Lieutenant in the Signal Corps in 1937 and went on active duty in 1940. In 1943-1944, as head of the Radar and Radar Countermeasures Section at SHAEF (Supreme Headquarters, Allied Expeditionary Forces) he took part in one of the first EMC studies (Project FEELER) when it was found, shortly before D-Day for the Normandy invasion, that severe mutual interference could be expected between various Allied radar and VHF systems which would be operating for communications and aircraft warning in the invasion area. Project FEELER tests and calculations in England prior to the invasion (taking into account antenna radiation and reception characteristics, harmonic radiation and frequency of propagation characteristics) resulted in an amendment to the Signal Annex of the Operation OVERLORD invasion plan. Specific locations were established for all radar and VHF equipment on the beach-head together with operating rules and conditions to prevent interference.

Later in the war, he became Head of electronics intelligence at Headquarters U.S. Air Forces in Europe and after the war led the Air Force investigation into German electronics systems, equipments and components. His article in the May 1949 issue of the magazine Electrical Engineering of the American Institute of Electrical Engineers described the German electronics, communications and missile guidance systems in some detail. He is now a Lt. Col., USAF (Ret.)

In a planning session during the organization of a new company in 1946, he originated the word "avionics" which became the name of the consulting firm Avionics, Inc. of which he was Vice President. In 1955, he joined the York Division of Bendix Aviation Corp. as Assistant to the General Manager and was active in development and production of various missiles and air defense systems, e.g. SAGE (Semi-Automatic Ground Environment) system.

In 1958, Sully joined Engleman & Co. where he worked on a joint project with Frederick Research Corp. to measure output and interference characteristics of Air Force high power radars throughout the United States. In 1961, he went with Frederick Research Corp. (later becoming Vice President) where he continued work in various aspects of electromagnetic compatibility as well as other technical areas. During this period, he edited (and wrote parts of) one of the first major EMC books - the famous 4 volume Handbook on Radio Interference published by Frederick Research in 1962.

Sully became Head of the Washington Office of HRB-Singer in 1964. Later, he joined OTM (Office of Telecommunications Management) in the Executive Office of the President as Head of the Spectrum Planning Division. In 1967, he became Technical Director of the Naval Scientific and Technical Intelligence Center. During his work with the Navy, he was awarded the Navy Superior Civilian Service Award, the Meritorious Civilian Service Award, and a number of Outstanding Performance Awards.

Currently, Sully is President of Sullivan Associates, consultants in engineering and management.

BOOK REVIEWS

BOOK REVIEW

by Jim Hill, RCA Service Company

When we don't have books on EMC to review, we go to closely related subjects such as electrical environment and mathematics. Transactions Editor, Richard B. Schulz, reviews the book, "Characterization of the Electrical Environment," as presented by a group of authors who originally published it as a Bell-Northern Research Report.

Your Editor is responsible for the second review. He chose a book with the pretentious title "Encyclopaedic Dictionary of Mathematics for Engineers and Applied Scientists." This should qualify as a library reference book instead of one on your own book shelf. Call it to the attention of your librarian.

I hope some of you readers will volunteer review of books that you feel should be brought to the attention of our group or at least send us the title of books you would like to see reviewed.

"Characterization of the Electrical Environment"

BY

D.W. Bodle, A.J. Ghazi, M. Syed and R.L. Woodside
323 pages, 150 illustrations, $17.50
Toronto: University of Toronto Press

Reviewed by Richard B. Schulz
IIT Research Institute/ECAC
Annapolis, MD

The authors state that "Communication facilities are normally exposed to a hostile environment, especially in rural areas. It is therefore necessary to study the environmental hazards and to characterize exposure conditions in terms of system design criteria so that the type and degree of protection required by various facilities may be determined.

"The purpose of this document is to quantize the present and future environmental exposure factors affecting communications systems. This will provide protection, system, design, and development engineers with the best current reference source covering the electrical protection design factors required to ensure reliable performance of communication facilities under field operating conditions.

"This document was originally published in 1973 as a Systems Engineering Report (SER 156) by Bell-Northern Research."

It still reads like a report, one that could be helped by careful organization and editing of the material. Not even an index is included. Nevertheless, the material does contain much valuable experimental data accompanied by necessarily sparse theoretical derivations. Most of these data are from widespread sources, with some emphasis on experience in Canada. Additional data are available from references listed in each chapter.

Following an introduction is a chapter on lightning effects on communication systems. Considerable information is given on thunderstorm activity and lightning characteristics. Then, much data on soil characteristics follow, since this is a major parameter in protection problems, which involve grounding, earth-return circuits, and buried cable. Exposure conditions are grounding, earth-return circuits, and buried cable. Exposure conditions are categorized, followed by an extensive and valuable evaluation of lightning-exposure conditions. This part of the work covers structures and especially cables of all types. The topic of surge currents is well covered, not only here, but later in Chapter 7 (an example of weak organization of material).

Chapter 3 is devoted to abnormal power interference that is hazardous for personnel and equipment, but does not cover steady-state interference and disturbances in the noise domain. It covers the characteristics of power systems and their effect on telecommunications plants, line protection of transmission circuits, the effects of system MVA capacity, and the statistics of power networks in Bell-Canada territory.

The chapter also covers resistive and magnetic couplings, fault currents, and extensive line-to-ground fault data. After some digression, it offers an excellent section on dc offset and overshoot, followed by some recommendations.

Extensive experimental data pertaining to electric shock are provided by Chapter 4. Its introduction contains Canadian mortality statistics for 60-Hz current and lightning. It then classifies degrees of shock and variables relating to the severity; it continues with an excellent section on physiological effects. A simplified electrical model of the human body is given and followed by a discussion (unrelated to the model) of effects of body weight, current and duration, including a good discussion on the electrocution equation. Data on dc, short-duration surge, and ac effects are given, together with a good summary of shock effects on humans. Totally out of place in this book are sections dealing with microwave radio transmitters and acoustic shock, since the physical mechanisms involved are entirely unrelated to the preceding material.

Chapter 5 on earth potential gradients is concerned with those gradients appearing in the vicinity of grounding electrodes. Earth potentials may create a shock hazard, damage communication plant and apparatus, and interrupt service. Major sources are lightning discharges to earth or to buried conducting objects, and earth-return power fault currents. Particularly thorough are appendixes to this chapter dealing with (1) analytical procedures and (2) magnetic storms.

The next chapter gives a scanty treatment of corrosion by identifying some of the agents and conditions that cause corrosion and suggesting means by which this knowledge may be used to reduce corrosion damage to a communication network.

The short subject of over-voltage in power utilization circuits, Chapter 7, is closely related to surge currents treated in Chapter 2. It provides examples of lightning and switching surges and shows how they can impair power-utilization circuitry.

A brief concluding chapter indicates the desirability of considering an electromagnetic pulse from a nuclear explosion, but provides no data due to the security classification of the subject.

In summary, this book is not well edited, but does provide a wealth of information on electrical-environment hazards and makes a valuable reference on the subject.

"Encyclopaedic Dictionary of Mathematics for Engineers and Applied Scientists"

Editor

I. N. Sneddon, University of Glasgow
1976 hardcover edition, 800 pages, $100. or L50

Reviewed by Jim Hill

One of the most significant developments in engineering in the 20th Century has been the increasing use of mathematics in the analysis of engineering problems. No longer is skill in the use of a slide rule sufficient mathematical equipment for the practicing engineer. Some electrical engineers have to be acquainted with quantum mechanics, transform theory, or Walsh functions. Other engineering disciplines face similar needs. Therefore, the need for an Encyclopaedic Dictionary of Mathematics for Engineers and Applied Scientists is apparent. The book includes mathematical concepts and technqiues which are most widely and frequently used in engineering. An extensive cross-reference system helps in giving easy access to the fundamental definitions. Emphasis is on applications rather than theory.

The Dictionary has been arranged in strictly alphabetical form. All important terms are the subject of individual articles, but many items are not given separate entries but are covered in related articles. A comprehensive index aids the reader in finding minor topics which are not in their alphabetical place. Some subjects such as computers are covered in depth with 8 to 10 pages, including a bibliography.

In the discussion on computers, it is brought out that when electronic digital computers became generally available in 1950, they gave us an increase in the speed of calculation by a factor of 1000. In the ensuing 25 years, there has been another increase by about the same factor, so that in this short period our mathematical powers have gone up a millionfold. In comparison, the speed of transportation has gone up by a factor of 100 from the horse to the jet airliner.

The computer has become indispensible in science, technology, industry and commerce. Without it, it would have been impossible to land a man on the moon. The extensive credit card services which are now so common are completely dependent on computers.

As a reference work, this book seems to fulfill its mission with authority. With an estimated 5000 subjects between "Abel Equation" amd "Zonal Harmonics" it will surely give enlightenment on any subject in mathematics, including Murphy's Formula.

The following article was contributed by Professor Robert Britton, California State University, Chico, California. It is significant with respect to non-sinusoidal functions in two ways. The internal structure of the array of computers may use Sequency Division Multiplexing for intercomputer communications; the tessellated computer is ideally suited for extremely fast computation of large two-dimensional transforms using bases such as Walsh, Slant or Fourier.

by

G. R. Redinbo

THE USE OF WALSH FUNCTIONS FOR COMMUNICATION WITHIN A TESSELLATED COMPUTER

Introduction

Tessellated computers are computer structures consisting of a large array of interconnected identical cells, wherein each cell is capable of executing its own instructions. The computer architecture proposed by John Holland, called the "Holland Machine", and the computer described by vonNeumann in his paper "Theory of Self-Reproducing Automata" are examples of tessellated computers.[1] A large network of inexpensive microcomputers connected together in some regular fashion could be considered a tessellated computer. The technology of integrated circuits has brought us to a point where a microcomputer can be purchased for less than $100. Thus we are motivated to consider the idea of connecting thousands of them together to produce a super computer. The basic problem with this idea is that no one has developed an effective control structure, in other words we have not figured out how to make such a network of processors work in cooperation. Another problem is that programmers are not experienced at developing algorithms that take advantage of parallism. And yet we observe that the most advanced computer, the human brain, which consists of a very large array of interconnected cells operating in parallel and in cooperation appears to work quite successfully. Thus, we are motivated to consider the concept of a tessellated digital computer.

I have no specific solutions or suggestions as to how to control a tessellated computer. What I do have to offer at this time is a cost effective method to provide the intercommunication within a three-dimensional tessellated computer. To provide direct intercommunication between thousands of microcomputers by conventional methods such as a cross-bar switch would be quite expensive. I propose that each microcomputer be packaged within a cube, and that this tessellated computer would be constructed by arranging the microcomputer cubes (nodes) together within a three-dimensional matrix of communication and utility conductors. Each node would be located geometrically at the intersection of three physically orthogonally oriented communication buses. Each bus will consist of only two wires, a transmission conductor, and a reception conductor. Within each microcomputer cube (node) would be a communication module. I would suggest that this communication module could be designed to implement either time division multiplexing (TDM) or sequency division multiplexing (SDM). TDM would be the easier method to implement, but SDM would have certain advantages to offer. Namely, greater immunity to impulse noise, and in the situation where utilization of the communication channel is below 50% a greater signal to noise ratio could be realized using SDM. Within this system serial information would be transmitted simultaneously between many different microcomputers by way of modulated mutually orthogonal Walsh functions.

This proposed communication system provides for a multitude of relatively inexpensive communication buses and the ability for simultaneous direct communication between all microcomputers connected to the same communication bus. Any microcomputer within this three-dimensional structure can select to communicate over one of three different adjacent orthogonally arranged buses. Although only two physical wires make up an individual communication path, simultaneous direct communication is possible among any combination of microcomputers connected to a bus by way of phase modulation of individually selected binary orthogonal waveforms (Walsh functions) generated by the special communication circuits associated with each microcomputer. The information is spearated in sequency instead of in space. Each node can be programmed with the appropriate information so that any combination of simultaneous intercommunication can be effected and be dynamically changed, depending upon the results of operations within the processor. We simply have an organization where in general some of the nodes can be transmitting information on one of three selected communication mediums at certain sequencies, and other nodes are receiving information over selected buses at selected sequencies, all being determined by the current state of each node. The maximum number of separate simultaneous nodal intercommunication transaction that can be accomplished is determined by the size of the Walsh function generator that is implemented and associated with each of the nodes. One node can transmit the same information to all or any number of other nodes connected to an associated bus depending upon how many of these nodes are tuned to that transmitting sequency. Also it would be possible for one node to inhibit another node by transmitting at the same sequency exactly the same bit pattern inverted. Basically this system provides a crossbar switching circuit in function space. In general the signal on a bus will be a multi-level analog step function which would be the arithmetic sum of a set of Walsh functions.

Characteristics of a Node

A node, which would be one microcomputer and a communication controller, could probably be packaged in a cube with dimensions of one centimeter on a side. A node needs only eighteen external connections. Figure 1 is a sketch showing the physical arrangement of these external connections. In addition to communication over the buses, each node will have a direct connection to each of its' six adjacent neighboring nodes. A control bus is provided to facilitate the process of configuring the processor, that is, loading the individual programs into each node. Different sequency Walsh functions transmitted over the control bus could be interpreted by the nodes as control information forcing them into specified modes, such as a normal run mode or a dormant mode or a program load mode.

The basic elements of a node would be a microprocessor, a memory unit, and a communication controller, which would control the transfer of information from the memory unit of one node to the memory unit of another node upon initiation by the microprocessor. The communications controller will control the following functions after being initiated by the microprocessor.

I. The transfer, over one of three buses at a particular sequency, of a specified block of information from local memory to the memory of some receiving node. The communications controller will interrupt the microprocessor upon completion of transmission.

II. The receipt, into local memory from one of three buses at a particular sequency of a specified maximum length block, of information from some transmitting node. The communications controller will interrupt the microcomputer upon completion of reception of information.

III. A direct memory to memory block transfer of a specified length between the local memory unit and the memory unit of one of the six physical adjacent nodes (neighbor nodes).

These are the three basic functions performed by the communications controller. The communications controller should be programmable so that the user can establish whatever communications protocol he wishes. A local memory access priority will be used, such that (1) the communications controller, (2) the local microprocessor, (3) any of six neighboring microprocessors can make a direct access to the local node memory unit in that order of priority.

Geometrical determinations require that two physical forms of a node must exist; these will be referred to as α and β nodes. One is simply a three-dimensional reflection of the other in terms of the arrangement of the external connections. A nodal processor physically will simply be a three-dimensional structure created by stacking alternating α and β nodal cubes together. There would be no particular requirements on the total number of nodes used or the resultant overall shape of the three-dimensional structure. In other words, this processor is completely modular and one may use only the number of nodes necessary to accomplish the required task. Obviously, the processor could be added to or modified by changing the number of nodes used or arranging them into a different three-dimensional structure, if desired. The communication buses plus the utility conductors (power, two clocks, ground, and control) form a three-dimensional structure into which the nodes fit. Figure 2 is a projection of the relationship between eight nodes arranged into a two cubic centimeter multiprocessor. With shielding existing around each node, the buses would essentially be coaxial conductors and a high signal to noise ratio should be possible with the buses.

If one were to construct a thirty-two cubic centimeter processor, it would contain 32,768 nodes. There would be sixteen planes of X buses, sixteen planes of Y buses, and sixteen planes of Z buses. Each plane would contain thirty-two spearate buses for a total of 1536 individual buses within the processor. There would be sixty-four nodes connected to any individual bus. Each node would be connected to three physically orthogonal buses which means that any node has 186 nodes with which it can communicate directly. By using a selected one of these nodes in an information relay mode, an individual node could communicate with any one of 2,976 nodes. By using two nodes, in the information relay node, at specific locations within the processor, an individual node could communicate with any other node within the entire processor. If each node contains a 1024 byte memory, then this processor would have a total memory sotrage capacity of 33,554,342 bytes (of eight bits each).

Conclusions

The problem of efficiently programming or configuring the nodal processor for general purpose applications is obviously a big one. A high level language should be developed for the specification of nodal processor configurations. The nodal processor could help open the way for the implementation of higher level languages in which the concept of parallelism is a basic feature.

Applications such as one or two dimensional transforms would appear to be algorithms easily configured as a pipeline process on the nodal processor. The usual flow diagram for fast transforms shows a set of nodes and the complex arithmetic involved in going from one set of nodes to another. With this proposed multi-microcomputer architecture, each microcomputer could be dedicated to performing the arithmetic of one butterfly, thus it is essentially possible to accomplish a direct mapping of the flow diagram, which is a parallel pipeline process, into the functional characteristics of the microcomputers and their programmed intercommunication. A nodal processor could be configured to directly perform a two-dimensional transform as a complete pipeline process. (Two dimensions of the processor for space and one dimension for time). An image could be a parallel input on one face of the nodal processor and an enhanced image could be the output on the opposite face of the processor.

The homogeneous characteristics of the processor provide for a graceful degradation of computing power if portions of the processor fail or are damaged. With spare nodes available recovery from a fault would simply involve reconfiguring the algorithm around the malfunctioning nodes. If no spare nodes are available then some parallism in computation would have to be sacrificed.

1. von Neumann, J., "Theory of Self-Reproducing Automata", Urbana, Univ. of Illinois Press, 1966.
2. Holland, J., "A Universal Computer Capable of Executing an Arbitrary Number of Sub-Programs Simultaneously", Proc. 1959 Eastern Joint Comp. Conf., 108-113.
3. Holland, J., "Iterative Circuit Computer", Proc. 1960 Western Joint Comp. Conf., 259-265.

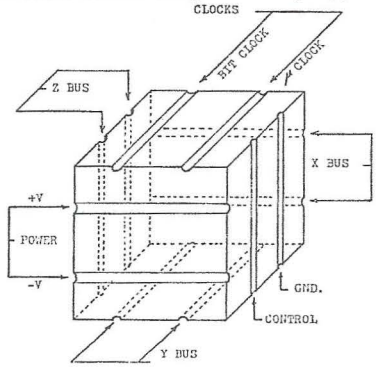

Figure 1. The β Node

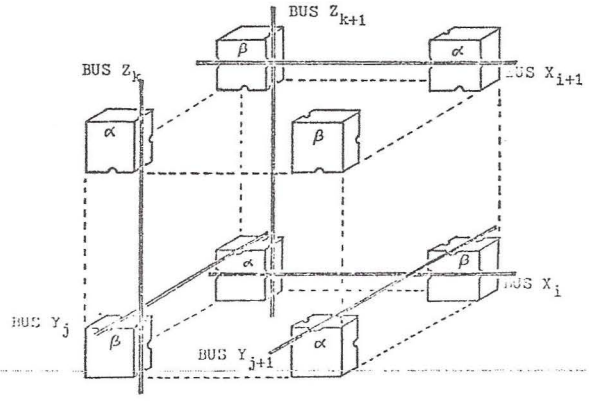

Figure 2. A Two Cubic Centimeter Processor

SOVIET STUDY INDICATES MICROWAVES CAN CAUSE DISORIENTATION, SEIZURES

A newly declassified U.S. Defense Intelligence Agency (DIA) report says extensive Soviet research into microwaves might lead to methods of disorienting human behavior or causing nerve disorders or even heart attacks. Soviet scientists are fully aware of the biological effects of low-level microwave radiation which might have offensive-weapons application, according to the report, which is based on an analysis of experiments conducted in the Soviet Union and Eastern Europe.

A copy of the study was provided by the Agency to the Associated Press in response to a request under the Freedom of Information Act. The DIA refused to release some portions of the study, saying that they would remain classified on grounds of national security.

The DIA report, distributed within the government last March, said that one biological effect which could offer antipersonnel uses is the phenomenon known as "microwave hearing." Sounds and possibly even words which appear to be originating intracranially (within the head) can be induced by signal modulation at very low average-power densities, the study said. It added that "combinations of frequencies and other signal characteristics to produce other neurological effects may be feasible in several years." The report concluded that Soviet research in this area "has great potential for development into a system for disorienting or disrupting the behavior patterns of military or diplomatic personnel; it could be used equally as well as an interrogation tool."

The report said the Soviets have also studied various changes in body chemistry and functioning of the brain resulting from exposure to microwaves and other frequencies of electromagnetic radiation. One physiological effect which has been demonstrated is heart seizure. It said that this had been accomplished experimentally in frogs by synchronizing the pulses of a microwave signal with the animal's heartbeat and beaming the radiation at the chest area. The effect probably is applicable to humans, it said.

The report said that other potential antipersonnel uses of microwaves could be made of their effect on the blood-brain barrier, which regulates the exchange of vital substances between brain cells and the blood. As the result of this, an individual could develop severe neuropathological (nerve disorder) symptoms and either die or become seriously impaired neurologically.

According to the DIA analysis, Soviet researchers have found that persons exposed to low-level microwave radiation experience more neurological, cardiovascular and hemodynamic (blood circulation) disturbances than do their unexposed counterparts. Also, persons exposed to microwaves tend to complain more frequently of subjective conditions including "headache, fatigue, perspiring, dizziness, menstrual disorders, irritability, agitation, tension, drowsiness, sleeplessness, depression, anxiety, forgetfulness and lack of concentration." Reports from European Communist countries indicate that a number of female industrial workers may have suffered aborted pregnancies as a result of exposure to microwaves.

The report - titled "Biological Effects of Electromagnetic Radiation (radiowaves and microwaves) in Eurasian Communist Countries" - was prepared by the Army Medical Intelligence and Information Agency and approved for distribution by DIA. It was compiled by Ronald L. Adams of the Army Surgeon General's Office and Dr. R. A. Williams of Battelle Laboratories, Columbus, Ohio.

CONTROVERSIES PERSIST OVER BIOLOGICAL DAMAGE

The effects of microwave radiation on biological systems may be divided into three classifications. These include early direct effects, early indirect effects, and late delayed effects. The boundaries between these divisions are, of course, not well defined. The last state may be due to "residual" microwave radiation injury and is the subject of a long on-going controversy as to whether or not non-thermal effects exist for non-ionizing (microwave) radiation.

Researchers have been zapping rabbits, garlic roots, beetles and the like for years, and, although much data has been accumulated, the information is still pretty much disorganized. The present status of the not yet fully developed theories, and models proposed to explain experimental observations, are summarized in Przemyslaw Czerski's "Experimental Models for the Evaluation of Microwave Biological Effects" (PROC. IEEE; Vol. 63, No. 11, Nov. 1975, pp. 1540-1544). This important survey paper details the contributions of not only microwave engineers, but of physiologists, cytologists, and biologists.

Other topics discussed include the effects of the organism's biological rhythms on the test data obtained, and simultaneous use of drugs and exposure to microwave radiation. Several phenomena unexplained by current theory are shown to need further research. A valuable aid for further study by the reader is the 55 references with strong coverage of Eastern Europe.

The above mentioned references are available from: Single Publication Sales, IEEE, 445 Hoes La., Piscataway, NJ 08854; Tel.: 201-981-0060.

WARNING SYMBOL FOR STATIC-SENSITIVE DEVICES

Representatives of several RCA activities met recently to consider the well-known problem of handling static-sensitive solid state devices. Unless appropriate precautions are observed, certain microelectronic solid-state devices, especially MOS types and high-frequency bipolar devices, are subject to permanent damage from electrostatic potentials which can accumulate, in routine handling, during test, shipping, and field servicing.

The group developed a distinctive warning symbol and a warning notice which would appear on data sheets, individual and bulk cartons, and storage bins. The symbol includes a lightning flash to indicate the possible transfer of electrostatic energy from a person's finger to the device (see accompanying figure). A red diagonal bar across the symbol signals "Don't touch." The warning notice reads "CAUTION - THIS IS A STATIC SENSITIVE DEVICE REQUIRING SPECIAL HANDLING. BEFORE HANDLING THIS DEVICE REFER TO SERVICE DATA OR TECHNICAL MANUAL FOR THE EQUIPMENT BEING SERVICED."

RCA SSD is also participating in EIA/NEMA industry standardization efforts to develop a similar symbol and precautionary statement. RCA plans to submit this information for committee consideration. Until an industry standard evolves, the RCA group believes they have developed a reasonable symbol and notice for at least interim use, providing a benefit to all concerned.

ELECTROSTATIC PROTECTION OF EED'S

Electroexplosive devices continue to have wide application in military and aerospace systems. The simple device consists of a fine wire in intimate thermal contact with a primary explosive material which in turn is explosively coupled to less sensitive explosive materials. Upon electrically heating the fine wire up to the initiation level of the primary explosive, the whole assembly will fire and provide the stimulus for the main explosive function. This initiator is the input trigger for the system and any weaknesses or failures can produce serious consequences. One problem area concerning the electrostatic or static electricity sensitivity of the EED is presently under investigation. Electrostatic energy delivered to the EED between the input lead wires and the metallic case or enclosure can in certain designs or failure modes inadvertently fire the item. The problem can be analyzed and quantified by certain measurement procedures. A variety of protection techniques can be employed. Theory and performances of certain improved methods capable of protecting the system are presented. "Electrostatic Discharge Protection for Electroexplosive Devices," by L. A. Rosenthal and S. Leopold, Conference Record, IAS Annual Meeting, IEEE Industry Applications Society, October 11-14, 1976, pp. 17-22.

FREE-LOADERS

Often, when potential members are approached about joining IEEE, they will indicate they can read the IEEE technical journals at the library, so why should they join IEEE? One has to be diplomatic when answering this question. However, it is usually quite effective to explain that IEEE membership dues pay for the publication of these journals. Thus, by not joining IEEE, they are letting members of IEEE carry them along. Many of these nonmembers can be persuaded to join so they can give direct support to the Institute and to the engineering profession.

A substantial number of nonmembers regularly attend Section and Chapter meetings. Here again, a constant promotional effort should be conducted to induce these nonmembers (who are enjoying membership privileges) to support your Section and the Institute by joining the IEEE.

APPLICATION NOTE ON FILTERS

Application Engineering Note No. 10-76 titled "Common Core - Common Mode Filters" has been published by LMI. The four-page note discusses the problems of testing common mode filters and the reason they do not comply with MIL-F-15733. It also includes LMI's design approach for such filters. Copies are available free of charge by writing on company letterhead to Fred Nichols, President, LMI, 6056 W. Jefferson Blvd., Los Angeles, CA 90016.

ZOELLNER DEPUTY DIRECTOR OF ECAC

Subsequent to the retirement of J. Paul Georgi, John A. ("Art") Zoellner assumed the position of Deputy Director of ECAC - effective 23 August 1976. Art has been at ECAC since 1961, most of this time as a member of the IITRI staff. Prior to his new position, he had been Deputy Director of Technical Operations for IITRI.

INTERFERENCE CRITERIA FOR MICROWAVE SYSTEMS

The Engineering Department of the Electronic Industries Association has published Industrial Electronics Bulletin No. 10-C, "Interference Criteria for Microwave Systems in the Safety and Special Radio Services." This is the third edition of the document, first published in July, 1972, and revised in March, 1973. This bulletin was prepared following the establishment of FCC Rules Part 94 which created a special rule part for private microwave. It takes into account technical criteria imposed in this new rule and provides new C/I tables covering the new cases. Additionally, a more rigorous mathematical analysis is used in determining the tabulated C/I values. Adjacent channel C/I tables have been replaced by a formula suitable for the threshold degradation criteria due to adjacent channel interference. The original bulletin, 10-A, was endorsed by representatives of the Operational Fixed Microwave Council (OFMC) and was submitted to the FCC as a recommendation of the joint OFMC/EIA task force. The second edition, 10-B, added an Appendix on "Interference Calculation Considerations, prepared as a guide for users. Some values of C/I were also changed due to improved calculation procedures and FCC decisions in Docket 18878 allowing greater deviation. Industrial Electronics Bulletin 10-C, which supersedes 10-A and 10-B, is available from the Standards Sales Office of EIA's Engineering Department, A complete index of EIA and JEDEC Standards is also available free of charge.

CAREER AIDS AVAILABLE

Tax tips and career planning are the subjects of two new publications available from IEEE. Sponsored by USAB, the 1976 IEEE Manpower Report, titled "Career Paths in E/E Engineering," teaches EEs how to avoid typical employment pitfalls and how to develop a structured approach to successful career planning. The report begins with an analysis of employment trends in electrical and electronics engineering and then considers how the individual EE can best react to these trends and even take charge of his or her career.

"Engineers and Federal Taxes," a second USAB-sponsored publication, attempts to dispel some of the mystery surrounding Federal Tax law. Assuming that many EEs handle their own returns without employing expert advice, the authors of this booklet have included everything from how to fill out a return to how and when to take deductions.

Both "Career Paths in E/E Engineering" (EHO117-2)--at $15 for members; $25 for non-members--and "Engineers and Federal Taxes" (EHO121-4)--at $2 for members; $5 for non-members--may be ordered from: IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.