IEEE

Electromagnetic Compatibility Society

Newsletter

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HAROLD RAYMOND SCHWENK
November 1, 1923–March 27, 1988
IEEE Senior Member

Founding Member and First Chairman PGRFI/IRE

"Let such teach others who themselves excel."
Alexander Pope, *Essay on Criticism*

The EMC Society has lost an outstanding member and teacher with the passing of Harold Schwenk of Mineola, NY. Harold was the rare engineer who could solve problems quickly and effectively without confrontation; thus, by example, he served as a teacher for all his coworkers. In a larger sense he taught about accomplishment and the human spirit with his unpretentious manner and generosity with his talents. The lesson of building for the future was apparent in his work as a founding member and first chairman of the Professional Group on Radio Frequency Interference, International Radio Engineers. The PGRFI was the predecessor of the IEEE Electromagnetic Compatibility Society.

Harold R. Schwenk was born in New York City and attended high school in Mineola, NY. From 1942 through 1946 he was an electronic specialist with the U.S. Marine Corps and served in the Pacific Theater. In 1950 he received his B.A. in physics from Hofstra University, Hempstead, NY. In 1951 Harold joined the Sperry Gyroscope Company in Lake Success, NY, where he performed EMC experiments on Sperry products. Later he was responsible for leading engineering personnel and technicians in analyzing, designing, testing and reworking electrical/electronics equipment so as to assure compliance with customer EMC requirements.

As his career progressed, he continued academic work at the Hofstra University Evening School, and in 1956 he completed the M.A. physics course work except for the Technical German Reading Examination. With the October 10, 1957 creation of the IEEE EMC Society, Harold founded the Metropolitan New York EMC Society Chapter. He served as Chapter Chairman several times.

In 1967 he joined Grumman Corporation of Bethpage, New York where he was employed as a Senior EMC Engineer. He applied his EMC expertise across the Grumman product line including the A-6B, EA-6B, E-2B/C, F-14 and EF-11 aircraft. Also he was responsible for conducting advanced development EMC engineering experiments. These efforts resulted in significant contributions to the design of shielded structures and in optimization of a design to protect an all-composite aircraft [1990 timetable] from the electromagnetic environmental effects of lightning.

His sudden death following his recent retirement from Grumman deprives the EMC society of a valued colleague. We in the Society extend our condolences to his wife Mary and children Michael, Linda and Ellen.

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CARNAHAN CONFERENCE '89

The 1989 Carnahan Conference on Security Technology will be held at the Swiss Federal Institute (ETH) in Zurich, Switzerland from October 3 through October 5, 1989. It will be organized by the Institute for Communication Technology of the ETH in Zurich in conjunction with the Georgia Institute of Technology in Atlanta, Georgia and with the cooperation of many international societies.

The conference will emphasize the research and development aspects of security, crime prevention and law enforcement. It will provide a forum for the dissemination of information and ideas on the use of available and future technology in these fields. A Call for Papers has been issued with a deadline of December 1, 1988 for the submission of a 200-500 word abstract (2 copies). Papers concerned with recent technical developments on the following topics are solicited:

- **Sensor and detection technology**
- **Evidence gathering and protection devices using new technology**
- **Alarm devices, searching aids and systems**
- **Monitoring, command, control and communication systems**
- **Computer system security and privacy**
- **Communication security and privacy including advanced modulation techniques, spectrum management and encryption**
- **Automatic identification and authentication of voice, handwriting, fingerprints and other biometric attributes**
- **Entry control systems, access delay technology and surveillance**
- **Automatic vehicle monitoring**
- **Anti-terrorism technology**
- **Drug deterrence technology**
- **Impact of security systems and technology on society**
- **Reports from authorities or agencies related to experience with security systems**
- **Standardization of security related products and procedures in view of harmonization of the EC standards in 1992**

For additional information, contact:

Dr. Gene Grenaker
TDD, RAIL, CCRF
Georgia Institute of Technology
225 N. Ave. N.W.
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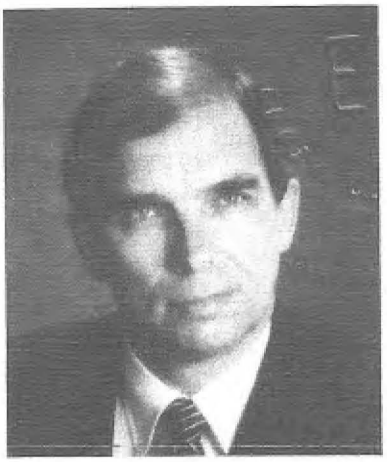
PRESIDENT'S MESSAGE



by Donald E. Clark

There is considerable concern within the IEEE about the Chapter's role and how well the chapter organizations are being served. Chapters are very important in the overall IEEE organization, and they serve as the local focal point for membership interactions and communications. The IEEE leadership recognizes that the relationship among Societies, Sections, and Chapters needs to be improved. They also recognize that the quality and availability of resources at the Chapter level need to be upgraded. The Chapters within the EMC Society are not exempt from these needs. To put the Chapters' roles and functions into perspective, I would like to address: (1) how the Chapter fits into the organization; (2) what resources are available to the Chapters; (3) the problems Chapters encounter; and (4) some possible solutions.

A Chapter is part of the two separate but interacting organizations: the Society and the Section. For areas concerned with technical objectives, the Chapter interfaces with the Society. In turn, the Societies are organized into Divisions according to technical disciplines. The EMC Society is part of Division IV: Electromagnetics and Radiation. The Division Directors and the Society Presidents serve on the Technical Activities Board (TAB). TAB performs functions delegated by the IEEE Board of Directors and recommends policies affecting the management and operation of the Societies. For areas concerned with geographically-defined objectives, the Chapter interfaces with the Section. The Sections, in turn, are organized into Regions with geographical boundaries. Each Region has a Director and these Directors serve on the Regional Activities Board (RAB). RAB performs functions delegated by the IEEE Board of Directors and recommends policies affecting the administration of the Sections. Within the EMC Society, the Chapters are organized under Mr. Bob Hofmann, the Director for Member Services. Under his directorship, Mr. Dan Hoolihan serves as the Chapter Coordinator and Mr. Charles Anderson is in charge of Chapter publicity. If the Chapter leadership understands the top level organizations, they have many avenues available for assistance and resources.

In fact, a number of program resources and services are available to the Chapters from either the IEEE or the EMC Society. An excellent brochure entitled, "A Guide to IEEE Program Resources" dated February 1988 is available from the IEEE Service Center. This guide lists available audiovisual aids and points of contact for the Distinguished Lecturer Programs within the Societies.

Another brochure entitled "Planning Successful Chapter Meetings" is available from the IEEE Technical Activities office. A number of resources and services are available within the EMC Society. The Society's Distinguished Lecturer Program is coordinated by Mr. Dave Hanttula. The program now has four lecturers, and the lecturers are subsidized by the Society. The Society also conducts the ANGEL Program to aid the Chapters. Each member of the Society Board of Directors is assigned as an "ANGEL" to a chapter. Each ANGEL acts as the interface between the Chapter and the Society. An ANGEL can authorize up to $500.00 annually for Chapter programs. To learn more about the ANGEL program, contact Mr. Bob Hofmann. The Society provides recognition to Chapters in several ways. The "Chapter of the Year" award was recently reestablished by Mr. Dan Hoolihan. Each year the Society invites the Chapter Chairmen to a breakfast meeting held during the EMC Symposium. At this meeting, the Chairmen are given an opportunity to interact with the Society officers.

As a Past Chairman of the Atlanta EMC Chapter and of the Atlanta Section, I have had an opportunity to observe the successes and problems at the Chapter level. One of the duties of a Chapter is to provide technical programs. Finding good speakers year after year can be a problem for Chapters, particularly once all the local speakers have been invited. Some Chapters are also faced with poor meeting attendance. It is axiomatic that if a good program is provided, good attendance will occur. However, when attendance is usually low, the Chapter officers will not invite out-of-town speakers since they fear low attendance. I have noticed that a Chapter one year will be very active and successful, and the next year the Chapter may struggle. The Chapter has the same membership and resources available both years. What causes this sudden about-face? I believe it is a lack of leadership. It is essential that the Chapter officers organize and lead the Chapter membership if a Chapter is to be successful.

I would like to make some suggestions on how a Chapter can be improved. First, the officers should recognize that they have much to gain by serving as Chapter leaders. It is an opportunity to develop interpersonal and managerial skills and to identify personal strengths and weaknesses. Secondly, the Chapter officers should know the IEEE organization and know how to obtain resources from the organization. Your Chapter members have paid for the resources; it is up to the officers to see they are utilized. Paradoxically, many of the available resources are never requested. Thirdly, officers should seek ways to improve meeting attendance. Consider joint meetings with other Chapters or with the local Section. Personally contact members and ask them to attend. Use the Distinguished Lecturer Programs. These programs provide excellent speakers, and members will attend when they see an opportunity for professional growth. Fourthly, be enthusiastic; a "can-do" attitude can go a long way.

The EMC Society has many very active chapters; and to these Chapters, I congratulate you on your success. To Chapters that have room for improvement, I hope I have provided insights and information that are beneficial. Remember, all chapters are eligible for the "Chapter of the Year" award.

Donald E. Clark, President
Electronics Research Building
Georgia Tech Research Institute
Atlanta, GA 30332

DISTINGUISHED LECTURERS CHOSEN

David M. Hanttula, Chairman of the Distinguished Lecturer Program reports that two additional speakers for the Distinguished Lecturer Program have been selected. They are:

Dr. W. Scott Bennett
Hewlett-Packard Company
Fort Collins, CO 80525
Telephone: (303) 229-3161

Donald W. Heirman
AT&T Information Systems
M/S Bldg. 41, Rm. 112
Crawfords Corner Road
Holmdel, NJ 07733
Telephone: (201) 834-1801

Scott is a Senior Member of IEEE, and Don is an IEEE Fellow. Both have contributed to technical sessions of the Society and are well regarded by their professional peers. The term for both will run from July 1, 1988 through June 30, 1989.

EMC '89

An Advance Call for Papers has been issued for the IEEE 1989 National Symposium on Electromagnetic Compatibility, which will be held at the Radisson Hotel, Denver, CO from May 23 through May 25, 1989. The IEEE EMC Society seeks original, unpublished papers on all aspects of EMC.

Prospective authors should submit a 50 to 75-word abstract and a 500 to 700-word summary (with up to five illustrations) explaining the contribution, its originality and relevance to EMC. Deadline for submission of three copies of the Abstract and Summary is September 15, 1988.

Suggested topics include, but are not limited to, the following categories.

- **Analysis**
- **Antennas**
- **Automotive Applications**
- **Cables**
- **Computers**
- **Education**
- **EM Environment**
- **EMP**
- **ESD**
- **FCC Compliance**
- **Industry Applications**
- **Lightning**
- **Materials**
- **Military Applications**
- **Noise**
- **Non-Sinusoidal Signals**
- **Propagation**
- **Shielding**
- **Spectrum Management**
- **Standards**
- **Statistics**
- **Systems EMC**

EMC topics of special interest this year include:

- **Measurement Facilities**
- **Measurement Techniques**
- **Measurement Theory**
- **Time-Domain Measurements & Theory**

Abstracts should be sent directly to:

Technical Papers Chairman
Dave Hill
P.O. Box 4056
Englewood, CO 80155-4056
Telephone: (303) 497-3472

BOD ACTIVITIES

BOARD OF DIRECTORS MEETING IN ATLANTA

by Donald N. Heirman

The first Board meeting of 1988 was held on April 7, 1988, at the Holiday Inn Crown Plaza in Atlanta, Georgia. Fourteen of the 20 Board members were present:

D.E. Clark	E.D. Knowles
E.L. Bronaugh	J.S. Hill
J. Nichols	H.R. Hofmann
R.T. Ford	J.J. Fisher
C.R. Tyson	W.E. Cory
R. Haislmaier	H.W. Ott
D.N. Heirman	D.A. Weber

President Clark, who served as temporary secretary at the November 19, 1987 Board meeting, presented the minutes of that meeting. The Board approved the minutes later in the meeting with minor changes. President Clark then turned the secretarial duties over to Secretary Janet Nichols. The Board approved the meeting agenda and several initial reports were given after general introductions were made. Treasurer Ford presented his report. The Society's net worth as of 1/1/87 was $279.5K. This is down about $60K from last report and largely reflects the effects of the 1987 October stock market fall. For 1987, the Society had a net surplus of $15.9K. Dick also presented graphs of our long term investment trends, cumulative net worth, and comparisons of 1987 income and expense breakdowns. For more detailed information, call Dick at (202) 767-3440. The Board approved the Treasurer's report. Next, Vice President Ed Bronaugh presented a first draft of the Long Range Plan for our Society. Ed is responding to the request of our President to review the management structure of our Society. Areas specifically under review include chapter development and liaison, the reporting process for our inter-society relations, and a more clear direction for our representatives to external organizations (CISPR, USRI, SAE, etc.). For more information, call Ed at (518) 843-2600. Immediate past President Carlson then described his plans for reviewing the Society's bylaws to see where they can be updated. The bylaws have not been changed since 1980. Any suggestions for changes to the bylaws should be forwarded to Len Carlson at (206) 773-6297.

The remaining major items discussed follow:

1. Director Bob Haislmaier (Communications Services) presented several reports. Bob reported that the NEWSLETTER was proceeding in a timely manner and that there were many good contributions including the new President's message column. He next summarized Editor Kanda's *Transactions Report*. Moto indicated that the special issue on electromagnetic shielding will be out this August. Dr. Maneck Master of AT&T Bell Labs was appointed as associate editor for papers dealing with lightning. Gene Cory then presented a brief review of the symposium activities. First, Hugh Denny presented a symbolic check to the Board in the amount of $28,372, which is the surplus from the 1987 Atlanta symposium. Hugh's excellent report further indicated that approximately 1100 attended and had the opportunity to hear 98 papers, visit 115 exhibit booths, and participate in various social functions. The Board expressed its congratulations to Hugh and his steering committee. Don Weber covered final plans for 1988 in Seattle. There will be 94 papers and an expected 112 booths sold. On Thursday, August 4, there will be a change in normal paper presentations format. Each author will give a 10-minute summary followed by a 1½ hour question and answer period. For 1989, we will have (2) two symposia. The Denver symposium is May 23-25 and the second is in Nagoya, Japan, on September 8-10. Complete reports on these two symposia will be given in Seattle. Possibilities of future symposia in Dallas (1993), Chicago (1994), Florida (1995), and Santa Clara (1996) were mentioned. For further information call Gene at (512) 522-2711. Next, Jim Hill presented his International Relations Committee report. Jim moved that the Board approve the exchange of approximately 30 copies of the British IERE/IEE and Zurich EMC symposium conference proceedings with 15 copies of our proceedings from two successive years of the IEEE International symposium on EMC held in the USA. Finally, the history committee is in search of policy statements approved by the BoD based on BoD meeting minutes prior to 1980. Anyone who has such information should contact Jim Hill at (216) 650-6230 or Bob Haislmaier at (202) 695-7503.

2. Director Don Heirman (Technical Services) presented his Standards Committee report. The report updated the Board on the 17 standards under the cognizance of the Society. In particular the IEEE Standards Board approved the withdrawal of IEEE STD 263 (Ignition Noise) and the revisions of IEEE STD 213 (LISN) and IEEE STD 139 (ISM). He also reported that the Standards Committee is moving forward with work on developing a test method for RF absorber performance (PAR 1128). They are try-

ing to get absorber manufacturer, active participation. Finally, Don reports that he was appointed to membership on the IEEE Standards Board New Standards Committee (NESCOM) which is responsible for reviewing all new standards activity requests from all IEEE societies. Next, Henry Ott presented the education committee report. He said that Herb Mertel (EMACO) and Roger Southwick (Consultant) were selected as EMCS distinguished lecturers through 1989. They are available to meet with your local EMC chapter and present talks on various subjects. For more information on the program, call Dave Hanttula at (415) 656-1661, ext 249. Henry also mentioned that there will be an article on EMC written by Kimball Williams of Eaton that will appear in the October or December issue of the IEEE Student member magazine, "POTENTIALS." The lead story on ethics in the Spring issue of our NEWSLETTER has been picked up and published in the IEEE United States Activities Board newsletter—IMPACT. If you recall, that article was based on an "Ethics in Engineering" program sponsored by the Santa Clara Valley Chapter of the EMC' Society. The BoD supported this program with its chapter "angel" funds. Finally, a report written by Wilf Lauber, chairman of the Technical Advisory Committee, was summarized by Don. Wilf reported that the seven EMCS technical committees reviewed 92 abstracts for the Seattle symposium. An additional thirty-two abstracts were not reviewed by the TC's. The TC's organized three tutorials/ workshops for Seattle including a workshop on "EMC Accreditation and Certification," a tutorial on "Harmonizing Domestic and International RF Emission Measurement Practices," and a workshop on "EMP Standardization Issues: Validation, Maintenance, and Surveillance."

3. Director Hofmann (Member Services) gave his report. He announced the restructuring of the committees reporting to him. In particular, Chapter activities such as tracking chapter officer changes, summarizing chapter meeting topics, hosting the annual chapter chairman's breakfast at the EMC symposium, etc., will now be handled by Dan Hoolihan (612) 583-3322. Charlie Anderson will be responsible for Chapter Publicity including the "Chapter Chatter" column in this NEWSLETTER. Charlie's new telephone number is (301) 733-3061. Bob reported that Bill Duff, Fellow Evaluation Committee Chairman is in search of more names to nominate for Fellow. Contact Bill at (703) 642-4049 for further details. Charlotte Tyson, Awards and Membership Chairman, presented the 1988 EMCS Award nominees for Board approval. The Board approved the list and the awards will be handed out at our Awards Luncheon in Seattle. Charlotte reported the following membership facts:

MEMBERSHIP STATUS

1987 Symposium

- **22 IEEE members new to Society**
- **55 New to IEEE and Society**
- **77 New members total signed at symposium**

Five fastest growing IEEE societies in 1987

- **13.1% Microwave Theory and Techniques**
- **8.3% Electromagnetic Compatibility**
- **7.4% Acoustics Signal Speech Processing**
- **6.3% Communications**
- **6.0% Antennas and Propagation**

Incentive Program

- **Print TSEMC27 in the Event Code box printed on all applications.**
- **This was done for all applications from symposium**

Senior Member applications have been revised and simplified.

Charlotte is to be congratulated for her considerable efforts in bringing new members into our society. For further information on the membership activity, call Charlotte at (303) 924-6041. Finally, Len Carlson is chairing a search committee for new Board members and Society officers for 1989. Nomination forms for BoD elections were included in the Spring NEWSLETTER.

4. Director McKerchar (Professional Services) was unable to make the meeting. President Clark reported that activity in the area of public relations for our society was moving along under the chairmanship of Herb Zajac (503) 627-4759. The other activities for Professional Services were covered in my last BoD Activities column.

5. President Clark next reviewed several activities under New Business. He handed out the 1988–89 EMCS Plan-of-the-year document. This document summarizes the goals of our Society and indicates where it is heading. Much of the plan is an outgrowth of a planning workshop held in San Antonio in February where all the officers and directors met to go over such items as committee plans, schedules, and budget needs. Each EMCS Committee chairman is requested to get a copy of this document from their director. Next, President Clark and Vice-President Bronaugh reviewed the information they heard at the last IEEE Technical Activities Board Meeting. Items included Society life membership, ethics code extension, electronic mail use, and chapter affairs activity. For details on these items call Ed Bronaugh at (518) 843-2600.

6. President Clark adjourned the meeting at 4:00 P.M. The next meeting will be in Seattle on Monday, 1 August, in the Westin Hotel. The EMCS Standards Committee will meet in the same room for 90 minutes immediately preceding the 9:30 A.M. Board Meeting. For more information, call Secretary Nichols at (800) 325-9814.

Respectfully submitted,
D.N. Heirman, Associate Editor
BoD Activities

TECHNICAL ACTIVITIES BOARD

PERIODICALS COMMITTEE

by Chester L. Smith

The periodicals committee held its first meeting of 1988 at IEEE Headquarters on Monday, March 28, 1988. The committee "monitors" periodicals that are late, and Division representatives are to determine the reason. Division IV has three on the "wanted" list, but none of these situations was serious. In each case, we expect to be on schedule by deadline times.

The financial problem the Magnetics Society had with the Translation Journal on Magnetics in Japan has been taken care of by TAB.

A division representative has two responsibilities: (1) to keep activities on time and (2) to monitor the technical quality of periodicals to assure that these are up to IEEE professional standards. Thus far division IV is way ahead on technical quality and has had only minor "glitches" with timing.

Publication delays are often the result of a guest editor. The publications committee has decided to prepare a manual for editors similar to those IEEE manuals on budget and finance prepared for Conference Chairmen and for Society Officers. The subcommittee appointed to prepare this booklet consists of the following:

Chester Smith, Chairman
MITRE
(617) 271-7086

Alan Cookson
Westinghouse
(412) 256-2160

Anil Jain
Michigan State University
(517) 353-5150

If anyone has suggestions, views or any other input on the proposed *Editor's Manual,* please feel free to let us know; or better yet, write them down and send to IEEE Headquarters to the attention of Barbara Ettinger.

There was some discussion of electronic handling of IEEE publications. This arrangement would include electronic submission of manuscripts to publications, electronic return of proofs, etc. The Computer Society is already doing much of their work via this route. Some problems brought up were that not everyone is equipped to handle manuscripts electronically and that mathematical text is not readily accommodated. Straight FAX, of course, presents no such difficulties. Also straightforward text can be submitted on floppy disks.

Another point of discussion was the question of whether IEEE has or is planning to publish transactions in Braille. So far, it is only an idea. With electronic processing, rendering transactions into Braille is possible. Is there any interest?

The question of mailing permits was brought up again. The new postal rates also were accompanied by some changes in the regulations, which are too convoluted to go into here. The bottom line is that Society Newsletters, Section Publications, etc. must be included under the IEEE 2nd Class Permit issued in New York. Publications can be deposited at any Post Office, however, since they are included in the "additional points of entry" clause in the IEEE mailing permit.

The next meeting of the Periodicals Committee is scheduled for Monday, June 13, 1988 at IEEE Headquarters, 235 E. 17th Street, New York, NY 10017.

Chester L. Smith
Representative, Division IV

SHORT PAPERS, ARTICLES, AND APPLICATION NOTES

By Edwin L. Bronaugh

We, the editors, want to publish practical papers just as badly as you, the readers, want to see them. They are hard to find. Your EMC Society Board of Directors established a department in the *EMC Newsletter* to search out and publish practical papers for you. Very few practical papers are rejected because we want to encourage their submittal.

When next you complain about how few practical papers appear in this, or any similar journal, ask yourself this question: "When was the most recent time that I, or someone from this division of my company, submitted a practical paper to the *EMC Newsletter* Associate Editor, E.L. Bronaugh?"

The main reason that one sees so many theoretical papers and so few practical ones is that university professors are recognized for writing theoretical papers while engineers are paid to produce hardware, not to write papers about it. Both do their jobs reasonably well.

Examples of general areas which both you and we want are as follows.

1) **Case histories.**
2) **EMC techniques which engineers actually found to be useful on a job, and those which were not useful or were too expensive.**
3) **How engineers and managers set realistic EMC requirements for a system or equipment.**
4) **The kinds of EMC designs or modifications which were actually cost-effective.**
5) **Use of EMC data from the field instead of from special laboratory tests. Comparison of field data with laboratory test data.**
6) **Engineering comments on the worth of standards such as the international or U.S. military standards on EMC.**
7) **Ideas, from experience, on the major obstacles to setting and achieving worthwhile EMC requirements in commercial, military, or other fields.**
8) **Where to find information—e.g., a list of trade and professional journals of value to EMC practitioners.**
9) **Annotated lists of computer programs for analyzing EMC situations; give full information; tell what the programs do, how big a computer they need, and where they are available.**
10) **Papers without equations.**
11) **Actual EMC field experience with several technologies for accomplishing the same thing, e.g., in the digital and microwave fields.**
12) **Digests of longer papers from other publications of other disciplines which have EMC application.**

Rarely, if ever, will a mathematical or statistical paper qualify as a practical paper, regardless of how good it is.

If you have an idea for a practical paper you would like to write, let me know and I will help you with it. Or give me the name of a colleague who wants to write a practical paper.

Edwin L. Bronaugh
Electro-Metrics
100 Church Street
Amsterdam, NY 12010
(518) 843-2600

INTER-SOCIETY ACTIVITIES

by Walt McKerchar

SAE Committee AE-4 on Electromagnetic Compatibility

The Executive Committee of the AE-4 will meet on July 31, 1988 from 7 p.m. to 9 p.m. in the Glacier Room of the Westin Hotel in Seattle. The national meeting of the committee will be held on August 1, 1988, just one day before the IEEE 1988 International Symposium on EMC, in the Fifth Avenue Room of the Westin. A special room rate has been established if the IEEE meeting is mentioned.

One of the items on the national agenda will be NATO Stang #3516, "EMC for Aircraft Electrical Equipment." This activity will address "Certification Modules" for sections of MIL-S-461, like CE/RS/RE etc. The AE-4 Committee will be requested to review these modules and to make comments.

Another topic of wide interest will be the progress of Subcommittee AE-4R on Aircraft Radiated Environments. Recent committee activity included two international meetings—one in Brighton, England and one at FAA Regional Headquarters in Ft. Worth, TX. Those interested in the results of both international meetings are invited to attend the August 1 meeting at the Westin.

NATO—Air Electrical Working Party (AEWP)

The NATO-AEWP met at the National Defense Headquarters in Ottawa as the guests of Canada. This occasion was their twentieth meeting. As the Director of Professional Services of the EMC-S, I had the honor to present to the AEWP, as part of their busy agenda, the International Civil Aviation Concerns on Aircraft Radiated Environments. The AEWP devoted a whole day to this concern. Several speakers from the FAA, ECAC, the U.S. military, government and industry outline current concerns regarding high RF power and "flight critical" equipment vulnerability.

The dB Society

As usual, this Society will hold its annual meeting and banquet during the 1988 IEEE Symposium. Having founded the Society and having served thirteen years as its President, I have announced my retirement from this position. I will, however, remain on the dB Society Board of Directors. The new officers will be installed prior to the close of the business meeting and will be announced in my next article.

INCEMIC '89

Participants in the highly successful INCEMIC '87 realized the importance of holding international conferences on a regular basis. Accordingly the Second International Conference and Workshop on Electromagnetic Interference and Compatability will be held in Bangalore, India from September 4 through 8, 1989.

A Call for Papers has been issued, and December 5, 1988 is the deadline for submittal of a 200-word summary. Papers on the following topics are solicited.

- **EMI in communication and computing systems**
- **EMI analysis, design and case histories**
- **EMI coupling in cables and connectors**
- **EMI measurements and measuring systems**
- **EMI design in industrial electronics**
- **EMP and other related transients**

For further information contact:

Col. (Dr.) G.K. Deb
Electronics and Radar Development Establishment
C V Raman Nagar
Bangalore 560 093
India

CHAPTER CHATTER

by Charles F.W. Anderson

SEATTLE

Good news from the Pacific Northwest! The Chapter is alive and well. They have had several meetings during the last few months. In October '87 George Kunkel of Spira Manufacturing spoke on the topic "The Design of EMI Gaskets and Shielding." There were eight IEEE members and two guests present. On December 4, '87 Joe Fischer of Fischer Custom Communications addressed the Chapter meeting. His presentation was titled "Characteristics of Coaxial EMP/Lightning Terminal Protection Devices." Eleven IEEE members and seven guests were present. March 29, 1988 was the Chapter's annual FCC Night. A panel of seven provided information on FCC regulations and testing procedures. Panel members from the FCC Western Region Office were Dennis Anderson, Investigative Engineer; Kris McGowan, Public Affairs Specialist; and Gary Soulsby, Engineer-in-Charge. Other panelists included Michael Cole of Acme Testing, Rod Munro of Spectrum Technology, and Larry Parks of Northwest Phone Services. There were thirty-three attendees, of whom nineteen were IEEE affiliates. As might be expected, the Chapter is in the final stages of preparing for the '88 Symposium, which promises to be a great one! Current officers of this Chapter are Chair Jerry Johnson of John Fluke Manufacturing and Vice Chair Bill Cooley of Science and Engineering Associates. Also Rod Munro of Spectrum Technology is Secretary-Treasurer, and Andrew Benson of Acme Testing is Assistant Secretary/Publicity. A new slate of officers was to be elected in May. [Thanks to Rod Munro for the input!]

CENTRAL NEW ENGLAND

At a February 25, '88 Chapter meeting held at the MITRE facility, Norman Brown of GE-Aircraft Engines was the guest speaker. His topic was "EM Environmental Effects: Impact on Aircraft Controls." There were thirty-five attendees, of whom eighteen were IEEE members. Nine were EMC Society affiliates. The final meeting of the '87/'88 Chapter year was held on April 28, '88 at the Chomerics facility in Woburn. Joe Butler of Chomerics spoke on the topic of "The Role of Shielding in EMC Compliance." There was also a tour of the Chomerics labs. Twenty-five attended, including seventeen IEEE members. This event was also the Chapter's annual senior EE Students Night. Election of officers for the '88/'89 Chapter year was held. Len Long of DOT/TSC is Chair, and John Clark of Analysis Engineering is Vice Chair. Also Joe Butler of Chomerics is Secretary/Treasurer; and Larry Lee, a manufacturers' rep, is Technical Program Coordinator. [Thanks to John Clark for the information.]

SANTA CLARA VALLEY

The Chapter held a meeting on May 10, 1988 at the Apple Computer facility in Cupertino. Robert Steinfeld of Apple was the speaker, and his topic was "An EMC Guide for Computing Devices."

SAN DIEGO

More good news! According to Herb Mertel, this Chapter has been "brought back to life." Since January the Chapter has been sponsoring an on-going series titled "Practical EMI/RFI Measurements." Herb started the series off with a conducted emissions pitch. Then in February, Al Mills, Section Leader of GD's EMC Design and Test Laboratory, and Herb double-teamed to present a session on radiated emissions. Two additional presentations were planned although titles weren't available as of deadline. Another interesting point is the Chapter's impressive list of sponsoring companies. [Our thanks to Herb Mertel for the input.]

WASHINGTON/NORTHERN VIRGINIA

On March 17, '88 the speaker at the Chapter meeting was Sam Frazier of NAVAIRTESTCEN whose topic was the "Naval Air Test Center EMP Program." [More details should be available for the next issue—C.F.W.A.]

TOKYO

Our most distant Chapter continues to hold its highly informative monthly meetings. Recent technical papers presented included both practical and theoretical ones, with the latter predominating. Among those of particular interest was one discussing CISPR-recommended open-site ground plane dimensions as compared with those required in the FCC standard. It was concluded that the latter would be a better choice.

QUERY ANSWERED

Thanks to both Steve Jensen and Herb Mertel for the following answer to the "XY" capacitor query in the previous issue.

X-capacitors are those connected *across* the leads to the item being suppressed; Y-capacitors are those connected *line to ground.*

PERSONAL NOTE

By virtue of the total of my calendar years plus my years of IRE/IEEE membership exceeding 100, I am now a Life Senior Member. Really, I don't feel a bit older than I did before my "gold card" arrived.

EMC CERTIFICATION AND ACCREDITATION

PROGRESS REPORT

by Russell V. Carstensen, P.E.

In the last issue [Spring 1988, Issue No. 137] you may have noticed the article on page 18 dealing with the IEEE position on specialty certification. The position paper was produced in preparation for the specialty certification meeting in Atlanta. The dynamics of this set of events were interesting. Your Institute provided a united opinion to preclude restrictions which would impede employment. However, during the course of the meeting, the text of the IEEE was adjusted, on site, to soften the position that IEEE was not aware of any condition for which specialty certification was required. The delegates chose to back off when floor discussion pointed out the complexity and impact of EMI problems in military systems.

I bring this up for two reasons. First, I appreciate the Institute's concern and interest in avoiding establishment of restrictive controls without sound basis. The second reason for mentioning this is that I appreciate the delegates' exercising their responsibility to bend in the face of new information. The discussion in the Atlanta meeting did demonstrate the need for specialty certification in the EMC area for military applications.

There were presentations at the EMC Expo on laboratory accreditation (in the morning) and personnel certification in the afternoon. The morning session was well attended. The kinds of questions ranged from the cost of having laboratories accredited ($2,500 to $4,000), the quality of inspectors (we plan to have Navy personnel as a part of the inspection team), to the availability of application materials. There will be an accreditation and certification workshop as part of the IEEE EMC Symposium in Seattle. We plan to distribute the NVLAP Accreditation Handbook and application forms at that workshop. The workshop will be on Tuesday, August 2, from 10 a.m. to 12 noon in the Vashor Room.

The afternoon session at EMC Expo dealt with personnel certification. We distributed *NARTE Handbooks* and application forms and discussed the philosophy, scope and strategy for the examination.

In the course of my discussions with the EMC community, some questions have been raised which warrant public response. One question concerned the perception that certification of personnel would be restricted to those with degrees in electrical engineering. That is not correct. Obvious candidates include EE's, physicists, and mathematicians, but the field is not restricted to these. The rules of procedure for evaluation of education and work experience are listed in the *NARTE Handbook*. They include a wholistic evaluation of the individual to determine his/her credentials in the area of EMC.

Other areas of concern are the concept of the certification testing and its applicability to narrow specialties. The examination will cover 26 areas of essential information. These areas are listed in the *NARTE Handbook*. At this time we do not plan to add specialty areas. Developing specialties is a very complex problem and requires more resources than we currently have available. Our intention is to establish a broad-based minimum requirement to identify a base of reasonably competent practitioners. There are major divisions both along the lines of design and test and along the lines of sensor systems, but the 26 areas listed in the *NARTE Handbook* are elements common to all.

There has been discussion of adding levels of certification at a future point. The idea of levels is to provide recognition for senior practitioners. There is merit to the idea, but there are also difficulties in establishing criteria for identification of senior standing. For example, do we recognize seniority based on years of practice, publications or patents, endorsement from peers or a combination of these attributes? I am interested in hearing more views on this.

We plan to have a study guide pamphlet on the structure of the examination with sample questions and solutions for the Seattle EMC Symposium. We expect to distribute it with applications and to send it to those who had applied before the study guide was ready.

The "grandfather" window will open officially on October 1, 1988 for 12 months, but applications are being accepted now. One new wrinkle to this is that we will be asking the "grandfather" applicants to submit questions and solutions for the examination. We have a large volume of questions now, but we want to build on those so as to accumulate a file of more than 5,000 questions. This request allows those of us who have been practicing in the field to inject solid practical situations and solutions. It will also provide an avenue for active involvement by those who will qualify by "eminence."

NARTE's address is:

P.O. Box 15029
Salem, OR 97309

EMC PERSONALITY PROFILE

GEORGE KUNKEL

by William G. Duff

George Kunkel was graduated from the University of California at Los Angeles (UCLA) with a Bachelors Degree in Engineering in 1968. His area of concentration for both his BS and MS degrees was in applied mathematics for engineers. Upon receiving his Masters Degree, he was offered a doctoral fellowship and a position as instructor in the UCLA Extension Department. He accepted the position as instructor and taught two courses on EMC design. They were System EMC Design and System Integration of Large Electronic Systems. The System EMC Design course covered bonding, grounding, shielding, filtering and electromagnetic (i.e. inductive, capacitive, and resistive) coupling to minimize the effects of EMI in a system. The System Integration course was concerned with delivering clean, distinguishable signals to receiver inputs. Grounding, power and signal distribution systems, signal conditioning and electromagnetic coupling were covered. The use of balanced transmission lines; balanced differentially-amplified circuits; and twisted and shielded transmission line pair, coaxial and triaxial cables was also included. The mathematical model used to predict electromagnetic response of electronic circuits was the Linear-Invariant Network, utilizing, to a great extent, "Green's Function" and the more general "Stokes' Function." The boundary conditions were established using stochastic and random variables.

Mr. Kunkel had been employed by the Sprague Electric Company as a "field engineering specialist" upon his graduation from UCLA in 1962. In this position, he assisted companies in complying with EMI and TEMPEST requirements. He also held the position of test director in the Sprague West Coast test facility. Subsequently he was employed as manager of the EMC Department at Electronic Specialty Company; was a Senior Engineer at JPL, where he handled EMC project management on one of the Mariner vehicles; and was Product Line Manager at Scanbe.

Then in 1969 he formed an engineering consulting company—Electro-Data Technology. As a consultant Mr. Kunkel accepted full EMI/EMC, EMP, TEMPEST, and RADHAZ responsibility for design, test, and compliance of electrical/electronic systems. He also started working on the design components for EMI protection. Two such products are the "Spira Shield" EMI/RFI line of gaskets and the "Kunkel Filtered Isolation Transformer."

In 1978 Mr. Kunkel formed Spira Manufacturing Corporation for the purpose of manufacturing and marketing the Spira EMI/RFI gasket and the Kunkel Isolation Transformer, which had been developed under his guidance. The Spira family of EMI/RFI gaskets provides the lowest EM bond between joint surfaces of any of the commercially available EMI/RFI gaskets. The tin and aluminum-plated versions of the gasket are more corrosion compatible with aluminum in the presence of moisture and salt fog conditions than any of the other gaskets on the market. The Kunkel filtered transformers have built-in capacitance and inductance members.

Today Mr. Kunkel is the owner and CEO of Spira Manufacturing Corporation, located in North Hollywood, California. Additionally he has been active professionally with both the AE-4 EMC Committee of the SAE and with the EMC Society of the IEEE since 1965. In 1965 he became Chairman of the Grounding and Bonding Subcommittee of AE-4, EMC Committee and was involved in the preparation of numerous recommended standards and practices. In 1969 he accepted further responsibility and became Chairman of the Specialist Working Group on Grounding and Bonding of the EMC Society of the IEEE. Then in 1975 he accepted the Chairmanship of the Technical Committee on Interference Control. As chairman of these committees, he has sponsored papers and workshop sessions at every IEEE International Symposium on EMC from 1969 through 1986.

Mr. Kunkel is listed in *Who's Who in Finance and Industry,* which cites his achievements in the field of engineering economics. His thesis topic "The Economic Viability of an Educational System for Undeveloped Countries" was considered by NASA when constructing an educational network for India. He is listed in *Who's Who in the West* and *Who's Who in the World* in recognition of his achievement in the field of electromagnetic effects design.

PCs FOR EMC

by Edmund K. Miller

This month I am pleased to present a guest column by Dan Higgins of Santa Barbara, CA on a topic that should not be at all controversial (!) that of choosing a microcomputer language for scientific computing. While the writeup below was received sometime ago from Dan, the topic is an essentially timeless one and so Dan's remarks remain relevant.

ALTERNATIVES TO FORTRAN FOR SCIENTIFIC COMPUTING ON MICROCOMPUTERS

by Daniel F. Higgins
1040 Veronica Springs Road, Santa Barbara, CA 93105

Most scientists and engineers are well acquainted with the idea of using the computer as a tool to help their work. To most of these scientists and engineers, FORTRAN is the language used to control that tool. FORTRAN was one of the first high-level computer languages. It was designed to be used by those familiar with equations and mathematical expressions. Very efficient compilers have been developed which make FORTRAN source code capable of generating efficient and very fast machine code. Also, because of its (relatively) long history, a great deal of powerful FORTRAN code exists, creating useful program libraries. It is thus not surprising that FORTRAN is often the language of choice for developing programs designed to carry out detailed numerical calculations (so-called "number-crunching" programs).

Much has changed in the computer world, however, since FORTRAN was first introduced. Many newer computer languages, such as BASIC, PASCAL, C, LISP, MODULA2, ADA, and FORTH, have been invented; and personal desktop computers with remarkable computing power are becoming quite commonplace. Yet much of the scientific and engineering community still seems tied to the large mainframe computers and the FORTRAN language. This is hardly surprising—computer technology has been changing rapidly and scientists or engineers not directly involved in that technology seldom have the time to try to keep up with all the developments. It seems appropriate, however, that a periodic review of new and perhaps better methods should be carried out.

A little known computer language with some very interesting characteristics is FORTH. The language was originally devised for controlling a radio telescope, and it is widely used in robotics and control applications. FORTH is a language which is compact, interactive, relatively fast, highly modular, extendible,and extremely powerful. It is also substantially different from most other languages in a number of ways. It has attracted a small but dedicated group of proponents, but it also has a number of vocal opponents.

A simple description of FORTH is difficult, but one way of describing it is to say that FORTH is a language made up of nothing but subroutines (small independent modules). In most other languages, it is desirable to build a program out of a number of modularized subroutines but often not convenient or efficient to do so. In FORTH, however, the entire language has been designed to be broken into small modules, called "words." The action of each word is defined in a "defintion" made up of previously defined words. As each definition is compiled, the word naming it is added to the FORTH "dictionary" and can be used in further definitions. FORTH is thus interactive because it is incrementally compiled. Each word is usually only a few lines long, and once the definition of a word has been loaded, the word can be executed by simply typing its name. And once a word has been compiled and added to the dictionary, it has the same status as any other word; thus, FORTH can be expanded to have hundreds of words (as opposed to the few dozen key words in BASIC or most other languages).

This extreme modularity and interactive capability make FORTH very easy to debug and to modify. In fact, that ease is one of its major advantages. FORTH is also relatively fast. It is typically 10–100 times faster than BASIC, but perhaps 2–4 times slower than the code generated by a good compiler. [And FORTH code is often speeded up by re-writing only one or two words in an assembler after the overall code structure is put together.]

FORTH is fast because its internals are very simple. Parameters are usually passed from one word to another by putting the parameters on a stack. Reverse Polish notation (RPN) is also used (like HP calculators). The use of a stack and RPN help keep the basic FORTH nucleus uncomplicated. Some people find the use of a stack for parameter passing and RPN objectionable, but others find it just takes some getting used to (and most scientists and engineers do not find RPN calculators particularly troublesome). The simplicity of the basic FORTH system is also appealing because its details can be understood with a little effort, while it is virtually impossible for anyone but an expert to understand the internals of a FORTRAN compiler.

The fact that FORTH can be extended also means that if you do not like some feature of the language, then you can change it. For example, one can write an algebraic parser so that algebraic, rather than RPN, expressions can be typed from the keyboard. One can also extend the compiler incrementally so that matrices or complex numbers can easily be created and manipulated. This extensibility also means that all FORTH systems tend to be slightly different even though there is an attempt to standardize the language. It is just too easy to customize it to the user's specific desires. FORTH systems are generally quite similar, however, and do exist for virtually every computer. They also tend to be one of the first languages available when a new microcomputer is built.

When a FORTH system is first turned on, the interpreter is simply waiting for input from the keyboard. One enters either FORTH words or numbers separated by spaces. The interpreter simply takes each "word" (as defined by the intervening spaces) and tries to find it in the FORTH dictionary. If the word is found, it is executed (i.e. whatever action it was defined to have is carried out). If the word is not found, then the interpreter assumes the characters represent a number and tries to convert them to a number. If conversion is successful, the number is placed on the stack. If not, the interpreter informs the user that it does not recognize the character string.

Certain FORTH words change this process. One example is the word ":" which is used to begin a 'colon definition.' [Note that any character other than a space can be used in a FORTH word—thus ":" is a perfectly acceptable word.] Such defining words are used to create new FORTH definitions. The colon thus 'turns on' the FORTH compiler and creates a series bytes in the computer's memory describing the actions to be taken later when the word being compiled is executed. The word immediately following the colon is the name of the new definition. All words after the name until a semicolon ";" is reached (marking the end of the definition) are the words to be executed when the word's name is later invoked. The semicolon returns the interpreter to normal action and shuts off the compiler. The long compiling and linking process of other languages can thus be done incrementally with FORTH, and the results can be checked interactively by simply typing the word on the keyboard.

Unlike most compilers, the FORTH colon compiler does not convert the words in the definition to machine code instructions for the specific computer processor being used. Instead, a series of addresses to the words in the definition are stored. Thus pointers to other words in the definition are saved; and FORTH is, therefore, said to be a "threaded" language (because the words are linked or threaded by these pointers). Much of the power of FORTH comes from the ability to follow all of these threads efficiently and to execute the words in a definition very rapidly.

Another unusual feature of FORTH is the ability to change and to modify the compiler itself. New "defining words" can be created to compile special classes of words. It is thus easy to add such concepts as complex numbers or matrices to a FORTH system which previously did not contain such structures. The ability to change the compiling process easily is a feature absent from traditional computer languages.

What are the limitations of FORTH? Some claim that FORTH programs are very difficult to read, especially for anyone but the original programmer. Difficulties in reading FORTH come from several sources, one of which is the poor choice of names. A programmer can name a word to draw a plot "DRAW-PLOT," but he could also name the word "#$7.-??." The second choice would obviously be somewhat hard to read. The use of reverse Polish notation is also sometimes blamed for making programs cryptic. Perhaps the biggest reason, however, is the fact that FORTH programs are seldom sequential. Programs are designed from the top down, but have to be written from the bottom up. Thus, low-level words which take care of the details are compiled first, while the overall program control words are not entered until last. In fact, reading a FORTH program is usually easier if one starts at the last words compiled and works backward!

It is also claimed that it is difficult to learn FORTH. Such claims may be related to the fact that FORTH is significantly different than most other computer languages, and using it effectively may require "unlearning" certain techniques which have been previously learned. Learning FORTH can also be quite frustrating because the language has relatively little error checking, and it is easy to make errors which can wipe out an operating system.

We at JAYCOR *[Editor's Note: This column was written while Dan worked at JAYCOR]* have used FORTH for several microcomputer programming projects. One of these is the M.A.C.E. code, an aide for EMP coupling analysis, which is being commercially marketed by JAYCOR. Another code, being used for in-house studies, is called GRAPHIT. GRAPHIT is really a set of FORTH words designed to make it very easy to display and compare mathematical functions. One only has to define a function such as "F1 (X) = SIN (X)/X END" and then one can plot the function using the command "PLOT F1." Plot types and scale values are easily changed and various types of overlays are easily generated. Functions can also be entered as data points (instead of algebraic expressions). Complex numbers are also supported as are Fourier transforms. The interesting point is that all these capabilities have simply been added to the FORTH language. They can be used in programs or just typed in from the keyboard. We have thus been able to build a customized language particularly for aiding various scientific and engineering studies. Building such an interactive system within the framework of FORTRAN would have been very difficult.

BOOK REVIEW

by Jim Hill, The EMXX Corp.

This time we are going to look at an impressive new book Henry Ott's *Noise Reduction Techniques in Electronic Systems,* 2nd Ed. The first edition came off the press in 1976. It quickly gained recognition as an EMC design manual and also as an undergraduate textbook. Author Henry Ott recently retired from the technical staff of AT&T Bell Labs to establish his own consulting firm. He received a BSEE from Newark College of Engineering and a MSEE from New York University. His experience includes three years in the Air Force—Air Research and Development Command and work in the fields of missile guidance systems, electromechanical control systems, nuclear instrumentation and telephony. In 1970 he originated a continuing education course at Bell Labs and has been teaching the course ever since. Recently he was elected a Fellow of the IEEE and has been very active in the EMC Society. He regularly contributes to this *Newsletter* on the activities of the EMC-S Education Committee.

This new edition is 426 pages as compared with 294 pages for the original edition. According to the author, this growth in the number of pages was required to cover the changes that have come about in the EMC field since 1976 when the first edition appeared. The saturation of the consumer market with digital electronics and the impact of the FCC Rules and Regulations on digital computer systems are responsible, in a large measure, for the increase in the pages. The sensitivity of digital systems to electrostatic discharge is the subject of a new chapter.

On the frontispiece author Henry Ott includes a statement credited to Albert Einstein, "Everything should be made as simple as possible but no simpler." Did Einstein provide the guidance to our author in the writing of this book?

NOISE REDUCTION TECHNIQUES IN ELECTRONIC SYSTEMS

by Henry W. Ott

Second Edition
A Wiley-Interscience Publication
John Wiley & Sons
605 Third Avenue, New York, NY 10016
426 Pages, Clothbound, $39.95

We agree with the author that his book is design-oriented with an EM engineering approach to EMC including the essential mathematics required. Let's take a look inside.

The introductory material in Chapter 1 now includes information on the FCC regulations and their impact on EMC technology. Chapters 2 through 7 have been updated and expanded. Chapter 2 covers cabling including material on some of the newer types of cables. Chapter 3 on grounding now includes hybrid grounds. Chapter 4 is on balancing and filtering. Chapter 5 on passive components emphasizes the characteristics of passive electronic components that affect their noise performance or their use in noise reduction circuitry. Chapter 6 on shielding has been expanded to include conductive coatings and windows, cavity resonance and grounding of shields. Chapter 7 on contact protection is unchanged in its good basic coverage of the subject. Chapters 8 and 9 on intrinsic noise points are unchanged from the first edition.

The material in the following chapters is entirely new. Chapter 10 on digital noise and layout discusses analog versus digital and time and frequency domain concepts. It covers noise voltage objectives and the hazard of unused inputs. Chapter 11 is titled "Digital Circuit Radiation" and is the key subject for today's designers who must meet the EMC regulations of the FCC, VDE, DoD, and others. It has an excellent analysis of differential-mode and common-mode radiation problems with a warning about CAD for printed wiring circuit boards. The 12th and final chapter on electrostatic discharge is particularly important because it deals with the effects of the human operator on sensitive solid circuit devices. As devices become smaller and faster, their susceptibility will increase. The author points out the similarities between methods used to provide ESD protection and those used to control common-mode emissions from I/O cables.

Following Chapter 12, there are five appendices which should be quite helpful to the reader. Appendix A discusses the concept of the decibel and its use including some pitfalls and cautions. Appendix B is a summary of noise reduction techniques. Included are a noise reduction checklist, techniques for suppressing noise at the source, elimination of noise coupling, reducing noise at the receiver and guidelines for controlling emissions in digital systems. Appendix C is a rigorous analysis of multiple reflections of magnetic fields in thin shields; it includes a table of correction loss factors for very thin shields.

Appendix D consists of problems for each of the chapters. Some problems are multiple choice and some require calculations. Some chapters have as many as eleven problems if the chapter has that many points to emphasize. Answers to the problems are contained in Appendix E. Appendix F "Electromagnetic Compatibility Testing Procedures" is an edited version of FCC Measurement Procedure MP-4 (1983), used by that agency to determine compliance with the radiated and conducted emission requirements of its Rules and Regulations Part 15, Subpart J on computing devices. Finally a very helpful, detailed index enhances the utility of this text.

Most engineers, scientists, and technicians are not well equipped to handle noise problems since the subject is not normally taught in engineering schools and available literature on noise reduction is scattered. This lack of understanding and appreciation of the noise problem is probably the biggest deficiency in an engineer's education. *Noise Reduction Techniques* fills this gap by providing an in-depth, single-volume summary of this important issue. It is a useful reference for circuit designers, physical designers, and technicians. It can be a classroom textbook on the practical aspects of noise suppression from audio frequencies through VHF. *Noise Reduction Techniques* is well organized with a terse summary of significant points at the end of each chapter. The bibliography at the end of each chapter had been updated with the addition of recent publications, referenced throughout the text. We commend the author for an exceedingly well done EMC test, design guide and reference book useful to the design engineer when he is fortunate enough to be able to put EMC in the initial design instead of into the retrofit. We believe that this book can be a helpful insight into any EMC problems which may be plaguing you.

EMCABS

by William H. McGinnis

In this issue we continue publishing abstracts of papers from previous EMC Symposia, other conferences, meetings and publications. The EMCABS committee is composed of the members listed below. By way of introduction to the community, they are listed with their company affiliations:

L.F. Babcock, Ford Aerospace Textron
E.L. Bronaugh, Electro-Metrics/Penril Corporation
R.N. Hokkanen, Harris Corporation
R. Jacobson, Sperry Flight System
S. Kuniyoshi, Naval Sea Systems Command
D.R. Kerns, Southwest Research Institute
R.B. Schulz, Consultant
R.M. Showers, University of Pennsylvania

"HOW CAN I GET A COPY OF AN ABSTRACTED ARTICLE?" The answer to this frequently asked question follows.

Most large public libraries, some small public libraries, all engineering school libraries and most other college or university libraries have copies of publications in which articles appear. If they happen not to have the desired publication, such libraries usually can obtain it or a copy of the article from other libraries or sources. Many company libraries, both large and small, also have such arrangements. Many articles also are available from the National Technical Information Service (NTIS) and/or the Defense Technical Information Center (DTIC). To retrieve an article or publication containing an article abstracted in EMCABS, it is suggested that you contact your company library, a nearby engineering school library, a university library or your municipal public library. If the library does not have the publication, go to the librarian, explain what you need and he or she will help you get the publication on loan, perhaps from another library or, for a nominal charge, from NTIS. If you have a Department of Defense contract, the contracting officer or your company librarian can help you get publications from DTIC. The information needed is contained in the EMC abstract heading.

Shielding of Electromagnetic Waves

EMCABS: 01-07-88

George Kunkel
Spira Manufacturing Corp., North Hollywood, CA
EMC Expo 88 Symposium Record
May 10-12, 1988, Page T31.1

ABSTRACT: The shielding of electromagnetic (EM) waves is achieved through the reflection and absorption of the energy in a wave. These waves are propagated from wires which take the form of power, signal and control lines. They also take the form of antennas when the propagation and/or reception of a wave is to be maximized. Wire treatment is also used as a method of reducing the effect of the wave on a system and as such falls into the realm of shielding. The session on shielding takes the form of a workshop session where approximately 40 slides are presented. These slides cover the definition and propagation of waves from antennas and wires, define a wave and illustrate the mechanism by which a wave penetrates a barrier. The barriers of concern are ideal barriers as well as finite size barriers with covers and apertures. Wire management techniques such as use of twisted wires and shielded wires are looked at. Specific problems are also presented for the purpose of illustrating the points brought out in the session.
INDEX TERMS: Shielding, aperatures, attenuation

High Frequency Electric Field Probe Development

EMCABS: 02-07-88

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2. University of Colorado, Dept of EE,
Colorado Springs, CO 80933-7150
EMC Expo 88 Symposium Record
May 10-12, 1988, Page T15.31

ABSTRACT: Various designs have been considered for electric-field probes for the frequency range 26-110 GHz. A fiber optic temperature sensor to detect the heating of a resistive strip was designed, built, and tested. With increased sensitivity, this design may be capable of operating throughout this range.
INDEX TERMS: HF probes, resistively tapered dipole

Semiconductor Based Surge Suppressors (Avalanche Junction Construction)

EMCABS: 03-07-88

David W. Hutchins
General Semiconductor Industries, Inc., Tempe, Arizona
EMC Expo 88 Symposium Record
May 10-12, 1988, Page E12.1

ABSTRACT: This paper discusses the type of semiconductor avalanche junction transient voltage surge suppressors (TVSS) available today and their application. Key parameters will be included along with their relationship to the selection process, device performance and circuit board considerations. Due to internally generated transients in addition to the residual threats of lightning, the key to complete protection is the proper selection and location of an individual protection element at the board or circuit level. Not only is the construction of the semiconductor chip important, but the package as well. Both must be considered in providing protection against the environmental threat. A transient voltage device must perform two functions, divert the transient current to ground and provide the lowest clamping voltage.

INDEX TERMS: Surge suppressors, ESD, EMP, component failure

EMC Design of Electronic Systems

EMCABS: 04-07-88

William G. Duff
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Alexandria, VA 22312
EMC Expo 88 Symposium Record
May 10-12, 1988, Page T11.1

ABSTRACT: This paper discusses the problem of electromagnetic interference (EMI) in systems, describes the techniques that may be used to control this EMI and provides guidelines for the electromagnetic compatibility (EMC) design of electronic systems. The basic elements of EMI (i.e., sources, coupling and susceptibility) are presented and methods for controlling undesired EMI interactions between equipments are described. The EMI control methods are discussed in terms of selecting equipments, grounding, interconnecting wires and cables, filtering and shielding. Guidelines for EMI control are provided in each of these areas.
INDEX TERMS: EMC control, coupling, grounding, shielding

Designing for EMI Compliance

EMCABS: 05-07-88

William D. Kimmel, P.E.
Kimmel, Gerke & Associates, LTD, 1544 N. Pascal, St. Paul, MN 55108
EMC Expo 88 Symposium Record
May 10-12, 1988, Page T21.7

ABSTRACT: The proliferation of electronic equipment has brought about government regulations (FCC, VDE, etc.) on emanations and the resulting interference on radio and television transmission. The designer is faced with a formal test by a certified test house, and is often suddenly faced with equipment which must be brought into compliance before it can be legally sold. This paper is aimed at the designer who will be required to produce equipment meeting the requirements of the applicable regulatory agency. It addresses issues which can be incorporated in the design and those which can be incorporated as a retrofit.
INDEX TERMS: EMI design, PCB design, grounding, apertures

Using Transfer Impedance to Calculate Electromagnetic Coupling Through Cables Shields

EMCABS: 06-07-88

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505/848-5399
EMC Expo 88 Symposium Record
May 10-12, 1988, Page T13.7

ABSTRACT: Surface transfer impedance is the intrinsic electromagnetic parameter for characterizing electromagnetic coupling through cable shields. Simple models are available to predict the surface transfer impedance of average and worst case braided cable. Once the cable shield current and load impedances are known, the voltage and current on the internal conductors can be calculated using Ohm's Law. Surface transfer impedance can also be used to calculate the shield current and longitudinal voltage drop, if the culprit signal is on the inside of the cable.
INDEX TERMS: Surface transfer impedance, EMI coupling

Development and Testing of Extremely Fast Electromagnetic Pulse Instrumentation

EMCABS: 07-07-88

G.D. Sower
EG&G Washington Analytical Services Center, Inc.
P.O. Box 9100, Albuquerque, NM 87119
Sixth NEM Symposium Record
May 16-19, 1988, Page 18

ABSTRACT: The state-of-the-art of fast transient data acquisition systems for electromagnetic signals is ever changing in response to new requirements. Measurements with rise times of less than 100 picoseconds are possible using sampling techniques, faster rise times are desirable. The instrumentation described herein includes the electromagnetic transducers (sensors), signal conductors, signal conditioning, and waveform recording. Each component in the system has its own characteristic rise time, which contributes to the total system rise time. Every part of the system must therefore be optimized in order to minimize the system rise time. For example, even moderate lengths of coaxial cable can cause significant degradation of fast transient signals.

INDEX TERMS: EMP, instrumentation

Predicted Shielding Effectiveness of Apertures in Large Enclosures as Measured by MIL-STD-285 and Other Methods

EMCABS: 08-07-88

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Sixth NEM Symposium Record
May 16-19, 1988, Page 110

ABSTRACT: Polarizability theory has been applied to the problem of predicting the magnetic field shielding effectiveness of a conductive shield with a well defined aperture. Shielding effectiveness, as defined by MIL-STD-285 is the ratio of the fields at a prescribed point with and without the shield in place. Using the relationships for the polarizability of a circular aperture and the field due to a magnetic dipole, the ratio of H_{ref} (magnetic field without shield) to H_q (magnetic field with shield) becomes: $Href/H_q = 0.295\ (R/a)^3$ where a is the aperture radius and R is the distance of the receiving loop from the shield. For R = 16 in = .406 m, $Href/H_q = 19.7 \times 10^{-3}\ a^3$ and the shielding effectiveness, SE = − 34 − 60 log a. For a = 1 in = .0254 m, the predicted shielding effectiveness is 61.7 dB.

INDEX TERMS: Shielding effectiveness

An Improved Electromagnetic Leak Detection System for Shielded Enclosures

EMCABS: 09-07-88

M.K. McInerney and Ray G. McCormack
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Champaign, IL 61820-1305
Sixth NEM Symposium Record
May 16-19, 1988 Page 92

ABSTRACT: A method for quickly evaluating the electromagnetic (EM) leakage of shielded enclosures is the "sniffer" method (Lockwood: 1967). In this technique a low frequency (95 kHz) current is injected onto the enclosure skin at diagonally opposite corners. An enclosure skin or seam defect which creates a discontinuity in the current will cause parallel electric and perpendicular magnetic fields to be established at the enclosure surface. An inductive probe/receiver combination is used to "sniff" the perpendicular component of the magnetic field at the enclosure surface. A value of magnetic field strength which is much greater than the values for the surrounding skin area indicates an enclosure defect.

INDEX TERMS: Shielding effectiveness

A Portable Stripline Antenna System

EMCABS: 10-07-88

C.C. Hermann[1], K.H. Coonrod[1], and C. Taylor[2]
1. TRW Defense Systems Group, Albuquerque, NM 87106
2. Ohio University, Athens, Ohio
Sixth NEM Symposium Record
May 16-19, 1988 Page 91

ABSTRACT: A flexible, light weight stripline antenna system has been developed under the EMPTAC contract with the Air Force Weapons Laboratory. The system will be used in various Hardness Maintenance/Hardness Surveillance (HM/HS) programs. The stripline antenna is used in a low level continuous wave (CW) measurement to both induce and measure the localized current on the exterior surface of the aircraft. The antenna has no direct electrical contact to the aircraft under test; therefore, it can be used to test any aperture on flight line aircraft without damage to the painted surface. The antenna system was evaluated by driving various apertures with a standard 50 ohm stripline antenna and comparing the results obtained to those obtained with the new system driving the same apertures. The electrical fields generated by the system have been modeled using a finite difference code. The evaluation results will be presented and various uses of the system will be discussed.

INDEX TERMS: EMP, antennas

Analysis and Design of Broadband Antenna for Anechoic Chamber Illumination

EMCABS: 11-07-88

Changyul Cheon and Valdis V. Leipa
The University of Michigan, Dept. of Electrical & Computer Engineering,
Radiation Lab, Ann Arbor, MI 48109
Sixth NEM Symposium Record
May 16-19, 1988 Page 48

ABSTRACT: To illuminate a tapered 60-foot anechoic chamber for scale model measurements, a 4-wire VV antenna is analyzed. A 2-wire V antenna is first studied to determine the optimum quadiatic end loading for minimum current reflection. These results are then applied to a 4-wire geometry which is then optimized to produce uniform linearly polarized field over the test region for frequencies 100 MHz to 1 GHz. Analysis was made using LLL NEC code. Both V and VV antennas exhibit relatively uniform input impedance (approximately 120-j70 ohms and 80-j40 ohms, respectively) and the VV antenna produces a uniform field within ±0.5 dB within a 2-meter diameter spherical test region.

INDEX TERMS: Antennas, susceptibility

Twin Coaxial Balun (TCB) Development

EMCABS: 12-07-88

G.D. Sower and L.M. Atchley
EG&G Washington Analytical Services Center, Inc., P.O. Box 9100
Albuquerque, NM 87119
Sixth NEM Symposium Record
May 16-19, 1988, Page 28

ABSTRACT: The Twix Coaxial Balun (TCB) is a transformer which accepts a signal, either pulse or CW, from a 50-ohm power amplifier and converts it to differentially (push-pull) drive a pair of symmetric 100-ohm transmission lines. This note* describes the manufacture and response of the TCB-1A, as built to the specifications of AFWL Measurement Note 31.
*AFWL Measurement Note 34

INDEX TERMS: Antenna

CALENDAR
1988

August 16–18

4th Annual Armed Forces Communications and Electronics Association Symposium
Franklin Plaza Hotel
Philadelphia, PA
Contact: AFCEA Philadelphia Chapter
c/o Unisys Corporation SDG
P.O. Box 517
Paoli, PA 19301

September 12–15

6th International Conference and Tutorial Day on Electromagnetic Compatibility
University of York
York, United Kingdom
Contact: The Conference Secretariat
Savoy Hill House
Savoy Hill, London WC2R OJD
United Kingdom
Telephone: 01-240 1871

September 26–29

IEEE Holm Conference on Electrical Contacts
San Francisco Hilton and Towers
San Francisco, CA
Contact: IEEE Holm Conference Registrar
345 E. 47th Street
New York, NY 10017
Telephone: (212) 705-7405

October 17–19

4th International Conference on Satellite Systems for Mobile Communications and Navigation
Institution of Electrical Engineers
Savoy Place
London, United Kingdom
Contact: SSMCN 88
Secretariat, Conference Services
The Institution of Electrical Engineers
Savoy Place
London WC2R OBL
United Kingdom
Telephone: 01-240 1871, ext. 222

November 8–10

7th International Conference
Israel Society for Quality Assurance
Tel Aviv, Israel
Contact: Conference Secretariat
PRTA Ltd1, 2 Kaufman Street
P.O. Box 50432
Tel Aviv 61500, Israel
Telephone: 03-664825
Telex: 361142

December 8–10

International Conference and Exhibition for Power Conversion and Intelligent Motion
Harumi Grand Hotel and Tokyo Int'l. Fairgrounds
Hall A
Contact: Intertec Communications, Inc.
2472 Eastman Ave., #33-34
Ventura, CA 93003-5774
Telephone: (805) 658-0933

CALENDAR
1989

March 6–9

8th International Zurich Symposium and
Technical Exhibition on EMC
Swiss Federal Institute of Technology
Zurich, Switzerland
Contact: Dr. T. Dvorak
ETH Zentrum-IKT
8092 Zurich, Switzerland
Telephone: (+411) 256-2790
or
Dr. R.M. Showers
Moore School of Electrical Engineering D2
University of Pennsylvania
Philadelphia, PA 19104
Telephone: (215) 898-8123

April 4–7

6th International Conference on Antennas and
Propagation (ICAP 89)
University of Warwick, Coventry
Contact: ICAP 89 Secretariat
Conference Services
Institution of Electrical Engineers
Savoy Place
London WC2R OBL
United Kingdom

April 17–21

Symposium on Corrosion and
EMI Shielding In Aerospace Equipment
(NACE Corrosion '89)
New Orleans, LA
Contact: Eric Carlson
Senior Research Associate
Chomerics, Inc.
77 Dragon Court
Woburn, MA 01888
Telephone: (617) 935-4850
or
Jack Guttenplan, M/S GA25
Rockwell International Electronic Operations
3370 Miraloma
Anaheim, CA 92803

May 23–25

IEEE 1989 National Symposium on Electromagnetic
Compatibility
Radisson Hotel
Denver, CO
Contact: John Tary
Tri-State Gen. & Trans. Assoc., Inc.
12076 Grant Street
Denver, CO 80233
Telephone: (303) 452-6111

August 22–25

1989 International Symposium on Antennas and Propagation
(ISAP '89 Japan)
Nippon Toshi Center
Tokyo, Japan
Contact: Dr. Takashi Katagi,
Chairman ISAP '89 Publicity Committee
Mitsubishi Electric Corporation
325 Kamimachiya, Kamakura, 247 Japan
Telephone (0467) 44-8862, FAX (0467) 47-2005
Telex: 3862-165 MULCO J.

September 4–8

2nd International Conference and Workshop on Electromagnetic Compatibility (INCEMIC)
Bangalore, India
Contact: Col. (Dr.) G.K. Deb
Electronics and Radar Development Establishment, C V Raman Nagar
Bangalore 560 093
India

September 8–10

IEEE International Symposium on EMC
Trade and Industry Center
Nagoya, Japan
Contact: Prof. Y. Miyazaki
Toyohashi Univ. of Technology
Toyohashi, Japan 440
Telephone: 0532-47-0111, ext. 576
FAX: 0532-45-0480

October 3–5

International Carnahan Conference on Security Technology
Swiss Federal Institute of Technology
Dr. Gene Grenaker
TDD, RAIL, CCRF
Georgia Institute of Technology
225 N. Ave. N.W.
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