

# Electromagnetic Compatibility Society

Newsletter



ISSUE NO. 109 SPRING 1981

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EDITOR: ROBERT D. GOLDBLUM

## IEEE FELLOWS-ELECTED

JANUARY 1, 1981

Society membership is indicated following Fellow citation. Only EMCS members are listed.

JAMES C. TOLER For contributions to electromagnetic compatibility testing which led to the development of reliable cardiac pacemakers. EMB, EMC

LOUIS J. URBAN For leadership in avionics research and development and contributions to guidance and control for missiles and aircraft.  
AES, COMP, COMM, EMC

WILLIAM G. DUFF For the development of design and analysis technology for achieving electromagnetic compatibility at the system level. EMC

GEORGE F. McCLURE For contributions to mobile telephone communications systems engineering and the creation of new and more effective methods of spectrum utilization.  
ASSP, CAS, VT, IM, AES, EM, COMP,  
COMM, PC, EMC, SMC

## BOARD OF DIRECTORS ELECTION

According to the By-Laws, nominations have been opened for membership on the Board of Directors. If you are interested in running for office on the Board of Directors for the EMC Society, call or write:

Gene Knowles  
625 Andover Park West  
Tukwila, WA 98188  
206-575-5280

The qualifications are:

- A. Membership in the IEEE and EMC Society
- B. Willingness and resources to attend meetings and to serve on the Board of Directors

Deadline for submittal of nominations is on or before June 15, 1981.

## DB SOCIETY AWARDS TROPHY TO SAE

Because of the fine work of SAE Committee AE-4 in the area of electromagnetic compatibility, the dB Society presented its Traveling Trophy to SAE for "Outstanding International Contributions to the Field of Electromagnetic Compatibility." The 1981 award ceremony took place on February 24th during the Honors Convocation and Luncheon held at Detroit Plaza.

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GLENVIEW IL 60025

## EDUCATION COMMITTEE NEWS

At the 1981 EMC Symposium in Boulder, CO, the Education Committee will sponsor a session on EMC Education. The Co-Chairmen are Dr. Jack Olin of General Motors Institute and Dr. Clayton Paul of the University of Kentucky. Papers will be presented on the subjects of: Undergraduate EMC Education, Graduate EMC Education, Education of EMC Test Personnel, On-the-Job EMC Training, and How to Keep Up With Changes in EMC Rules and Regulations. In addition, the video tape, "An Introduction to EMC," which is being produced by the Education Committee, will be shown.

A few EMC related short courses are being offered by Don White Consultants during the summer months. Introduction to EMI/RFI/EMC will be offered on May 26-28 in Seattle, WA. MIL-STD-462 and System-Level EMI Testing and Procedures will be presented on June 8-12 in Washington, DC. EMI Control in Design of Telecommunication Systems will be given on July 7-9 in Los Angeles, CA. For more information on these, as well as other courses, contact Don White International Training Center at 703-347-0030.

R & B Enterprises is offering two one-day seminars dealing with the FCC Rules on Computing Devices. They are: The Requirements and Testing of Computer Devices per FCC Dockets 20780 and 80-284 and Design for Compliance to FCC Docket 20780. They will be held on Long Island, in Boston, Baltimore, Chicago and Denver. For more information on these, as well as other courses, contact R & B Enterprises at 215-828-6236.

If you know of any EMC related seminars or short courses that you would like to see listed in this column, please send me the information at least one month before the issue date of the newsletter and I will be glad to include it.

*Henry Ott*

Chairman  
EMCS Education Committee  
Bell Laboratories  
Room 2C-248A  
Whippany, NJ 07981  
201-386-6660

DEADLINE FOR JULY 1981 ISSUE OF  
THE NEWSLETTER IS JUNE 15, 1981

## MEMBERSHIP GROWTH SETS ALL-TIME RECORDS

Year-end 1980 IEEE membership, 213,812, shows a record growth of 6.01 percent and an increase of 12,189 members over last year. Student membership is up to 34,782 and Societies membership totals 235,839.

Regions 1 and 6 have each attained over 40,000 members and the Computer Society reached a record high of 52,427 members.

MDC wishes to thank all the volunteers who contributed to this outstanding growth in 1980.

### NEWSLETTER STAFF

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## YOUR SOCIETY AT MID-YEAR



Donald N. Heirman  
President

As we approach mid-year, it's time to see where we stand and what is still to be accomplished during 1981. The Board of Directors met on 24 February 1981 in Washington, D. C. The meeting was attended by 14 of the 20 Board members, as well as several other EMC-S Committee chairmen and members. The agenda covered over 75 action/discussion items, ranging from the budget to the approval of the 1986 EMC Symposium site in San Diego. A few of the key items are summarized:

1. The 1980 budget was closed with the Society showing continued financial soundness with only a few thousand dollar increase in net funds over the previous annual budget. This is well within IEEE guidelines.
2. A proposed international EMC symposium participation policy drafted by Jackie Janoski was presented for Board review. The proposal covers procedures for publicity, attendance, and technical program involvement between us and other international EMC-oriented conferences. Bill Duff, 10507 Clipper Dr., Fairfax Station, VA 22039, is anxiously looking for help with carrying on this work, including getting approval from IEEE Headquarters.
3. The 1986 EMC-national Symposium location in San Diego was approved by the Board. Herb Mertel, 5754 Stadium St., San Diego, CA 92122, will be the general chairman.
4. Standards activities continue to be key. The most recent standards proposals include the emission control of home appliances and the proposed abandonment of the letter designators for the various radar bands used during and since World War II. Our standards chairman, Bud Taggart, National Bureau of Standards, Boulder, CO 80303, still is seeking help from you our members to keep these and the other standards projects reported in this column in the

Winter Newsletter moving to a successful conclusion.

5. The roles of the Chapters and the Board continue to be discussed. There will be a permanent chapter chairman's working breakfast at our national symposia. Each chairman will be asked to take on projects for the Society such as standards work and review, support candidates for election to the BoD, and provide fresh ideas for the management and technical direction of the Society. Limited funds are available to support technical projects, subject to the prior submission to the Board for approval. And, please, please, let us know of your newly-elected chairmen and officers. It is quite frustrating to know chairmen shown in the "Chapter Chatter" column are incorrect and not to hear of the correction for over a year, if then. The newly-elected chairmen should send an updated elected official roster to Charlie Anderson and to me in care of Bell Labs, Holmdel, NJ 07733.

6. Our new representative to the TAB committee on Man and Radiation (COMAR) is Joe Chislow, Bell Labs, West Long Branch, NJ 07764. Any views on the subject should be directed towards Joe.

7. We have instituted an ad hoc working group on Broadband Interference. Paul Newhouse, ECAC, Annapolis, MD 21402, is chairing this group. What is needed is inputs on the technical areas which should be addressed for emission limits and measurement techniques in anticipation of an EMC-S standard in this area. Also, the Chief Scientist of the Federal Communications Commission, Dr. S. J. Lukasik, has requested that the Society address this subject which has been neglected in the past. George Hgan, SRI International, Arlington, VA 22209, is also assisting Paul in this effort. They both want to have member inputs as soon as possible.

8. Membership development was addressed. There will be a booth at the Boulder EMC-S symposium where we will encourage attendees to drop in and we will, hopefully, answer any questions you might have regarding the Society. For new members, the hope is to approve offsetting at least the \$7.00 EMC-S membership fee for those who join the IEEE and Society at the symposium. There will be a draft EMC-S handbook available to pass out to those interested in the activity of the Society and its working committees. L. A. (Art) Wall, FCC, Washington, DC 20554, is in charge of that project. He needs help to assemble the information. We hope that the Washington, DC Chapter members can take this on as a Chapter project.



9. BoD nomination petitions are due by 30 May 1981. Each chapter chairman, as well as other Society members, have been contacted to solicit names for election to the Board of Directors. Bylaws, Paragraphs 4.0 through 4.8, spell out the requirements. In essence, they describe the requirements for becoming a Board member, as follows:

- A. Be a member of the Society in good standing with dues paid.
- B. Be technically active in EMC.
- C. Have adequate resources/backing to attend all Board meetings.  
There usually are three a year, with one coinciding with the annual symposium. (A BoD member cannot miss three successive meetings or membership will be dropped.) Resources should include correspondence, telephone calls, etc.
- D. Participate actively at Board meetings, assigned special projects, and committee activities.

The chairman of the nominations committee is Gene Knowles, 16954 SE 149th, Renton, WA 98055. We need qualified candidates to continue the tradition of excellence our Society represents. Drop Gene a line to offer your participation.

10. Committee vacancies need to be filled. There are committee chairman vacancies which need to be taken over by volunteers. They include membership, intersociety relations, committee on social implications of technology, and professional activities committee. Contact the President or the Secretary, Leonard Thomas, 1604 Buchanan St., NE, Washington, DC 20017, and we will speed information on these activities to you.

11. IEEE Congressional Fellowship Program. The Board has approved a \$5000.00 contribution to the IEEE Congressional Fellowship Fund to partially offset the approximate \$25,000.00 annual cost for a Fellow. We feel encouraged by the opportunity to support technical contributions to Senators so that they may have the full benefit of the Institute in the legislative process.

12. Symposium steering committee policy items were discussed. The Board appointed Gene Cory, Southwest Research Institute, P.O. Drawer 28510, San Antonio, TX 78284, to draw up policy items which the Board would want the symposium steering committees to follow on certain matters. Several Board members have indicated areas where improvements can be made in exhibits policy, handling non EMC-S concurrent meetings at the symposium site, and annual non-session oriented matters. If any member would like to offer positive items for Gene to consider, please drop him a line.

13. The Baltimore symposium chairman reported that approximately \$25,000.00 above costs was taken in. In part, income from the unexpectedly high attendance, exhibits, and last minute gratis hotel services were the cause. The Board is taking under advisement the disposition of these funds. For certain, membership dues will be maintained again at the \$7.00 level and other membership benefits will be accommodated.

The above are but a few of the ongoing activities of your Society and its elected Board members. The plea for your taking the time to help in our diverse technical and professional activities again is sounded. Key contacts have been mentioned in this report. Please feel free to contact me, too. For the past year and a half, I have set up an after-hours answering set to record your messages. Call: 201-949-5535 after 5:00 P.M., New York City time. The Board and I hope to see you in Boulder this August for our annual symposium. The Board meeting is the day before (August 17, 1981) and all members are welcome. We also will have an information booth in the exhibits area where we can answer your questions in person and, hopefully, interest you in volunteering some small amount of time to our Society's committees and projects. Let's make the last half of 1981 even better than the first!!

*Don Heirman*

Don Heirman, President





# EMC STANDARDS ACTIVITIES



by Richard B. Schulz

Now that we finished reviewing the thrusts of various US voluntary standards committees, this column will be devoted largely to two items: 1, a status report on new/revised EMC standards, and 2, scheduled meetings of EMC committees. For the present column, no status report is supplied. However, your attention is called to a revised military handbook now completed, MIL-HDBK-237A, 2 February 1981, Electromagnetic Compatibility Management Guide for Platforms, Systems and Equipment. Availability: Naval Publications and Forms Center, 5801 Tabor Ave., Phila., PA 19120.

Scheduled meetings of voluntary committees that develop and coordinate EMC standards follow.

<u>COMMITTEE</u>	<u>NAME</u>	<u>NEXT MTG.</u>
ANSI C63	Radio Elec. Coord. Techn. & Develop.	8/21/81 Boulder (EMC '81)
ANSI C68	High-Voltage Test- ing Techniques	May 81 Ft. Lauder- dale
ANSI C95	Radio Frequency Radiation Hazards	Unscheduled
ANSI MD105	Medical Electronics	5/12/81 DC (HIMA)
CBEMA ESC5	Environment & Safety Comm. - Subcommittee 5	5/19-21/81 Wash., DC (EMC '81, also)
EIA G-46	Electromagnetic Compatibility	Early May Dayton (WPAFB) 8/17/81 Boulder (EMC '81)
EIA R-2	Consumer Electro- magnetic Compatibility	Unscheduled
EIA TR8.10	Vehicular Electric Interference & Electromagnetic Compatibility	Unscheduled

IEEE S27	EMC Standards Committee	8/17/81 Boulder (EMC '81)
SAE AE-4	Electromagnetic Compatibility	8/12-21/81 Boulder (EMC '81) 10/5-8/81 Anaheim (SAE Congress)
SAE ESC/SC	Electronic Sys- tems Comm./EMI Standards & Test Methods Subcommittee	Unavailable
SAMA PMC 33	Process Measure- ment & Control	5/20-21/81 DC (SAMA)



# EMC PERSONALITY PROFILES

by William G. Duff



CARL CARSON ALLEN

Carl Allen received his education through high school in Newton, Illinois and from the 8th grade on, extracurricular activities included the completion of three correspondence courses in radio, electrical engineering and electronics. These courses were from National Radio Institutes, Radio & Television Institute and American Technical Society. During high school, he worked in a Western Auto Supply as head of the Radio Department with sales and service responsibility. At the conclusion of his junior year, he purchased a radio shop, renaming it "Allen Radio & Electrical Service." This grew into a sizeable radio, appliance, records and service store which was sold when World War II began.

He entered the U.S. Navy in January 1942 as a Radioman 2nd Class Petty Officer and was assigned to the first radar class at Balaban and Katz Experimental TV Studios, State & Lake Bldg., Chicago, IL. This class helped for entry into the Navy radar program. He completed the Radar Course at Treasure Island, CA and was assigned to the attack transport, U.S.S. Calvert where he remained through seven major invasions, leaving the Navy in December 1945 as Chief Electronic Technician.

He returned to Newton, IL to re-open his radio, television, appliances, record and service store. He was among the first to offer television sets for sale in Southern Illinois (Hallicrafters and Motorola). This organization was again sold in October 1950 when his inactive Naval Reserve enlistment

became active duty due to the Korean War. He served in electronic activation of Naval Destroyers at Charleston Naval Shipyard, S.C. While on duty here, he became interested in Radio Frequency Interference, largely due to several articles on that subject in a Navy technical journal.

In March 1952, he was employed by Hopkins Engineering Co., Inc., Washington, D.C. His first assignment was as a Field Engineer on R&D contract with the Navy Department, Code 837, Bureau of Ships. Mr. Leonard W. Thomas was Head of Code 837, providing excellent instruction and direction. His first task on that program was the reduction of third order harmonics from FM Station WFAN which was interfering with a Radio sonde program at the Bureau of Standards.

Following this program, he held positions of EMI Laboratory Supervisor, Assistant Secretary-Treasurer, Vice President, Manager of Engineering Services, Manager, R&D Department, and Manager, EMC Markets in the same company that had name changes and mergers from Hopkins Engineering Co., Inc., International Electronics Engineering, Inc., International Electronics Mfg. Co., Electro-International, Inc. to Honeywell Inc. (1966)

He joined IEEE in 1965 as a Member. He was Chairman of the Washington EMC Chapter in 1971-72 and a member of the original IEEE and EMC Technological Forecasting and Assessment programs. He was Chairman of the Baltimore/Annapolis EMC Chapter, 1977-78. He served as Exhibit Chairman for the 1976 and 1980 EMC symposiums. He is a member of SAE Committee AE-4, ANSI C.63.1 committee and Past President, Central Maryland Chapter, AFCEA. He is presently Vice President of the EMC Society.

He married Betty Sims of Newton, IL in 1945 and they are parents of a son, Terry L. Allen. Carl lives in Silver Spring, MD. He is active in several social and service organizations, teaches an adult Bible class and enjoys camping, hiking, photography, fishing and Biblical research.



# Book Reviews



by Jim Hill, EMXX Corporation

The review in this issue has been volunteered by M. K. Anderson of Martin Marietta in Denver. We always are looking for volunteer reviewers. Let us hear from you if you have a book you think would be of interest to our readers. We would like to have your review or we will find some one to review the book for you. Preferably, the book should be one currently available from the publisher.

## *"Coupling to Shielded Cables"*

BY

Edward F. Vance

Published by John Wiley and Sons, Inc.  
One Wiley Drive, Somerset, NJ 08873

Reviewed by M. K. Anderson  
Martin Marietta Aerospace  
Denver, Colorado

As stated in the preface of the book, the author's objective was to develop a reference work on coupling to cables and coupling through cable shields. Although the book falls short of this lofty goal, it establishes a firm foundation for understanding the problems of predicting and minimizing the coupling of electromagnetic signals into cables.

The author deals with the coupling of fields into both overhead and underground cables. To characterize the coupling from shields into the inner conductors, he uses the concept of transfer impedance and admittance.

Chapter One is introductory, outlining the topics covered in the other chapters.

Chapter Five deals with the coupling through cable shields. An equivalent transmission line model for braided cable is developed that includes distributed series voltage sources to represent the leakage through the cable shields. The coupling through the shield is evaluated using the technique of transfer impedance and transfer admittance. Both aperture and diffusion coupling through the shields are discussed, along with saturation effects in ferromagnetic shields. Shields considered are the walled tubular shield, braided shields, tape shields, spiral shields, and multiple shields.

Plots are given to aid in evaluating diffu-

sion through the thin wall shield, for evaluating the aperture coupling through braided shields, and for evaluating tape wound shields. Using the computed values of transfer impedance and transfer admittance along with the previously developed transmission line equations, voltage and currents are evaluated for the following cases: cable of finite length matched at both ends, the semi-infinite line, and cable open-circuited at both ends. Measurement techniques, the relationship between transfer impedance and shielding effectiveness, and the leakage through connections and splices are discussed. Examples are worked for the various cases.

In summary, the book is a good collection of equations, graphs and examples that will assist anyone involved in the calculation of coupling into cables. It also includes a good list of references. The book's weak point was a lack of derivations. Many of the equations seemed to appear as if by magic, others give a source but omit the intermediate steps. This leaves me unsure of the frequency and dimension limitations. For without a knowledge of the limitations, the material is useable only under those conditions specifically stated. In spite of this weakness, it is a useful addition to the library of anyone involved in cable coupling problems.

Chapter Two describes the phenomena of electromagnetic propagation on both sides of the soil space interface. The characteristics of the soil are discussed along with the variations due to temperature and moisture content. Graphs and tables of typical soils are included. The equations for propagation into the soil and the fields above the soil are given, with some indication of where they came from. Plots showing the magnitude and phase of EM fields with respect to frequency both above and below the surface are given. Transients are included, with plots showing the response of cables to a double exponential wave.

Chapter Three deals with the currents induced in above-ground cables. The formulas for a transmission line with series distributed sources are given as they apply to four types of problems:

1. Above-ground transmission lines
2. Buried cables and conduits
3. Shielded cables
4. Vertical elements



The cases considered are the semi-infinite line over a perfectly conducting ground plane, the semi-infinite line over a ground plane of finite conductivity, a line of finite length, a vertical line, and lines containing both horizontal and vertical elements. The basic assumptions are that the radius of the cable and its height above ground are small with respect to a wavelength. Needed equations and plots, along with examples, demonstrate the coupling response for the various cases.

Chapter Four deals with the current induced in buried cables. The characteristic impedance and propagation constant of a conductor buried in soil are given. Cases considered are the transient response of buried cables at large depths, long cables, cables of finite lengths with open and shorted ends and vertical cables. Examples are given of the response of the various cases.



#### CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS

Papers now are being solicited for the Conference on Precision Electromagnetic Measurements (CPEM) to be held June 28 - July 1, 1982, at the University of Colorado in Boulder. CPEM long has been recognized as the international forum for the discussion of all aspects of electromagnetic measurements. The technical program of CPEM will include the theory, design, performance and application of electromagnetic measurements, techniques, instruments, and systems. Papers describing significant original work on any of these topics would be appropriate for this conference.

Interested authors should submit a 35-40 word abstract and a 500-1000 word summary by January 1, 1982. Contributions should be sent to David W. Allan, Technical Program Chairman, CPEM 82, National Bureau of Standards, 325 Broadway, Boulder, CO 80303. All accepted abstracts and summaries will be printed in the conference digest.

The Boulder Laboratory of NBS serves as the secretariat for the CPEM Executive Committee. Robert A. Kamper, Chief of NBS' Electromagnetic Technology Division, is the CPEM Chairman. For general conference information, contact Dee Belsher, Arrangements Chairman, CPEM 82, National Bureau of Standards, 1-4001, 325 Broadway, Boulder, CO 80303; Tel.: 303-497-3981 (FTS 320-3981).

#### IEEE EMC SYMPOSIUM

Some 500 attendees are expected at the IEEE 1981 International Symposium on EMC to be held August 18-20 in Boulder, CO. Problems of electromagnetic compatibility and electromagnetic interference are growing almost daily as new electronic products and systems come into use. Designers and engineers will find the EMC Symposium extremely helpful in providing information on how to measure and ameliorate problems of unwanted electromagnetic radiation.

The symposium will feature workshops on FCC measurements and electromagnetic properties of composites. There will be special sessions on electromagnetic compatibility design in microelectronics, electromagnetic environments, and lightning. Regular sessions will cover a wide variety of topics including communications, static discharge, spectrum management, transmission lines, and standards and regulations.

Copies of the preliminary program and registration information can be obtained by writing to: Charlotte Tyson, Registration Chairwoman, EMC '81, IBM, 592/025-1, P.O. Box 1900, Boulder, CO 80302, or call: 303-447-5072. The symposium will take place at the University of Colorado, Boulder.

Harold E. (Bud) Taggart of the National Bureau of Standards Boulder Laboratories is Chairman of the Symposium Steering Committee.

#### EASCON INCORPORATES EXHIBITS MOVES TO DOWNTOWN WASHINGTON, DC

EASCON announces its annual Electronics and Aerospace Systems Conference to be held November 16-19, 1981. EASCON '81 has moved downtown to the Washington Hilton, a large centrally located facility in downtown Washington, D.C. This change will facilitate ease of operations for the conference and allow attendees to take advantage of all the cultural and social opportunities that Washington has to offer.

The 1980s will be a decade where the mutual interchange and understanding between government and industry will be of paramount importance. Therefore, EASCON is featuring the GOVERNMENT-INDUSTRY INTERCHANGE theme.

Industry hardware and software will be exhibited this year to complement the technical, classified and tutorial programs. The exhibits will feature the latest technological developments in the electronics and aerospace industries.

EASCON '81 will be Washington's major technological event of the fall. For more information, contact: Dr. Delbert D. Smith, EASCON General Chairman, and Senior Vice President Corporate Affairs, COMSAT, 950 L'Enfant Plaza, S.W., Washington, DC 20024; Tel.: 202-554-6111.



URSI GENERAL ASSEMBLY TO CONVENE IN  
WASHINGTON, DC IN AUGUST, 1981

The twentieth General Assembly of the International Union of Radio Science (URSI) will be held in Washington, DC on August 10 to 19, 1981. Over 1000 scientists from all parts of the world are expected to attend.

General Assemblies of the Union are held every three years, traditionally alternating between European and non-European sites. The two previous URSI General Assemblies held in the United States were in Washington, DC in 1927 and in Boulder, CO in 1957. The most recent URSI General Assembly, held in Helsinki, Finland, in August 1978, included five open symposia on specialized topics in addition to the technical sessions of the Commissions. Over 500 papers were presented in about 100 sessions. The technical program in Washington is expected to be of comparable size.

The Union is an international organization devoted to stimulating and coordinating studies in the electromagnetic and telecommunication sciences. Its members are National Committees rather than individuals. As one of URSI's 36 Member Committees, the United States National Committee for URSI (USNC/URSI) represents the United States National Academy of Sciences within the Union. URSI realizes its aims largely through its nine Commissions which cover the following fields: electromagnetic metrology and biological effects of electromagnetic waves; fields and waves; signals and systems; physical electronics; electromagnetic noise and interference; wave phenomena in non-ionizing media; ionospheric radio and propagation; radio waves in plasmas; and radio astronomy. The General Assembly is the outstanding international event in the triennial program cycle of the Union and its Commissions. Other meetings sponsored by one or more Commissions are held between General Assemblies.

The Union's nine International Commissions are responsible for generating the technical program for the General Assembly. This activity is being coordinated by a task group of the URSI Board under Professor William E. Gordon of Rice Univ. in Houston, TX. Professor Gordon is a Vice President of URSI.

USNC/URSI will host the Twentieth General Assembly and is providing guidance for an Organizing Committee charged with arranging this event. USNC/URSI is chaired by Dr. C. Gordon Little of the NOAA Research Laboratories in Boulder, CO. The Organizing Committee is chaired by Dr. Geoffrey Hyde of COMSAT Laboratories in Clarksburg, MD.

The 1981 General Assembly will be held at the Hyatt Regency Hotel in central Washington. Participation in General Assemblies no longer is restricted to the official delegations of the Member Committees and all interested scientists are invited to participate.

For further information, please contact the Executive Secretary of the 1981 URSI General Assembly Organizing Committee by writing to: R. Y. Dow, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, DC 20418, or by telephoning 202-389-6478.

NUCLEAR AND SPACE RADIATION  
EFFECTS CONFERENCE

SEATTLE, WA - JULY 21-24, 1981

This conference will cover nuclear and space radiation effects, and EMP effects, on electronic devices, materials, circuits and systems, as well as semiconductor processing technology and techniques for producing radiation-tolerant ("hardened") devices, integrated circuits and memories. The program will consist of six to eight sessions of contributed papers, several invited papers, and a special VLSI session. A poster session also is planned. In addition, a Short Course on radiation effects will be offered on July 20th.

Papers describing significant findings in the following or related areas will be included:

- Electromagnetic Pulse Phenomena: EMP, IEMP, SGEMP, SREMP
- Electromagnetic Pulse Assessment and Test Technology for Systems
- Spacecraft Charging and Space Radiation Effects
- New Developments, New Technologies: Semiconductor Processing, Radiation Hardening, EMP Hardening
- Radiation Sources, Simulation, Energy Deposition and Dosimetry

Conference attendees are encouraged to bring their families. An extensive and excellent social program is being planned which will include a reception, a picnic, tours, spouses' programs and children's activities. Attendees may wish to plan their family vacation along with attending this conference.

For additional information, contact:

Publicity Chairman:  
Howard H. Sander  
Sandia National Laboratories  
Division 2143, P. O. Box 5800  
Albuquerque, NM 87185  
505-844-1209

## IEEE TO CONSIDER NAME CHANGE

The Institute is considering a proposal to change its name. Acting on a motion submitted by Director Emeritus Donald G. Fink, the Board of Directors instructed the President to appoint a committee to study the possibility of changing IEEE's name.

A candidate for the new name, proposed by IEEE's Computer Society, is the Institute of Electrical and Computer Engineers. Robert W. Lucky, Executive Vice President, is chairing the committee to investigate the name change.

In its resolution urging the name change, the Computer Society cited six reasons that IEEE's name should become the Institute for Electrical and Computer Engineers:

1. The computer disciplines and technology are of interest to all Groups and Societies of the IEEE.
2. The Computer Society is the fastest growing part of the IEEE.
3. Computer science is the largest single discipline in the world.
4. The IEEE leads in accrediting computer engineering academic programs.
5. A number of E.E. departments have changed their names to Electrical and Computer Engineering.
6. The Computer Society publishes more publications and pages than any other technical discipline in the IEEE.

## OPTICAL FIBERS MEASUREMENT SYMPOSIUM DIGEST

A digest of papers presented at the 1980 Symposium on Optical Fiber Measurements now is available. The symposium was held last October 28-30 at the National Bureau of Standards (NBS) in Boulder, CO. Widespread interest in optical fiber measurements was indicated by the attendance of 220 people. This was the first meeting of this scope devoted solely to measurement of optical fibers.

The symposium was sponsored by NBS in cooperation with the Institute for Electrical and Electronics Engineers' Transmission Systems Subcommittee on Fiber Optics and the Optical Society of America. Symposium sessions were comprised of invited papers, contributed papers, and workshops on the subjects of attenuation, bandwidth, index profile and geometric measurement, joint/defect characterization, field measurements, and standards. Most sessions were concerned with characterization of multimode fibers; one session was devoted solely to single mode fibers.

A limited number of copies of Technical Digest-Symposium on Optical Fiber Measurements, 1980 (SP 597) and the digest supplement (containing two post-deadline papers and a list of attendees) are available at no charge from the editors. Address requests to G. W. Day and D. L. Franzen, Electromagnetic Technology Div., National Bureau of Standards, Boulder, CO 80303.

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# EMCABS

EDWIN (ED) BRONAUGH

In this issue we are publishing 42 abstracts. These are abstracts on various EMC topics. We plan to continue publishing abstracts of papers from previous EMC Symposia and from other conferences. The present EMCABS committee is composed of the members listed below. Several members of our present committee have indicated they cannot continue to support EMCABS work, so I am now looking for volunteers to help abstract EMC articles. Please write to me at the address listed in the listing of associate editors.

L. F. Babcock	E. L. Bronaugh
D. R. Kerns	R. N. Hokkanen
R. B. Schulz	R. M. Showers



CONTROLLING ELECTROMAGNETIC INTERFERENCE GENERATED  
BY A COMPUTER SYSTEM  
DANIEL T.Y. WONG  
HEWLETT PACKARD  
HEWLETT PACKARD JOURNAL  
SEPTEMBER 1979, PG. 17-19

ACCESSION NO.  
EMCABS 3-81-1

**ABSTRACT:**

IN DESIGNING EQUIPMENT TO MEET EMI STANDARDS,  
TWO BASIC TYPES OF EMI EMISSIONS ARE CONSIDERED:  
CONDUCTED AND RADIATED. CONDUCTED EMISSIONS CONSIST  
OF RADIO NOISE CONDUCTED THROUGH THE AC POWER LINE.  
RADIATED EMISSIONS CONSIST OF ELECTROMAGNETIC ENERGY  
RADIATED FROM THE EQUIPMENT AND CONNECTING CABLES.

**INDEX TERMS:**

COMPUTERS, INTERFERENCE, REGULATIONS, VDE, CONDUCTED EMISSION  
RADIATED EMISSION.

64-K RAM REBUFFS EXTERNAL NOISE

H. KATTO  
HITACHI, LTD., TOKYO, JAPAN  
ELECTRONICS  
VOLUME 53, No. 17 JULY, 1980 Pg 103-106

ACCESSION NO.  
EMCABS 3-81-2

**ABSTRACT:**

REDUCING THE AMOUNT OF STORED CHARGE AND LIMITING  
THE SOURCE OF POWER TO A SINGLE +5 VOLT SUPPLY LEAVES  
A MEMORY OPEN TO THE EFFECTS OF EXTERNALLY GENERATED  
NOISE. THIS NOISE CAN TAKE THE FORM OF A PARTICULAR  
INPUT DATA PATTERN, FLUCTUATIONS OR BUMPS IN THE  
POWER SUPPLY, OVERSHOOT ON INPUT SIGNALS, AND ALPHA  
RADIATION.

**INDEX TERMS:**

64K RAM, SUSCEPTIBILITY, EXTERNAL NOISE, ALPHA PARTICLES,  
TRANSIENTS

GUARDING ICS AGAINST STATIC DISCHARGE

DONALD R. YENNI JR.  
3M CO., ST. PAUL, MINN.  
ELECTRONICS  
VOLUME 53, No. 16 JULY, 1980 Pg.115-121

ACCESSION NO.  
EMCABS 3-81-3

**ABSTRACT:**

MAJOR ADVANCES IN PROCESSING ARE RESULTING IN  
VERY LARGE-SCALE MOS INTEGRATED CIRCUITS. HOWEVER, THE  
FINER LINES AND THINNER OXIDE LAYERS OF THESE NEW  
SUPERCHIPS WILL AGGRAVATE A PROBLEM THAT HAS PLAGUED  
MOS MANUFACTURERS AND USERS SINCE THE EMERGENCE OF  
THESE DEVICES - DEVICE FAILURE FROM ELECTROSTATIC  
DAMAGE.

**INDEX TERMS:**

VLSI, MOS IC'S, PACKAGING, STORAGE, STATIC DISCHARGE,  
CONDUCTIVE PLASTIC

PROTECT DATA-ACQUISITION SYSTEMS WITH THE RIGHT  
INPUT ISOLATION  
STEVEN CONNORS,  
DATA TRANSLATION INC., NATICK, MASS  
ELECTRONICS  
VOLUME 53, No. 10 APRIL 1980 Pg 134-141

ACCESSION NO.  
EMCABS 3-81-4

**ABSTRACT:**

ENGINEERS HAVE DESIGN OPTIONS FOR ISOLATING THE  
INPUTS OF DATA-ACQUISITION SYSTEMS, WHICH DEPEND  
HEAVILY ON SUCH ISOLATION IN INDUSTRIAL-CONTROL OPERATIONS.  
IN THESE APPLICATIONS, COMMON-MODE VOLTAGES CAUSED  
BY IMPROPER CIRCUIT AND/OR POWER GROUNDING CAN ATTAIN  
LEVELS THAT CAUSE NONISOLATED SYSTEMS TO FAIL.

**INDEX TERMS:**

ISOLATION, GROUNDING, FLYING CAPACITOR, DATA ACQUISITION,  
INSTRUMENTATION

HARDENING RAMS AGAINST SOFT ERRORS

MARK BRODSKY,  
ZILOG INC., CUPERTINO, CA  
ELECTRONICS  
VOLUME 53, No. 10 APRIL, 1980 Pg.117-122

ACCESSION NO.  
EMCABS 3-81-5

**ABSTRACT:**

IT HAS BEEN REPORTED THAT THE CHARGE USED TO  
DETERMINE BIT STATE COULD BE UPSET AND ALTERED BY  
ALPHA RADIATION COMING FROM TRACE ELEMENTS IN A CERAMIC  
PACKAGE. THE RESULTING SOFT ERRORS-IN WHICH A BIT  
IS SWITCHED FROM A 1 TO A 0, OR VICE VERSA-CAUSE NO  
CIRCUIT DAMAGE AND LEAVE NO TELL-TALE SIGNS TO INDICATE  
THAT THEY EVER OCCURRED.

**INDEX TERMS:**

SUSCEPTIBILITY, RAMS, ALPHA RADIATION, SOFT ERRORS, HARDENING

UPDATE ON ELECTROMAGNETIC SHIELDS AND PLASTICS

W.D. NASON,  
ROCKWELL INTERNATIONAL, AVIONICS, CEDAR RAPIDS, IO  
INSULATION/CIRCUITS  
VOLUME 26, No. 11 OCTOBER, 1980 Pg. 46-47

ACCESSION NO.  
EMCABS 3-81-6

**ABSTRACT:**

A NUMBER OF PLASTIC MATERIALS AND PROCESSES  
APPLICABLE TO PLASTICS ARE AVAILABLE TO PERMIT THE  
USE OF PLASTICS FOR ELECTROMAGNETIC SHIELDS. WHERE  
AND HOW THESE MATERIALS CAN BE USED ADVANTAGEOUSLY IS  
A QUESTION THAT MUST BE ANSWERED BY THE SYSTEM DESIGN  
PROCESS.

**INDEX TERMS:**

SHIELDING, PLASTIC

# SOLENOID SELECTION AND PROTECTION

VINCE COUGHLIN,  
ASSOCIATE EDITOR  
DESIGN ENGINEERING

VOLUME 51, NO. 10 OCTOBER, 1980 Pg. 45-48

## ABSTRACT:

CHOOSING THE APPROPRIATE SOLENOID IS ONLY HALF THE JOB. CORRECT CHOICE OF THE PROTECTION CIRCUIT ENHANCES DESIGN INTEGRITY, IMPROVES PRODUCT RELIABILITY

## INDEX TERMS:

INDUCTIVE KICK, SWITCHING, DIODES, ZENER, ARC SUPPRESSION  
PROBES AND TEST CELLS SIMPLIFY EMI TESTING

Andy Santoni,  
Western Editor

EDN

SEPTEMBER, 1979 Pg. 51-54

## ABSTRACT:

THE MEASURING PROBE AND THE INSTRUMENT IT WORKS WITH HANDLE ELECTRIC FIELDS FROM 200kHz to 1 GHz. THE PROBE RELIABLY MEASURES COMPLEX ELECTROMAGNETIC FIELDS, SUCH AS THOSE WITH REACTIVE NEAR-FIELD COMPONENTS, MULTIPATH REFLECTIONS, UNDETERMINED FIELD POLARIZATION, MULTIPLE FREQUENCY COMPONENTS, COMPLICATED MODULATIONS AND LARGE GRADIENTS.

## INDEX TERMS:

EMI TESTS, EMI TEST EQUIPMENT, FIELD STRENGTH METERS, RADIATION EMISSION, SUSCEPTIBILITY  
EMI, THE FCC, VDE, AND YOU

IVER SONDERBY-PRODUCT MANAGER, MAGNETICS  
STANFORD APPLIED ENGINEERING, SANTA CLARA, CA  
ELECTRONIC PRODUCTS

VOLUME 23, NO. 1 JUNE 1980 Pg. 45-46

## ABSTRACT:

BECAUSE OF THE LARGE VOLUME OF COMPLAINTS ABOUT EMI THAT HAVE REACHED THE (FCC), IT HAS RELEASED A NEW SET OF REGULATIONS SPECIFYING THE MAXIMUM LEVEL OF ELECTRICAL NOISE THAT CAN BE CONDUCTED FROM ELECTRONIC EQUIPMENT INTO THE AC POWER LINES. THESE REGULATIONS WILL APPLY TO ALL EQUIPMENT INTENDED FOR USE IN THE US AND WILL, THEREFORE, AFFECT VIRTUALLY ALL COMPUTERS.

## INDEX TERMS:

EMI REGULATIONS. FCC. VDE. COMPUTERS. COMMERCIAL EQUIPMENT, FILTERS

ACCESSION NO.

EMCABS 3-81-7

# COMPUTER-AIDED-DESIGN PROGRAM SUPPLIES LOW-PASS-FILTER DATA

GEORGE H. WARREN,  
NATIONAL SEMICONDUCTOR CORP.

EDN

VOLUME 25, NO. 15 AUGUST 1980 pg. 143

## ABSTRACT:

THE PROGRAM PRESENTED HERE CALCULATES A LOW-PASS FILTER'S ATTENUATION-AT-FREQUENCY WHEN YOU SUPPLY THE FILTER'S ORDER (N), OR THE ORDER FOR A GIVEN ATTENUATION REQUIREMENT, AND THE POLES' QUALITY FACTORS (Q) AND FREQUENCIES. AND BECAUSE THE PROGRAM INCLUDES BUTTERWORTH, CHEBYSHEV AND ELLIPTIC APPROXIMATIONS, YOU CAN EASILY DETERMINE WHICH IS BEST.

## INDEX TERMS:

LOW PASS, FILTER DESIGN, COMPUTER PROGRAM

EMI SHIELDING AND PROTECTIVE COMPONENTS

JIM MC DERMOTT,  
SPECIAL FEATURES EDITOR

EDN

SEPTEMBER 1979 Pg. 165-176

## ABSTRACT:

THE ELECTRONIC WORLD IS NOISIER TODAY THAN EVER BEFORE: FORTUNATELY, MANUFACTURERS OFFER A WIDE VARIETY OF AIDS TO HELP YOU CONTROL ELECTROMAGNETIC INTERFERENCE.

## INDEX TERMS:

SHIELDING, FILTERS, GASKETS, AIR VENTS, WINDOWS, CONNECTORS  
FERRITE BEADS, VARISTORS, ZENER DIODES.

THE TRUTH ABOUT ISOLATION AMPS

ALAN HAUN  
ANALOG DEVICES, NORWOOD, MA  
ELECTRONIC PRODUCTS MAG.  
OCTOBER, 1979, Pg. 57-61

## ABSTRACT:

AN ISOLATION AMPLIFIER HAS AN INPUT CIRCUIT THAT IS GALVANICALLY (NO OHMIC CONNECTION) ISOLATED FROM THE OUTPUT STAGE AND THE POWER SUPPLY TERMINALS. THIS ISOLATION IS PROVIDED BY MAGNETIC, OPTICAL, OR MECHANICAL COUPLING TECHNIQUES.

## INDEX TERMS:

COMMON MODE, ISOLATION, GROUND LOOPS, LEAKAGE CURRENT, TRANSFORMER COUPLING, OPTICAL COUPLING, MECHANICAL COUPLING.

ACCESSION NO.

EMCABS 3-81-10

ACCESSION NO.

EMCABS 3-81-11

ACCESSION NO.

EMCABS 3-81-12



MULTISTRAND LITZ WIRE ADDS 'SKIN' TO CUT AC LOSSES  
IN SWITCHING POWER SUPPLIES.

T.A.O. GROSS

T.A.O. GROSS AND ASSOCIATES, LINCOLN, MA 01773

ELECTRONIC DESIGN

FEBRUARY, 1979 Pg. 86-89

**ABSTRACT:**

A MULTISTRAND CONSTRUCTION OF FINE-FILM  
INSULATED WIRES, LITZ PROVIDES A LOT OF "SKIN" IN A  
SMALL SPACE. SINCE HIGH-FREQUENCY AC CURRENTS CROWD  
THE SURFACES OF THEIR CONDUCTORS, PROVIDING A LARGE  
SURFACE AREA REDUCES THE AC RESISTANCE IN COILS.  
THIS ELIMINATES THE CROWDING- OR "SKIN EFFECT"- THAT  
ADVERSELY AFFECTS THE INDUCTOR'S Q AND THE AMOUNT OF  
POWER THAT THE TRANSFORMERS CAN HANDLE.

**INDEX TERMS:**

LITZ, SKIN EFFECT, IMPEDANCE, INDUCTORS, TRANSFORMERS, "Q"

BYPASS SUPPLY LOADS WITH CARE FOR OPTIMUM TRANSIENT  
RESPONSE

Laudie Doubrava,

Textronix Inc

EDN

SEPTEMBER, 1979 Page 113-117

**ABSTRACT:**

BECAUSE MALFUNCTIONS IN DIGITAL CIRCUITS OFTEN  
PROVE TRACEABLE TO POWER-SUPPLY NOISE, IT'S HIGHLY  
USEFUL TO FIRST EXPLORE THE CAUSES OF THIS NOISE AND  
THEN DETERMINE WAYS OF MINIMIZING IT. IF YOU CAN CONQUER  
NOISE IN THIS MANNER, ACHIEVING CIRCUIT STABILITY, YOU'LL  
BE WELL ON THE WAY TOWARD PRODUCING A SATISFACTORY  
DESIGN.

**INDEX TERMS:**

POWER SUPPLY, COMMON IMPEDANCE, TRANSIENTS, LOADS, DAMPING.

TAKING THE GUESSWORK OUT OF RFI MEASUREMENTS

GUNTHER SORGER,

EATON CORPORATION

MICROWAVE SYSTEM NEWS

VOLUME 10, No. 11 NOVEMBER, 1980 Pg. 47-55

**ABSTRACT:**

IF ALL YOU NEED FROM AN INSTRUMENT IS A  
"QUICK LOOK" AT INTERFERING SIGNAL MEASUREMENTS, GET  
A SPECTRUM ANALYZER. BUT IF YOU HAVE TO VERIFY THOSE  
MEASUREMENTS ACCORDING TO SPECIFICATION, YOU ACTUALLY  
NEED AN RFI RECEIVER.

**INDEX TERMS:**

SPECTRUM ANALYZER, EMI METER, RECEIVERS, MEASUREMENT

ACCESSION NO.

EMCABS 3-81-13

TRANSIENT RECORDERS

ANDY SANTONI,

WESTERN EDITOR

EDN

VOLUME 25, No. 22 DECEMBER, 1980 Pg.182-194

**ABSTRACT:**

TRANSIENT RECORDERS PROVE VALUABLE FOR STUDYING  
THE EFFECTS OF CONTACT BOUNCE IN RELAYS AND SWITCHES.  
WITH THEM, YOU CAN MEASURE THE MAXIMUM VOLTAGE OR THE  
MAXIMUM DURATION OF A SWITCHING TRANSIENT, DETERMINING  
THE STRESS ON BOTH THE SWITCH ITSELF AND THE COMPONENTS  
SURROUNDING IT, OR YOU CAN DESIGN APPROPRIATE CIRCUITRY  
OR SOFTWARE TO COMPENSATE FOR SWITCH BOUNCE. IN THE  
DESIGN OF DIGITAL CIRCUITRY, YOU CAN LOOK FOR NARROW  
GLITCHES AND DETERMINE WHETHER THEY RESULT FROM  
CROSSTALK WITH ADJACENT SIGNAL LEADS OR FROM PROBLEMS  
IN THE POWER AND GROUND DISTRIBUTION NETWORK.

**INDEX TERMS:**

TRANSIENT RECORDERS, MEASUREMENT, STORAGE OSCILLOSCOPES,  
TRANSIENTS

OPTICAL ISOLATION AVOIDS EMI

None

EDN

SEPTEMBER, 1979, Page 42-45

**ABSTRACT:**

IF YOU WANT TO AVOID THE EMI PROBLEMS INHERENT IN  
TRANSFORMER-COUPLED ISOLATION AMPLIFIERS AND IN THE PROCESS  
OBTAIN A SMALLER, LOWER COST PACKAGE, TRY USING OPTICALLY  
COUPLED HYBRID LINEAR AMPLIFIERS.

**INDEX TERMS:**

OPTICAL ISOLATOR, LED, PHOTO DETECTOR, ISOLATION, COUPLING

POWER SUPPLY DISTRIBUTION AND GROUNDING

GEORGE CHRYSSIS,

DATTEL-INTERSIL, INC. MANSFIELD, MA

ELECTRONIC PRODUCTS MAG.

SEPTEMBER, 1979, Pg. 105-107

**ABSTRACT:**

A LARGE PERCENTAGE OF SYSTEM DEGRADATION CAN BE  
TRACED TO IMPROPER POWER DISTRIBUTION AND/OR GROUND LOOPS.  
THE SYMPTOMS OF THESE POOR DESIGNS ARE EXCESSIVE NOISE  
AT THE LOAD, VOLTAGE SPIKES ON THE POWER BUSES, SOURCE  
AND LOAD OSCILLATIONS, CROSSTALK, AC POWER LINE NOISE  
PICKUP AND POOR LOAD REGULATION.

**INDEX TERMS:**

POWER SUPPLY, GROUNDING, LOOPS, COMMON IMPEDANCE

ACCESSION NO.

EMCABS 3-81-16

ACCESSION NO.

EMCABS 3-81-14

ACCESSION NO.

EMCABS 3-81-17

ACCESSION NO.

EMCABS 3-81-15

ACCESSION NO.

EMCABS 3-81-18

# NUCLEAR HARDENING OF WEAPON SYSTEMS

MARION A. ROSE,  
IRT CORP, SAN DIEGO, CA  
DEFENSE ELECTRONICS,  
SEPTEMBER, 1979, Pg. 43-53

ACCESSION NO.  
EMCABS 3-81-19

## ABSTRACT:

THIS THREE-PART SERIES SURVEYS THE CONCEPT OF WHOLE-SYSTEM RADIATION HARDENING, RATHER THAN JUST A CRITICAL PART OF THE SYSTEM. PART ONE LOOKS AT THE NUCLEAR ENVIRONMENT, SOME OF THE GENERAL EFFECTS, AND HOW TO PROTECT AGAINST THEM.

## INDEX TERMS:

EMP, NUCLEAR HARDENING, X-RAY, THERMAL EFFECT, FILTERS, SHIELDS, FIBER OPTICS.

ELECTRONIC EQUIPMENT ENCLOSURES-A DOLLARS AND SENSE APPROACH  
ALEX MENDELSON, ASSOCIATE EDITOR  
ELECTRONIC PRODUCTS MAG.  
ELECTRONIC PRODUCTS  
DECEMBER, 1979, Pg. 31-40

ACCESSION NO.  
EMCABS 3-81-20

## ABSTRACT:

A VARIETY OF METHODS CAN BE USED TO APPLY CONTINUOUS CONDUCTIVE SURFACES TO PLASTICS. USING CONDUCTIVE PAINTS AND PRESSURE SENSITIVE FOILS IS GENERALLY THE LEAST EXPENSIVE. SILVER REDUCTION, VACUUM METALLIZATION, ELECTROPLATING, CATHODE SPUTTERING, AND FLAME OR ARC SPRAYING ARE MORE COMPLEX.

## INDEX TERMS:

CABINETS, ENCLOSURES, PLASTIC, SHIELDING, CONDUCTIVE COATINGS.

FILTER CONNECTORS ELIMINATE THE EFFECTS OF RAMPANT EMI WHILE REDUCING SYSTEM COST AND SIZE.  
JIM MC DERMOTT, SPECIAL FEATURES EDITOR  
EDN  
EDN  
Pg. 109-118 DECEMBER, 1979

ACCESSION NO.  
EMCABS 3-81-21

## ABSTRACT:

DESIGNERS ARE TURNING TO FILTER CONNECTORS TO PROTECT THEIR CIRCUITS AND EQUIPMENT. THESE CONNECTORS, WHICH INCORPORATE SMALL, HIGH-PERFORMANCE FILTERS IN THEIR PINS, HELP CONSERVE CRITICAL BEHIND-THE-PANEL SPACE AND REDUCE COSTS, COMPARED WITH APPROACHES COMBINING STANDARD CONNECTORS PLUS ASSEMBLIES OF FILTERS IN SHIELDED "DOG HOUSES."

## INDEX TERMS:

CONNECTORS, FILTERS, FILTER PINS, SUPPRESSION

# RESISTIVE AND INDUCTIVE SKIN EFFECT IN RECTANGULAR CONDUCTORS

W.T. Weeks,  
IBM, East Fishkill, N.Y.  
IBM JOURNAL, RESEARCH AND DEVELOPMENT  
VOLUME 23, NO. 6, NOVEMBER, 1979, Pg. 652-660

ACCESSION NO.  
EMCABS 3-81-22

## ABSTRACT:

AT VERY LOW FREQUENCIES, CURRENT DISTRIBUTES ITSELF UNIFORMLY THROUGHOUT THE CROSS SECTION OF A CONDUCTOR. AS THE FREQUENCY INCREASES, THE CURRENT REDISTRIBUTES, CROWDING TOWARDS THE SURFACE OF THE CONDUCTOR UNTIL, AT VERY HIGH FREQUENCIES, IT IS EFFECTIVELY CONFINED TO A THIN SKIN JUST INSIDE THE SURFACE OF THE CONDUCTOR. THE DETERMINATION OF THE CURRENT DENSITY AS A FUNCTION OF FREQUENCY IS THE MAJOR PROBLEM IN DEVELOPING A THEORY OF SKIN EFFECT.

## INDEX TERMS:

ELECTRICAL BONDING, BOND IMPEDANCE, SKIN EFFECT, RF BONDING

ZAP THE ZAPPER BEFORE IT ZAPS YOUR DESIGNS-IMPROVED ICs, PROTECTIVE COMPONENTS HELP  
JIM MC DERMOTT, SPECIAL FEATURES EDITOR

ACCESSION NO.  
EMCABS 3-81-23

TECHNOLOGY NEWS  
VOLUME 25, No. 16, SEPTEMBER 5, 1980, Pg. 59-64

## ABSTRACT:

IF YOUR DESIGN HAS EXPERIENCED MYSTERIOUS PC-BOARD FAILURES, OR IF YOU'VE CHECKED OUT A KNOWN-GOOD BOARD AND LATER FOUND THAT IT WASN'T, OR IF YOU'VE HAD OTHER DESIGN PROBLEMS WITHOUT APPARENT CAUSES, THE GUILTY GREMLIN COULD BE ELECTROSTATIC DISCHARGE (ESD).

## INDEX TERMS:

ELECTROSTATIC DISCHARGE, SUSCEPTIBILITY, INTEGRATED CIRCUITS, SEMICONDUCTORS, RELIABILITY.

GUARDING AGAINST DC TRANSIENTS

DAN EISENSTADT  
Airpax, Cambridge, MD  
DESIGN ENGINEERING,  
VOLUME 51, NO. 8, AUGUST, 1980, Pg. 43-44

ACCESSION NO.  
EMCABS 3-81-24

## ABSTRACT:

HERE ARE SEVERAL WAYS OF MODIFYING CIRCUITS TO AVOID DAMAGE TO COSTLY ELECTRONIC EQUIPMENT FROM UNAVOIDABLE SURGES IN ELECTRICAL POWER.

## INDEX TERMS:

TRANSIENTS, SUPPRESSION, ZENER, VARISTOR, SPARK GAPS,



EMP Simulators for Various Types of Nuclear EMP Environments: An Interim Categorization

Carl E. Baum

Air Force Weapons Laboratory

IEEE Trans. EMC, Vol. EMC-20, No. 1, pp 35-53, Feb 1978

ACCESSION NO.

EMCAES 3-81-25

**ABSTRACT:** Nuclear EMP environments have various forms depending on the location of the system exposed to the EMP environment. One can simulate these environments with various degrees of completeness on such systems. This note discusses the basic types or categories of EMP simulators. Such categories are based on the electromagnetic geometry of the simulator structure and electrical sources, including the location of the system under test and other nearby materials significantly influencing the electromagnetic fields. The various types of simulators are suitable for simulating different types of nuclear EMP environments. A particular type of EMP environment can be simulated with different degrees of completeness depending on the type of simulator used. In this note we only consider nonnuclear types of energy sources, and in some cases high energy photon and electron sources.

**INDEX TERMS:** EMP simulators, nuclear EMP environment, interim categorization.

APPLICATION OF THE HYBRID TECHNIQUE TO TIME DOMAIN PROBLEMS

Gary A. Thiele and George K. Chan

Ohio State University

IEEE Trans. EMC, Vol. EMC-20, No. 1 pp 151-155, Feb. 1978

ACCESSION NO.

EMCAES 3-81-26

**ABSTRACT:** A hybrid technique which formally combines the method of moments with the geometrical theory of diffraction is used to efficiently generate sufficient frequency domain data so that accurate transformation to the time domain can be accomplished via the fast Fourier transform. The advantage of the hybrid technique is that it permits one to solve problems that cannot readily be solved by either method alone. For example, the problem of a monopole at the center of a circular disk is considered. The monopole is characterized by the method of moments, and the finite size of the disk is accounted for by geometrical theory of diffraction techniques. The technique applies equally well, however, to antennas on other bodies such as satellites and aircraft and could be used to investigate the electromagnetic pulse (EMP) response of antennas on such bodies.

**INDEX TERMS:** Time-domain problems, hybrid techniques.

COMPUTER CODES FOR EMP INTERACTION AND COUPLING

R.M. Bevensee, J.N. Brittingham, F.J. Deadrick, H. Lehman,

E.K. Miller and A.J. Poggio

Bevensee, Brittingham, Deadrick, Miller and Poggio -

Lawrence Livermore Lab.; Lehman - formerly Lawrence Livermore Lab, now

Science Applications

IEEE Trans. EMC, Vol. EMC-20, No. 1, pp 156-165, Feb. 1978

**ABSTRACT:** The properties of a number of digital computer codes appropriate for various classes of external coupling problems are described. Limitations and approximations of numerical methods in general are reviewed. Thin-wire codes are tabulated to indicate their basic properties, special features, and structures analyzed, including grid models of surfaces and wire stick models of aircraft. Surface codes are tabulated for bodies of revolution, arbitrary surfaces and hybrid surface-wire or surface-aperture configurations in or below the "resonance" regime, and GTD codes for higher frequencies. Various aperture codes for studying apertures in planes, in empty bodies, or with a wire pickup behind the aperture are summarized and tabulated. Some codes for long cables above or below the earth are reviewed. Conclusions warn against imprudent use of computer codes in general.

**INDEX TERMS:** EMP, interaction, coupling, computer codes.

ACCESSION NO.

EMCAES 3-81-27

PROBLEMS AND SOLUTIONS ASSOCIATED WITH PRONY'S METHOD FOR PROCESSING TRANSIENT DATA

Michael L. Van Blaricum, Raj Mittra

Van Blaricum - Mission Research Corp; Mittra - Univ. of Ill.

IEEE Trans. EMC, Vol. EMC-20, No. 1 pp 174-182, Feb. 1978

ACCESSION NO.

EMCAES 3-81-28

**ABSTRACT:** Three difficulties associated with Prony's method are studied. These are the extension of the method to allow multiple poles, the development of techniques for determining the number of poles contained in the transient data, and the effects of noise in the data on the numerical procedures. Solutions to these difficulties are studied, and numerical samples are presented.

**INDEX TERMS:** Transient data processing, Prony's method, problems, solutions.

ON A METHOD COMPUTING TRANSIENT WAVE PROPAGATION IN

IONOSPHERIC REGIONS

K.G. Gray and S.A. Bowhill

University of Illinois

IEEE Trans. EMC, Vol. EMC-20, No. 1, pp 183-184, Feb. 1978

ACCESSION NO.

EMCAES 3-81-29

**ABSTRACT:** A consequence of an exoatmospheric nuclear burst is an electromagnetic pulse (EMP) radiated from it. In a region far enough away from the burst, where nonlinear effects can be ignored, the EMP can be represented by a large-amplitude narrow-time-width plane-wave pulse. If the ionosphere intervenes the origin and destination of the EMP, frequency dispersion can cause significant changes in the original pulse upon reception. A method of computing these dispersive effects of transient wave propagation is summarized. The method described is different from the standard transform techniques and provides physical insight into the transient wave process. The method, although exact, can be used in approximating the early-time transient response of an ionospheric region by a simple integration with only explicit knowledge of the electron density, electron collision frequency, and electron gyrofrequency required. As an illustration of the method, it is applied to a simple example and contrasted with the corresponding transform solution.

**INDEX TERMS:** Propagation, transmit wave, ionosphere, computational method.

EVALUATION OF A PROCESSING TECHNIQUE FOR TRANSIENT DATA

A. Poggio, M.L. Van Blaricum, E.K. Miller, and R. Mittra

Poggio and Miller - Lawrence Livermore Lab; Van Blaricum -

Mission Research Corporation; Mittra - University of Ill.

IEEE Trans. EMC, Vol. EMC-20, No. 1 pp 165-173, Feb. 1978

ACCESSION NO.

EMCAES 3-81-30

**ABSTRACT:** A data processing technique, namely Prony's method, is evaluated. The use of the algorithm for EMP and other transient problems is illustrated and the relationship between the waveform parameterization and the singularity expansion method (SEM) is described. The impulse response of a synthesizer network is obtained using Prony processing of the output of the double exponential excited circuit. Difficulties which arise in this type of processing such as rank deficiency, aliasing, and noise effects are considered and methods for alleviation such as filtering and rank-over-specification are introduced and evaluated. The overall status of waveform parameterization as applied to SEM is considered and suggestions for future research presented.

**INDEX TERMS:** Transient data, processing, Prony's method, evaluation.



BASIC STATISTICAL CONCEPTS FOR ANALYSIS OF RANDOM CABLE COUPLING PROBLEMS

M.A. Morgan and F.M. Tesche

Morgan - formerly Science Applications, now Univ. of Miss.;

Tesche - Science Applications

IEEE Trans. EMC, Vol. EMC-20, No. 1, pp 185-187, Feb. 1978

**ABSTRACT:** Electromagnetic pulse (EMP) internal interaction analysis is complicated by the presence of many random parameters which preclude the deterministic solution for induced excitations at particular load points. The objective of this communication is to discuss a fundamental technique for the statistical analysis of load excitations induced on an N-wire random cable via use of the reciprocity theorem in conjunction with subset representation of a statistical ensemble.

ACCESSION NO.

EMCABS 3-81-31

**INDEX TERMS:** Cable coupling, random, statistical concepts.

External Interaction of the Nuclear EMP with Aircraft and Missiles

Clayborne D. Taylor

Mississippi State University

IEEE Trans. EMC, Vol., EMC-20, No. 1, pp 64 - 76, Feb. 1978

ACCESSION NO.

EMCABS 3-81-34

**ABSTRACT:** The general problem of external coupling of the nuclear EMP to metal structures is discussed with attention directed toward aircraft and missiles. Theoretical and experimental data are presented for the skin current and charge densities induced on aircraft. Recommendations for future studies are also given.

**INDEX TERMS:** Nuclear EMP, External Interaction, Aircraft, Missiles

Pulsed Power for EMP Simulators

Ian D. Smith and Harlan Aslin

Smith - Physics International Co.; Aslin - Physics International Co., now San Francisco Div. of Systems, Science and Software

IEEE Trans. EMC, Vol., EMC-20, No. 1 pp 53 - 59, Feb. 1978.

**ABSTRACT:** Simulation of nuclear weapons effects has been the main motivation for pulse power development in the U.S. in the last decade. EMP simulation has been responsible for a major class of pulse power systems. A general survey of pulse power techniques is given, focusing on those particularly applicable for EMP simulation. This is followed by brief descriptions of several representative simulators.

ACCESSION NO.

EMCABS 3-81-32

**INDEX TERMS:** Pulsed Power, EMP Simulators

Topological Concepts for Internal EMP Interaction

Frederick M. Tesche

Science Applications, Inc.

IEEE Trans. EMC, Vol. EMC-20, No. 1, pp. 60 - 64, Feb. 1978

ACCESSION NO.

EMCABS 3-81-33

**ABSTRACT:** A description of the methodology used for analyzing problems relating to the internal interaction of electromagnetic pulse (EMP) energy is presented. A formal definition of the term "internal interaction" is made, and the question of how problems in this area are related to the other areas of EMP analysis is illustrated. Various topological concepts useful for decomposing the internal interaction problem into smaller, more manageable problems are also discussed.

**INDEX TERMS:** EMP, Internal Interaction, Topological Concepts.

Surface Current and Charge Density Induced on Aircraft

Y. M. Hwang, L. Peters, Jr., and W. D. Burnside

Hwang - formerly Ohio State Univ., now Ford Aerospace and Communications Corp.; Peters, & Burnside - Ohio State Univ.

IEEE Trans. EMC, Vol., EMC 020, No. 1, pp 77 - 81, Feb. 1978

**ABSTRACT:** The usefulness of the geometrical theory of diffraction (GTD) in computing the surface current and charge density induced on aircraft is illustrated. This is a high-frequency solution for an arbitrary incident plane wave and fuselage observation points. A pattern is presented for an arbitrary incident plane wave as well as a series of frequency and time domain plots for roll plane incidence. A 3-dimensional pattern is presented for plane wave incidence (as a function of incidence angle) as well as examples of roll plane results in both the frequency and time domain.

ACCESSION NO.

EMCABS 3-81-35

**INDEX TERMS:** Surface Current, Charge Density, Aircraft, Geometrical Theory of Diffraction.

Electromagnetic Penetration Through Apertures in Conducting Surfaces

C. M. Butler, Y. Rahmat-Sami, and R. Mittra

Butler - University of Mississippi; Rahmat-Samii & Mittra, Univ. of Illinois

IEEE Trans. EMC, Vol. EMC 020, No. 1, pp 82 - 93, Feb. 1978

**ABSTRACT:** In designing hardened systems, one must be able to characterize as well as quantitatively determine the penetration of EMP signals through apertures of general shapes in structures of varying configurations. In this paper a tutorial review of a number of methods for analyzing such aperture problems is presented with an emphasis on techniques. The discussion presented here is reasonably self-contained and is supplemented by references to classical as well as current approaches to the aperture problem. An extensive set of representative numerical results is included.

ACCESSION NO.

EMCABS 3-81-36

**INDEX TERMS:** Apertures, Conducting Surfaces, EMP Penetration



## EMP Response of Aircraft Antennas

K. S. H. Lee, T. K. Liu, and L. Marin

Lee and Marin - Dikewood Corp; Liu - formerly Dikewood Corp. now Science Applications, Inc.

IEEE Trans. EMC, Vol., EMC-20 No. 1, pp 94 - 99, Feb. 1978

**ABSTRACT:** The responses of aircraft antennas to a broadband electromagnetic wave such as the nuclear electromagnetic pulse (EMP) are analyzed. For convenience of analysis the antennas are divided into five classes: blades, loops, slots, bowls, and long wires. From each class a few specific antennas are selected as examples for detailed discussion. For each exemplary antenna the detailed equivalent circuit, input impedance, and effective height at the antenna's connector are given. Measurements of input impedance on some antennas are compared with the corresponding calculated results.

**INDEX TERMS:** Aircraft Antenna, EMP Response

## EMP Coupling Through Cable Shields

Kendall F. Casey, Edward F. Vance

Casey - Kansas State Univ; Vance - SRI International

IEEE Trans. EMC, Vol., EMC-20, No. 1, pp 100 - 106, Feb. 1978

**ABSTRACT:** Recent research in electromagnetic coupling between the interior and exterior of coaxial cables is described. Both tubular shields and shields with apertures are discussed with reference to the physical coupling mechanisms and their mathematical representations in terms of transmission-line models.

**INDEX TERMS:** Cable Shields, EMP Coupling

## Analysis and Synthesis of An Impedance-Loaded Loop Antenna Using the Singularity Expansion Method

Ronald F. Blackburn and Donald R. Wilton

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Logistics Ctr., Hill AFB; Wilton - University of Miss.

IEEE Trans. EMC, Vol. EMC-20, No. 1 pp 136 - 140, Feb. 1978

**ABSTRACT:** The singularity expansion method (SEM) is used to represent the current on a loaded loop antenna. The shift in the poles of the loop due to impedance loading can be analyzed using contour plots in the complex frequency plane of the Fourier model impedance transfer functions. The same plot may also be used to determine a loading function which will yield a specified pole pattern leading to frequency or time domain synthesis. A simple example of time-domain synthesis is presented.

**INDEX TERMS:** Loop Antenna, Impedance-Loaded, Analysis, Synthesis, Singularity-Expansion Method

## Broadband Analysis of VLF/LF Aircraft Wire Antennas

L. Marin, J. Castillo, and K. S. H. Lee

Marin and Lee - Dikewood Corp.; Castillo - Air Force Weapons Laboratory

IEEE Trans. EMC, Vol. EMC-20, No. 1, pp 141 - 145, Feb. 1978

**ABSTRACT:** The broadband response of a VLF/LF dual-wire aircraft antenna is analyzed. The impedance properties and the induced currents on the two wires of different lengths are obtained via a super-position procedure in which the original problem is split into two transmission-line (differential-mode current) problems and two antenna (common-mode current) problems. Results for the input admittance and short-circuit current of a representative VLF/LF dual-wire antenna are presented.

**INDEX TERMS:** Wire Antennas, VLF/LF, Aircraft, Broadband Analysis

## Error Probability of a Binary Signal Perturbed by Inter-symbol Interference and Impulsive Atmospheric Noise

V. K. Jain and S. N. Gupta

Indian Institute of Technology, New Delhi

IEEE Trans EMC, Vol. EMC-20, No. 2, pp 352 - 353, May 1978

**ABSTRACT:** This paper analyzes the performance of baseband polar signals in the presence of impulsive atmospheric noise and intersymbol interference (ISI). Different levels of ISI have been considered to make the analysis more meaningful. Possible explanations for the results are offered. A comparison has also been made with the system operating in Gaussian noise.

**INDEX TERMS:** Binary signal, Intersymbol Interference, Impulsive Atmospheric Noise, Error Probability

## Low-Frequency Shielding Properties of Conducting Cylindrical Shells of Arbitrary Cross Section

Te-Kao Wu and Leonard L. Tsai

University of Mississippi

IEEE Trans EMC, Vol. EMC-20, No. 2, pp 349 - 351, May 1978

**ABSTRACT:** The shielding properties of general, two dimensional, finitely conducting shells with vanishingly thin walls are analyzed by the integral-equation method. For the circular cylinder case, a field plot throughout the shield interior reveals that, at the 'no shielding' frequencies found by Schieber, fields are attenuated greatly, except near the center. The influence of slots in the shell walls is also assessed for both circular and rectangular cylinders. Due to focusing effects, the field at the shield center is even stronger than the incident field at certain resonant frequencies for the slotted cylindrical shells.

**INDEX TERMS:** EM Shielding, Cylindrical, Finitely Conducting, Low Frequency



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