APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY (ACES)

NEWSLETTER

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ACES NEWSLETTER COPY INFORMATION

Issue	Copy Deadline
March	January 25
July	May 25
November	September 25

Send copy to Paul Elliot at the above address in the following formats:

1. A hardcopy.
2. Camera ready hardcopy of any figures.
3. If possible also send text on a floppy disk. We can read any version of MICROSOFT-WORD and ASCII files on both IBM and Macintosh disks. On IBM disks we can also read WORDPERFECT and WORDSTAR files. If any software other than MICROSOFT WORD has been used on Macintosh Disks, contact the Secretary BEFORE submitting a diskette. If it is not possible to send a Macintosh disk then the hardcopy should be in Courier font only for scanning purposes.

NEWSLETTER ARTICLES AND VOLUNTEERS WELCOME

The ACES Newsletter is always looking for articles, letters, and short communications of interest to ACES members. All individuals are encouraged to write, suggest, or solicit articles either on a one-time or continuing basis. Please contact a Newsletter Editor.

AUTHORSHIP AND BERNE COPYRIGHT CONVENTION

The opinions, statements and facts contained in this Newsletter are solely the opinions of the authors and/or sources identified with each article. Articles with no author can be attributed to the editors or to the committee head in the case of committee reports. The United States recently became part of the Berne Copyright Convention. Under the Berne Convention, the copyright for an article in this newsletter is legally held by the author(s) of the article since no explicit copyright notice appears in the newsletter.

OFFICER'S REPORTS

PRESIDENT'S REPORT

ACES must reach out to become a strong participant in the international CEM community. It can do this by addressing the broad spectrum of electromagnetics, covering problems in bioelectromagnetics, consumer electronics, power engineering, communications, remote sensing, nondestructive evaluation, and other areas. In this way ACES will be responsive to workers who will make the transition from defense areas to commercial applications, and promote the cross-pollination of ideas and techniques among applications areas. The natural result of this will be an increased membership.

ACES strengths in developing, distributing, and validating codes and computational techniques must be maintained. In addition, ACES must become involved in such matters as developing standards for applications protocols, integration of software, and data transfer, as well as canonical problems and protocols for validating software. No organization in CEM has taken on these problems, and ACES would be a natural for the task. I attended a workshop on the National Initiative for Product Data Exchange that was held at the National Institute of Standards and Technology (NIST) in December 1992, and volunteered ACES participation in assisting in the development of electromagnetics standards. But ACES, of course, is an organization of volunteers, and we need someone, or several people, to volunteer their time to pursue these ideas. It is possible that some of these activities lie within the purview of already existing ACES committees, but the need to have people actively promote these efforts remains.

I continue to be impressed, but not surprised, by the quality of our technical publications. The Special Issue of the Journal on Bioelectromagnetic Computations, that Tony Fleming and Ken Joyner organized, was superb. The authors produced papers of outstanding technical value.

See you at Monterey.

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NOTICE OF THE ANNUAL BUSINESS MEETING

Notice is hereby given that the annual business meeting of the Applied Computational Electromagnetics Society, Inc. will be held at 109 Glasgow Hall, Naval Postgraduate School, Monterey, CA on Tuesday 23 March 1993 at 7:30 AM PST for purposes of:

1. Receiving the Financial Statement and auditors report for the year ending 31 December 1992.
2. Announcement of the Ballot Election of the Board of Directors.
3. Summary of the activities of incorporation and report of the non-profit status of the corporation.
4. Other business to be announced at the time of this meeting.

By Order of the Board of Directors
Richard W. Adler, Secretary

ANNUAL REPORT 1992

As required in the Bylaws of the Applied Computational Electromagnetics Society, Inc. a California Nonprofit Public Benefit Corporation, this report is provided to the members. (Additional information and an auditors report will be presented at the Annual Meeting and that same information will be included in the July Newsletter for the benefit of members who could not attend the Annual Meeting.

MEMBERSHIP REPORT

As of 31 December 1992, the paid-up membership totaled 514, with approximately 28% of those from non-U.S. countries. There were 8 student, 88 industrial (organizational) and 418 individual members. The total membership has decreased by 2% since 1 January 1992, but non-U.S. membership has increased by 6%.

Richard W. Adler, Secretary

ANNOUNCEMENT ON DUES INCREASE

In accordance with a 5-year financial plan adopted by the Board of Directors in July 1992, for the purpose of maintaining ACES as a financially solvent non-profit corporation, the annual membership dues will increase by $5, effective 1 April 1993, and will increase by an additional $5 each year.

MEMBERSHIP RATES EFFECTIVE 1 APRIL 1993

AREA	INDIVIDUAL SURFACE	INDIVIDUAL AIRMAIL	ORGANIZATIONAL (AIRMAIL ONLY)
US & CANADA	$ 60	$60	$110
MEXICO, CENTRAL & SOUTH AMERICA	$ 63	$65	$110
EUROPE FORMER USSR TURKEY SCANDINAVIA	$ 63	$73	$110
ASIA, AFRICA, MID EAST, PAC RIM	$ 63	$80	$110

FINANCIAL REPORT

ASSETS		
BANK ACCOUNTS	**1 Jan 1992**	**31 Dec 1992**
MAIN CHECKING	5,610	1,802
EDITOR CHECKING	2,496	1,754
SECRETARY CHECKING	1,766	2,009
SAVINGS	2,269	296
CD #1	10,617	11,068
CD #2	10,617	11,068
TOTAL ASSETS	$33,375	$27,998

LIABILITIES	0

NET WORTH 31 December 1992	$ 27,998

INCOME	
Conference	47,283
Publications	3,121
Membership	28,062
Software	5,040
Interest & misc.	5,700
TOTAL	89,205

EXPENSE	
Conference	21,030
Publications & Flyers	37,565
Software	1,074
Services (Legal, Taxes	5,431
Postage	16,888
Supplies & misc.	12,611
TOTAL	94,600

NET INCREASE for 1992	<$5,395>

The losses for 1992 are due to (1) the depletion of the original 1986 LLNL $40,000 start-up grant, (2) increased publications cost (9%), (3) increased postage and flyer costs (18%), (4) cost of completion of non-profit status. Income increased by $8,326 but expenses increased by $9.726. Net worth dropped by $5,377.

James C. Logan, Treasurer

COMMITTEE REPORTS

ACES EDITORIAL BOARD

PUBLICATIONS COMMITTEE

PUBLICATION SCHEDULE AND FINANCIAL RESOURCES

We are continuing to investigate ways to augment our financial resources, so that we can publish three ***ACES Journal*** issues each year while also maintaining membership affordability worldwide. This has been primarily an ACES Board of Directors effort; however, I have also been asking ***ACES Journal*** Editors for their own suggestions and have received encouraging feedback. One suggestion involves the development and sale of pre- and post-processors for electromagnetics modeling codes. (Actually, this has already been attempted on a limited scale with the sale of the NEEDS package). Another promising suggestion involves sponsored research types of activities, which can be generalized to include code validation and data base standardization / documentation. Although the aforementioned activities are outside of the realm of publications, we hope that various members of ACES will be inspired to organize and lead these efforts or similar ones, especially in consideration of their value to ACES beyond revenue-generation.

The need for tri-annual publication has been foreseen more than a year ago, but immediate action was necessitated by unexpected success in attracting papers for regular and special issues of the ***ACES Journal***. (This success does NOT mean that henceforth, we can become complacent!) Specifically, as we were printing the recent Special Issue on Bioelectromagnetic Computations, organized and edited by **Tony Fleming** and **Ken Joyner** (Australia) and already an acclaimed publication, another special issue on Computer Applications in Electromagnetics Education, made possible by CAEME Director **Madgy Iskander** (USA), was nearing completion. At the same time, the next regular issue, which will include benchmark problem solutions in addition to several outstanding papers, had already been scheduled for publication in July 1993. Under the original publication schedule, the "Education" Special Issue would have been published in November 1993. However, this delay would have been unfair to the authors and would have tarnished our reputation for rapid review and publication of acceptable papers. Therefore, we decide to accelerate the 1993 publication schedule. This schedule acceleration will buy time for ACES to consider and implement new revenue-generation activities. Provided that we are successful in this, we can publish three ***ACES Journal*** per year beginning in 1993.

Another Special Issue on Advances in the Numerical Computation of Low Frequency Electromagnetic Fields is now being organized by **Adalbert Konrad** and **Doug Lavers** (Canada). In addition, **Christian Hafner** (Switzerland) has created an excellent opportunity to publish a Special Issue on Multipole Methods. Assuming that we can synchronize this opportunity with the necessary funding, this issue will also be published.

NEW EDITORS

We have begun adding new Editors who will formulate standards of publication and arrange for the review of papers in "non-mainstream" areas -- educational aspects of computational electromagnetics, input/output issues and computer hardware. A fair review process for such papers is essential in our efforts to publish more "non-mainstream" papers (IN ADDITION TO the "mainstream" or semi-traditional" types of papers which we presently publish) while simultaneously maintaining standards of publication appropriate for a refereed journal. This is no easy task!

I am pleased to announce that the ACES Editorial Board now includes substantial representation of our "sister communities" in computational electromagnetics -- TEAM, COMPUMAG, and The CEFC. Prior to becoming ACES President, **Hal Sabbagh**(USA) initiated the process of reaching out to these communities in his capacity as a Guest Editor of ***The ACES Collection of Canonical Problems – Set 1*** (originally intended as an ***ACES Journal*** Special Issue). We value our relationships with these communities and hope to work with them more closely in future years.

PROMOTIONAL ACTIVITIES

The ***ACES Journal*** is becoming a preferred publication among an increasing number of authors, but active promotion remains an imperative if we are to continue attracting and publishing the best papers. In recognition of this ongoing need, **Duncan Baker** (South Africa) and **Wes Williams** (USA) are continuing their invited paper campaign, which we anticipate will mainifest the additional payoff of increased membership.

Another recent project, made possible by **Paul Elliot** and **Ray Perez** (USA) has been a series of descriptive articles about ACES in newsletters and magazines of other professional societies. Meanwhile **Kenzo Miya** (Japan) has made ACES more visible among his colleagues in the Japan Society for Applied Electromagnetics in Materials and is interested in cooperative activities between our two groups.

YOU

In consideration of the fact that the ***ACES Journal*** and ***ACES Newsletter*** subscriptions are the centerpiece of the ACES membership package, we Editors are interested in your professional needs and in any concerns you may have in regard to our publications. Although the combined ***ACES Journal*** Editorial Board and ***ACES Newsletter*** Staff now represent 13 nations on five continents (while also maintaining balanced representation among electromagnetics applications areas and among industry, academia, and government), we cannot foresee every professional need. Therefore, your suggestions and feedback remain vital to us and are your opportunity to help make ACES the best possible professional society which we can be.

Please let me know how we can continue making your membership in ACES a professionally rewarding experience. Your suggestions and comments will receive my personal attention (although inquiries regarding subscription fulfillment should be directed to the ACES Secretary, **Richard W. Adler**). The other Editors and I want to help!

David E. Stein
Editor-in-Chief

FINANCIAL COMMITTEE

This is the third year in a row in which ACES has run at a loss. The Board implemented a budget process, starting 1991, and set two goals: (1) balance out our income and expenses and (2) increase our reserves to equal one years' income. Despite cost cutting measures, such as reducing the number of publications, and increasing membership dues, we have so far failed to achieve our goals. The membership dues do not cover the total cost (including printing and postage) of our publications or the other costs, such as secretarial services, telephone and postage, which are necessary to conduct the business of ACES. Our yearly conferences and short courses make up the difference, almost. We have continued to eat away at our cash reserves every year and are now faced with the prospect of dipping into our savings. These are hard times for everyone, including ACES. The Board must find ways to both cut cost and increase revenues. The choices are tough ones that may not be popular, but the survival of ACES is at stake.

James C. Logan
Chairman, Financial Committee

REPORT ON ACES UK CHAPTER

The UK Chapter continues to thrive. We had our first annual meeting since our formation last October 1992, which was well attended with over 30 present. The day followed a format pioneered by the UK NEC Users group of invited speakers followed by contributions in the afternoon.

Invited speakers provided overviews of work undertaken at a number of UK Universities. It is clear that the subject is flourishing at least in those locations. The following subjects were presented:

On the use of Inhomogeneous Grids in Time Domain Finite Difference Modelling Method (Dr. R. Lau, CurlSol Ltd)

Integral Equation Methods for CEM (Dr. S. Walker, Imperial College)

A Review of CEM Activities at the University of York (Dr. S.J. Porter)

Moment Methods and Superconductors (Dr. G. Cook, University of Sheffield)

Those interested may wish to contact the authors directly - ACES UK can provide contact addresses.

UK Chapter membership continues to grow. We are currently examining the demand for a "hands on" beginners course in NEC, primarily aimed at students and young graduates. Much will depend on an economic viability, but we have hopes this may occur during later 1993.

Dr. A.K. Brown
Managing Editor

ACES UK CHAPTER NEWSLETTER TABLE OF CONTENTS

The ACES-UK Chapter which was recently formed published an excellent regional Newsletter. The Table of Contents for their first newsletter is shown below, as well as the contents of its predecessor the NEC-UK Users Group Newsletter. Anyone interested in these articles is encouraged to contact the editor Jeff Cox:

Dr. J.W.R. Cox
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ACES-UK Newsletter No. 1 (Autumn 1992)

NEC UK USERS GROUP NEWSLETTER CONTENTS

No. 1 (Spring 1988)

NEC UK USERS GROUP NEWSLETTER CONTENTS

No. 2 (Spring 1989)

"CARFEM * News from Bradford University" - Peter S. Excell, Bradford University

"An Alternative Methods of Considering the magnetic Current Annular Ring (Frill) Source" **
J.W.R. Cox, Royal Aerospace Establishment

"Derivation of the Expressions Concerning the Maximum Coupling Between a Pair of Antennas" J.W.R. Cox, Royal Aerospace Establishment

"4th Annual Review of Progress in Applied Computational Electromagnetics 1988"
Pat Foster, Microwave and Antenna Systems

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* Computer-Aided RF Electromagnetics

** A revised version has been published in the ACES Journal, Vol. 5, No. 1 (Summer 1990)

No. 3 (Spring 1990)

"Some Remarks on the Current Slope Discontinuity Source as Described in the NEC Manual" *** J.W.R. Cox, Royal Aerospace Establishment

"2-D NEC Contribution" - D. Brammar, Royal Signals and Radar Establishment

"An Attempt to Model Microstrip Using NEC" - Pat Foster, Microwave and Antenna Systems

No. 4 (Spring 1991)

"International Conference on Computation in Electromagnetics"
Brian Austin, University of Liverpool

"Calculation and Corroborative Measurement of the Reactance of a Long-Wire Antenna Installed on a BAC 1-11 Aircraft" - J.W.R. Cox, Royal Aerospace Establishment

"Performance of Resonant Dipole Antennas Using MININEC and Modelling of a Dipole Gap Using NEC" - M.J. Alexander and M.J. Salter, National Physical Laboratory

"Optimising a VAX Computer for NEC Runs" - Alan Boswell, Marconi Research Centre

"Display of Geometry and Current Information on Wire-Grid Models"
R.J. Najm and B.A. Austin, University of Liverpool

"MN and YO - Enhanced MININEC and the Yagi Optimizer"
Ian White, IFW Technical Services

*** Reprinted in this issue of ACES Newsletter

SOME REMARKS ON THE CURRENT SLOPE DISCONTINUITY SOURCE AS DESCRIBED IN THE NEC MANUAL

J. W. R. Cox
Defense Research Agency (DRA), P160 Building
Farnborough, Hampshire GU14 3TD UNITED KINGDOM

[Editor's note: This article is republished with permission from the NEC-UK Users Group Newsletter No. 3 Spring 1990. According to NEC guru Gerry Burke, the current-slope-discontinuity source in NEC is reasonably accurate for thin wires (large segment length/radius ratio, and large dipole length/radius ratio such that $\Omega = 2$ ln (dipole length/radius) > 16). The current-slope-discontinuity source is less sensitive to source segment length relative to adjacent segment lengths than is the applied-E-field source, but in general the applied-E-field source works better. A related paper comparing several source models entitled "Test of a Coaxial Line Source Model for NEC" by G.J. Burke was given at the 3rd Annual Review of Progress in Applied Computational Electromagnetics, Monterey, CA 1988.]

The method by which the current slope discontinuity source is considered in the NEC manual (part I, pp 63-67) may seem a little perplexing when first encountered. The source region is introduced as a portion of biconical transmission line, whereas in practice sources are almost invariably highly localized; that is, their dimensions are very much less than the wavelength. Consequently, transmission line effects and in particular the characteristic impedance of the line are not expected to be explicitly apparent. I think that the discussion in terms of a transmission line obscures the fact that this source actually drives a structure by forcing equal and opposite electric charge to oscillate upon the input terminals (*ie* those conductors forming the 'source region'). This arrangement is like a circuit being driven by a charged capacitor in such a way that the charge on the plates is being constantly replenished or removed by some means so as to maintain the prescribed charge variation.

If the two terminals have a capacitance C between them and carry a charge amplitude q_0, this results in a voltage V_0 across the terminals where

$$q_0 = CV_0 .$$

If the source region extends for a distance δ either side of the nominal position of the source, this results in an average linear charge density over one half of the source region of (q_0/δ) and a density of $(-q_0/\delta)$ over the remaining half. Hence, crossing the source, a discontinuity in the linear charge density of

$$\frac{q_0}{\delta} - \left(-\frac{q_0}{\delta}\right) = \frac{2q_0}{\delta} \qquad (1)$$

is encountered at the nominal source position, s_0.

In the NEC implementation, the source position is considered to be at the junction between two segments simply because it is more convenient to impose the discontinuity there than anywhere else on a segment.

The linear charge density is related to the current, I, by the equation of charge conservation, so that (using the same symbols as the manual)

$$\frac{\partial I}{\partial s} = -jw\rho,$$

where ρ is the linear charge density. The size of the step discontinuity in the linear charge density at the source is therefore given by

$$\lim_{\varepsilon\to 0}\left[\frac{\partial I}{\partial s}\bigg|_{s=s_0+\varepsilon} - \frac{\partial I}{\partial s}\bigg|_{s=s_0-\varepsilon}\right] = -\frac{j\omega 2q_0}{\delta} = -2j\omega v_0\left(\frac{C}{\delta}\right).$$

The NEC manual gives an expression for $\frac{\partial I}{\partial(ks)}$ rather than $\frac{\partial I}{\partial s}$. These quantities are related by

$$\frac{\partial I}{\partial s} = \left(\frac{\partial I}{\partial(ks)}\right)k,$$

so that

$$\lim_{\varepsilon\to 0}\left[\frac{\partial I}{\partial(ks)}\bigg|_{s=s_0+\varepsilon} - \frac{\partial I}{\partial(ks)}\bigg|_{s=s_0-\varepsilon}\right] = -2j\frac{\omega}{k}v_0\left(\frac{C}{\delta}\right) = -2jcv_0\left(\frac{C}{\delta}\right), \quad (2)$$

where c is the speed of light in free space. The capacitance per unit length of the terminals, C/δ, can be derived analytically for some simple shapes, but involves the usual difficulty of making an arbitrary decision about the extent of the source region. It is a simple matter to show that for a biconical capacitor of infinite extent

$$\frac{C}{\delta} = \frac{\pi\varepsilon_0}{\ln|\cot(\theta/2)|}.$$

Making the same assumption as in the manual concerning the extent of the source region and taking θ to be small, produces

$$\frac{C}{\delta} = \frac{\pi\varepsilon_0}{\ln(2d/a)}.$$

Hence the right-hand side of equation (2) becomes

$$-\frac{jv_0}{60\ln(2d/a)}.$$

This is identical to expression 190 in the manual but for the quantity ln(2d/a) instead of [ln(2d/a) - 1]. This latter quantity is a consequence of spatially averaging the characteristic impedance of the biconical transmission line as indicated in the manual. The reason for doing this is not immediately obvious because once d is defined, values of θ and hence the characteristic impedance of the line follow. If the spatial averaging was not performed the result for the magnitude of the discontinuity in the current slope would be the same as that derived here.

A difficulty with sources which are seemingly more realistic than the pulse source is apparent in the foregoing. The source for which an analytical expression is obtained must, in effect, be amended to make it suitable for incorporation into a problem which has been discretized. At some stage in the implementation the integration over the (continuous) source of an analytically derived quantity is necessary and the result considered as acting at a (discretized) point on the problem being considered. That is, the source has to be formulated as a lumped component for compatibility. As in the case of the magnetic frill discussed in the previous newsletter, this process tends to undermine the claim of greater realism by smearing out the configurational details of the source. In the present case, the linear charge density on the capacitor is integrated over the source region in order to specify a mean value for the current slope which is then imposed at the source position. In fact, the analytical expression for the linear charge density on a biconical capacitor exhibits a singularity at the junction of the two cones (*ie* the nominal source location) and so could not be used anyway. This singularity is, however, incidental.

In addition, it does not seem to be particularly advantageous to produce a supposedly realistic source model if, when the problem has been solved, it is necessary to perform a line integral of the tangential electric field in the region of the source in order to calculate the applied voltage. The only means by which the above difficulties can be ameliorated without resort to *ad hoc* assumptions is by adopting as fine a discretization as practicable at least in the area surrounding the source. Under such circumstances the pulse source is likely to be as good as any.

ANTENNA ANALYSIS COMPUTER PROGRAM DISKS OFFERED

R.P. Haviland
1035 Green Acres Circle N
Daytona Beach, FL 32119

A set of computer programs directed especially to the Radio Amateur may be helpful to professionals as an aid to project exploration and preliminary design. The programs cover a wide range of antennas and frequency ranges from MF to SHF. The set includes three disk packages.

The first package, PRACTICAL ANTENNA DESIGN AND ANALYSIS, includes BASIC programs titled:

- Dipoles Near Resonance
- Loaded Antennas
- Inverted Vee Antenna
- Short Verticals
- Symmetrical Tee Antenna
- Diskcone Antenna
- Large Circular Loops
- Helical Antennas
- Flat Top Beams
- NBS Yagi Antennas
- Log-Periodic Antennas
- Parabolic Dish Antennas
- Long Wire Antennas
- Tee Match
- Tower Design
- Self-Supporting Pipe Masts
- General Cylindrical Antennas
- Windom Antenna
- Cage Antenna Diameter
- Multi-band Trap Antennas
- Radial Mode Helix
- Small Loops
- "Quad" Loops
- Arrays of Antennas
- Uniform Yagi Array
- High Gain Yagi Antenna
- Optimum Horn Designs
- Vee Beams
- Coax Cable Loss
- Element Data and Sag
- Pole and Anchor Depths
- Guy Wire Tension

In addition, a copy of the original version of Mininec is included. This volume is available as disk for several computers, or in paper, which includes hints for use.

Programs in the second package, PRACTICAL ANTENNA DESIGN AND ANALYSIS, Vol 2, also in BASIC, are:

- Resistance Broad-banding
- VHF-SHF Broadband Dipole
- Circular Loop Array
- 4 Element W2PV Yagi
- Cloverleaf Antenna
- Cross Antenna
- Ferrite Rod Antenna
- Small Transmit Loops
- Waveguide end Antennas
- Slotted Waveguide Antennas
- Waveguide Data
- Isolation Between Dipoles
- Load-to-Generator Transfer
- Taper Correction
- Stub Matches
- RF Safety Limits
- Polyrod Antenna
- MF-HF Broadband Dipoles
- Coaxial Colinear Antenna
- Arrays of Verticals
- Beverage Antenna
- Corner Reflectors
- Cylinder-Slot Antenna
- J-Pole Antenna
- Rhombics
- Sleeve Monopole Antennas
- Standard Gain Antenna
- Gamma Match
- RF Line Calculations
- Element Size Correction
- Impedance from SWR Data
- Earth Penetration
- RF Calculations

These programs are available only on disk, for two computers.

Package three, Mininec For Amateurs, is intended to make Mininec 3 source code readily available to the Amateur Radio community. It includes the original source code (through change 9), and several variations for small computers, for large antennas on expanded computers, and for antenna optimization for gain or F/B ratio. Compiled versions are included, for speed, as well as ASCII BASIC versions.

This package also includes a set of original auxiliary programs intended to simplify Mininec use. A set of "MAKE" programs creates input files for dipoles, verticals, quads and Yagis. Extensive files of standard designs are included. Another set of programs creates other Mininec input files, directly or by manipulating file data by combining, scaling and positioning of elements to form complete arrays, array supports and antenna- support combinations. These programs are in ASCII format, to suit the variety of BASICs available, or to modify for special needs.

Where possible, techniques nomenclature and references are consistent with Amateur practice, in line with target use. However, considerable effort has been expended in securing completeness and accuracy.

The material is available from MiniLab Books, P.O. Box 1086, Daytona Beach, FL 32121-1086, or from Ham Radio Bookstore, P.O. Box 209, Ridge, NH 03461.

It may be noted that specialized versions of Mininec are offered in Amateur Radio Publications by others.

This information was supplied by ACES member R. P. Haviland, P.E., W4MB, originator of the programs, by request.

PERSPECTIVES ON ACES AND COMPUTATIONAL ELECTROMAGNETICS

The ACES Newsletter continues this series of "Perspectives" articles to provide a forum for discussion of present and future needs in computational electromagnetics, areas of challenge, and potential electromagnetic solutions. As a result of this discourse it is hoped that electromagnetics related problems and requirements can converge with prospective solutions. Perspectives from a wide range of applications and work settings will be represented, including international scientific institutions, educational institutions, government labs and agencies, and industry. Editors Dave Stein and Ray Perez are coordinating this effort. This issue features the following "Perspectives" articles by Fady Harfoush and Robert Bevensee.

COMPUTATIONAL ELECTROMAGNETICS IN ACCELERATOR PHYSICS

Fady Harfoush, Thomas Jurgens, and Jean-Francois Ostiguy
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Batavia, Illinois 60510

This paper looks at the particular applications of computational electromagnetics to problems in accelerator physics. In high energy physics research the machines are a series of devices which have an evacuated pathway through which a charged particle beam passes. The beam is usually a series of particle bunches rather than a continuous stream. The devices are designed to interact with the beam in a prescribed manner. Some devices measure the beam, i.e. beam position monitors and wire scanners. Other change the direction the beam travels, i.e. bending magnets, kicker magnets, and electrostatic separators. Still other devices accelerate the beam, i.e. radio frequency (RF) quadrupoles and RF cavities. The electromagnetic fields in accelerating structures can deleteriously affect the beam and cause its loss. Tools that allow computation of these fields to a high accuracy are needed not only when the machine is being designed but also later when the machine is built and problems such as beam instabilities need to be investigated.

We start by discussing the types of problems being analyzed, and then review the numerical tools used to model such problems. Finally we discuss some of the current research work in this field, and present our views of future work that needs to be done. This paper is not about code listings and detailed descriptions. Such information can be found in our list of references.

Design Issues in Accelerator Physics

The nature of problems in accelerator physics can be categorized as static, harmonic or time domain. Superconducting magnet, conventional magnet, and electrostatic separator design are some of the problems analyzed using static codes. These codes solve for Poisson equation and are capable of solving problems with nonlinear constitutive relationships. The constraint on field quality is rather high allowing in many cases only 0.01% change in field over a given region. In a circular machine the beam is circulating in a pipe for many turns and a small deviation in the field quality can have a big accumulative effect on the beam to cause its loss. Codes like MAFIA-S3, POISSON [1] and many available commercial codes have been successfully used to achieve such a field quality in a magnet design. To obtain the desired field quality and uniformly one often needs to run the code many times until a design matching the desired goal is obtained. Certain codes allow for automated optimization of some design variables based on a given set of criteria. In most cases the optimization routine is poorly implemented and one needs to start with a good guess of what the final solution is for it to converge.

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* Operated by the Universities Research Association under contract with the U.S. Department of Energy

Harmonic Codes such as URMELT, SUPERFISH, MAFIA-E3 [1], solve the Helmholtz equation and compute the eigenmodes in resonant structures such as accelerating cavities and beam sensors. These codes allow for the calculation of resonant frequencies to a good degree of accuracy (about 0.03% for SUPERFISH). Here too, many iterations might be needed to tune the cavity to the desired resonant frequency. Besides the resonant frequency of the dominant accelerating mode, the field gradient along the longitudinal axis of the structure where the beam travels is a part of the design criteria. Higher order modes which can propagate in the beam pipe and cause the beam to become unstable are also analyzed. Accelerating structures such as found in a LINAC (Linear Accelerator) can be composed of many cavities coupled to each other to form a section. In turn each section is coupled to nearby section through a bridge coupler. For this, the model should allow for the computation of the efficiency of input power coupled to a section and the coupling factor from cavity to cavity. Because of limited computing power only one cavity or few cavitiies of a given section are modeled.

Time domain codes such as TBCI, ARGUS, QUICKSILVER, and AMOS [1] are used to model wake fields, transient field behavior in various devices, and to self-consistently model beam traversal through a device. Wake fields occur when a moving particle bunch (beam) excites electromagnetic fields in the devices it traverses. These fields are analogous to the waves found in the wake of a boat traveling through water. Resonances of the device are stimulated during the bunch's passage through it, causing fields to persist after the bunch has exited. These remnant fields affect, usually deleteriously, subsequent bunches which enter the device. Understanding and control of wake fields is important in machines that have small bunch separation. One way to quantify the likelihood that a structure would produce wake fields is by calculating its impedance. This is done by taking the integral of the field along the longitudinal line where the bunches are traveling. Care must be given so as to include all persistent fields in the integration. If the bunch happens to be a point charge this is simply the beam impedance. Other terminology such as Green function (for mathematicians) or impulse response (for engineers) can be used. Time domain calculations are also relevant for the calculation of transients in pulsed powered cavity structures as found in a linear accelerator, and in pulsed powered kicker magnets. An overshoot in the transient response for example, can cause a breakdown in the cavity. Direct beam-beam and beam-structure interactions are modeled with particle in cell codes. Particle in cell codes (or self-consistent models) allow for the beam to redistribute itself due to the electromagnetic forces acting upon it.

Most of the problems in accelerator physics are interior problems in other words electromagnetic fields are confined to a bounded region. Contrary to exterior problems, like scattering problems, where space is unbounded, the interior problem can be solved without imposing outgoing boundary conditions.

Review of Numerical Techniques

Since the early days of the development of the theory of electricity and magnetism by Maxwell, accurate solution of initial and boundary value problems have been a major pre-occupation of electrical engineers and applied scientists. Until the advent of digital computers, analytic techniques such as conformal mapping, the method of images or the method of inversion were used to obtain closed form solutions for canonical problems. The analytic approach imposes severe limitations on the type of problems being considered. For non idealized problems even approximate solutions are sometimes hard to obtain. With inhomogeneities and nonlinearities included the problem becomes quickly intractable analytically. Numerical methods eliminate much of the deficiencies of the analytical approach. However, one should not conclude that numerical methods are a panacea.

The numerical tools used in accelerator physics, like many other fields, can be broadly classified as finite element (FE) method or a finite difference (FD) method. The basis of finite difference schemes is the replacement of a continuous domain with a grid of discrete points or "nodes". The discretization of the equations and the boundary or interface conditions is performed by various algorithms which replace derivatives and/or integrals with approximations which are functions of the nodal values. In the traditional version of FD method, the nodes are positioned on a regular orthogonal grid. For static problems regular grids are almost always used in practice because smart interpolation schemes, difficult to implement in automatic form are required to handle certain types of boundary and interface conditions. On the other hand, the use of a regular grid leads to a highly symmetric discrete equations that can be solved very efficiently. Example of codes based on the FD method are POISSON, and MAFIA-S3.

The Finite Element method was developed to provide more geometric flexibility. It deals with arbitrary shaped regions in a systematic manner that can be easily automated. More importantly the use of a non-uniform mesh does not require any modification to the solver. The general definition of FE encompasses the so-called Method of Moments (MOM) and Boundary Element Method (BEM). In the FE method, the problem region is partitioned into subregions called elements. The unknown fields are represented by suitable interpolation functions that contain, as unknowns, the values of the unknown field at the respective nodes of each element. In contrast with the FD approach, the interpolation functions represent the unknown field not in the neighborhood of a node but rather over each element. The discretization of derivatives and integrals is performed by substituting the approximations into the corresponding field expressions. The resulting expression is then projected onto a discrete subspace spanned by weighting functions. This yields a system of discrete equations that can be solved using standard methods. The classical FE method corresponds to the case where the weighting function and the interpolation functions are identical. The MOM and the BEM correspond to the case where the weighting functions are fundamental solutions of the Laplace operator.

The FD and FE methods can be further subdivided into a frequency domain type solution or a time domain type solution. Each of these methods vary in their use of computer resources, representation of complex geometries, ability to model arbitrary media types, and proficiency in handling various sources.

The nature of a computer algorithm determines its computer resource. Both FE and FD frequency domain algorithms are implicit in nature and can be solved using either direct or iterative techniques (i.e. conjugate gradient method). Finite element time domain (FETD) algorithms are generally implicit in time where each time step requires solving a linear system. Time iteration size is not restricted by the Courant stability condition. FD time domain (FDTD) algorithms can be either explicit or implicit. The implicit FDTD algorithms are similar to the FE time domain methods in their matrix construction. Explicit FDTD algorithms do not require the solution of a linear system. A big advantage of the explicit FDTD method is that memory requirements scale linearly with the number of field unknowns irrespective of the dimensionality of the problem and can be solved in one step. Iterative methods are less efficient than this, they vary between a single step algorithm which scales quadratically and a multiple step algorithm which scales linearly. But contrary to the implicit method time iteration size is restricted by the Courant stability criteria.

Work on automated mesh generation for FE algorithms is more mature than for FD algorithms. Time domain codes can model nonlinear phenomena where the frequency conversion of energy occurs. Frequency dependent media parameters have been incorporated into FDTD codes. FETD codes have been used for eddy current simulations. The modeling of the movement of charged particles is done with FDTD codes, both rigid beam and self-consistent versions exist.

Current Research and Conclusions

Rapid advancements in computing capability are enabling scientists and engineers to use numerical modeling tools to analyze large scale problems of volumetric complexity never considered before. This section will concentrate on recent progress made in FD algorithms of relevance to accelerator physics.

Although existing FDTD codes all discretize some form of Maxwell's equations they differ tremendously in their ability to handle open boundary conditions, moving boundaries, thin wires, narrow sub-cell slots and joints, cracks, nonlinear materials, frequency dispersive materials, and curved surfaces. Thin wires are present when modeling diagnostic electronics present in a beam pipe. Induced current on thin wires are used for example to determine the profile of a beam. Coupling through thin slots and tiny holes also requires the handling of sub-cell geometries (smaller than a cell size). The modeling of dispersive material characteristics will enable us to add microwave filters to our model, and investigate the possibilities of filtering out undesired frequencies in the spectrum of wake fields. Dispersive materials are also present in the form of ferrites in high speed kicker magnets.

Many times we are faced with the need to model accurately fine geometries such as tapered beam pipes at small angles, tiny holes and slots. Tapered beam pipes are used for impedance matching and to reduce wake fields and an exact representation is crucial. The ability to accurately represent arbitrary media interfaces has been present in FE codes for years. Most FD codes suffer from stepped edge approximations to media interfaces which do not coincide with mesh lines. However, recent advances in FD meshing have demonstrated it is possible to overcome this problem [2,3,4] in two and three dimensions. Conformal modeling (not to be confused with conformal mapping) uses Ampere's and Faraday's integral equations to deform the meshes near the boundary of the geometry. This modeling permits a more accurate representation of a complex structure without the need to refine the mesh. Mesh refinement schemes have been investigated as another way of modeling small geometric features [5]. Other FDTD methods attempt to use a non-orthogonal coordinate system to better adapt the grid lines to the geometry under consideration. If care is not taken artificial reflections can be introduced at boundaries of two different meshed regions.

The 2 1/2 *D* AMOS FDTD code [4] allows for dispersive material to be included in the modeling of accelerating structures. Others have successully modeled linear and nonlinear dispersive material using a first order Debye and a second order Lorentz dispersion relations [6]. Previous work with FDTD have demonstrated the ability to include thin wires and thin slots [7,8]. This work has yet to be extended to problems in accelerator physics. The commonly used time domain code in accelerator physics MAFIA still lacks most of the capabilities mentioned above. The same is true also about the code ARGUS which is now emerging as a substitute to MAFIA.

When solving for the resonant modes in a 3-D simulation it is desirable to reach an accuracy of 0.01% comparable to the 2-D SUPERFISH accuracy. However, the majority of 3-D codes are not able to approach this accuracy level due to computer resource limitations. Such limitations can be overcome with more powerful supercomputers and advanced softwre tools to run the codes on parallel machines. In addition advanced FD meshing techniques can provide greater accuracy at asymptotically little computer cost. Another problem encountered with the discretization of the Helmholtz equation to solve for eigenmodes is the appearance of solutions which are not real. These modes are generally referred to as ghost modes. In 2-D it is possible to identify these ghost modes, a task which is much more complicated in 3-d. More powerful techniques should be incorporated in existing codes to better identify these modes. Many codes still lack automated optimization routines to achieve a desired design criteria.

The large amount of information obtained from 3-D simulations makes global data analysis difficult. Visualization allows this analysis to be done in a more efficient manner and has become a valuable design and analysis tool in many areas [9, 10]. It is also a powerful educational tool to demonstrate effects hard to explain with numbers. Accelerator physics is but another area that can benefit from recent advances in visualization.

For any comments, questions, or clarifications regarding this manuscript the authors can be reached at their electronic mail addresses listed below.

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A FUZZY LOGIC APPROACH TO OBTAIN CONFIDENCE IN ELECTROMAGNETIC MODELLING

by

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We might categorize the various *independent* classes of errors in modelling problems as follows: (1) *geometrical errors* (wires and/or patches in the wrong places; irregular finite element boundaries), (2) *mathematical-approximation* or *discretization errors* (changing integrals to summations or differential equations to difference equations, with too few discrete elements such as wire segments or finite difference cells) (3) *representation errors* (poorly chosen basis and/or expansion functions, and (4) *logical programming errors.* Class (2) includes spurious responses. Class (4) errors are straightforwardly corrected by checking. Class (1) errors are perhaps the most subtle because they can yield poor electromagnetic responses even with fine discretization and well-chosen representation functions.

The "brute force" approach to studying the effect of geometrical errors -- by varying parameters (positions of wire junctions or edges shared by surface patches or constitutive parameters in finite difference cells) and computing the responses -- requires prohibitive computation time. One would like to relate multiple uncertainities in these parameters directly to those of the responses in one systematic computation.

Fuzzy logic offers a methodical way of obtaining C-confidence intervals for many responses from the C-confidence intervals of the geometrical parameters of interest. A C-confidence interval is a range of a parameter in which it will lie with probability = C. Fuzzy logic rules yield the C-confidence interval for a parameter z=x(+−x÷)y from the C-confidence intervals of x and y. Let us apply it to a method-of-moment code which inverts the N x N complex matrix equation V=ZI to obtain I.

The C-confidence intervals for the real and imaginary parts of $Z_{ij} = \int dr \int dr' f_i(r) O(r,r') g_j(r')$, which f_i, O, and g_j are the ith "test" function, an operator, and the jth "expansion" function are tedious to evaluate in terms of the intervals of the geometrical parameters involved. So we shall assume they are estimated in a reasonable way.

Then the inversion of V=ZI by LU decomposition and back substitution requires only elementary operations, and we can continually update the N^2 C-intervals (for each Z_{ij} as it is changed in course of the inversion) plus the N C-intervals (for all the V_i as they undergo change). The result is the C-confidence intervals for the real and imaginary parts of all the I_j, as determined by the C-intervals for *all* the Z_{ij}.

BIO

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CHANGING TIMES FOR R&D AND ITS EFFECTS ON ELECTROMAGNETIC RESEARCH
PART I

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ABSTRACT

The last three years have seen significant changes in the economic, political and social arena in this country and around the world. These changes have literally shaken the status-quo of Research and Development (R&D) funding to a point that serious reconsideration of the goals and objectives of R&D are now required. In Part I of this perspective series this editor reviews some of the basic causes which threaten to impact R&D funding for many years to come. In the next issue of the Newsletter, Part II will focus on present trends in R&D which will affect the way we look at funding. Part II will also focus on the outlook of funding for R&D in Electromagnetics.

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Being submerged in a world of R&D where our ideas, imagination, creativity and hard work are not only recognized by our superiors but also by our colleagues can indeed be a rewarding endeavor. However, it is often the experience of many that too much preoccupation with research can sometimes obscure our vision to the world around us, hence, failing to recognize the external forces that shape our capability and availability to do work, specially when such forces have a direct impact on the funding which finances such work. Though we are usually aware of funding issues within our own immediate circle, we must realize that a trickle-down effect is always at work, hence, our funding outlook for a potential project in the future depends very much on the type of external factors that are present now and which many times are well beyond our sphere of influence or control. As I think about this subject it reminds me of my vacation with my family in South Florida last August when I was caught by hurricane Andrew. Being in the calm eye of the hurricane can give a false sense of security since you will soon be caught up in the storm. It is not the eye which controls the storm, it is the storm around the eye which dictates the course. Though we may think that the altruistic goals of R&D are well positioned within the calm eye of funding appropriations, the truth is that we are so close to the storm of funding crises that it is inevitable that sooner or later those R&D goals will be caught in it – that time has finally arrived.

The determining influence that external factors have in research opportunities is not something new but is as old as science itself. Back in the 16th century the astronomer Tycho Brahe got a job working for a very influential employer -- the king of Denmark. The king made him astrologer for the court (i.e to read/interpret horoscopes). Tycho was very good at making astronomical measurements and this allowed him to secure from the king a constant and bountiful source of funding. This funding permitted Tycho to build an observatory, hire assistants and create his own "research group", and what is most important, it allowed him to perform astronomical measurements of the moon and planets for a period of 20 years. These valuable measurements were then used a few years later by the mathematician Kepler to discover his three laws of planetary motion. Many years later Isaac Newton would use Kepler's work to discover not only the universal law of gravity, but the three (3) laws of mechanical motion that still bear his name and which made Newton the father of classical mechanics. What a difference good funding can make. Many examples in modern history can also corroborate the thesis that external events do have profound influence in the course of science funding.

The last two years have seen profound changes in the outlook of R&D at the academic, industrial and federal level. At the external level the profound political changes in eastern Europe and former Soviet Union have eliminated (for now) the ideological conflict that drove the defense industry to ride on budgets of $300 billion a year for almost all the decade of the 1980's. During such times not only the major defense contractors and the hundreds of subcontractors enjoyed a substantial margin of comfort in funding, but the private sector and many in academia enjoyed the trickle-down effects of such plentiful funding. It has been predicted that up to 40% of our engineers and physicists worked directly or indirectly with Department of Defense (DOD) funding during the1980's. Though in the last two years the DOD budget has been reduced by only $10 billion/year (e.g $290 billion FY93), thousands of layoffs have occurred across all sectors of the defense industry (e.g over 100,000 in the aerospace industry in California alone). This tragic scenario is not a reflection of the present, but rather of the future to come, since it is expected that the DOD budget will be reduced by about $100 billion within the next 2-5 years. Another consequence of decreased DOD funding is the consolidation of the defense industry with fewer players – kind of the survival of the fittest. Many defense subcontractors may be disappearing in the near future and a lot of mergers may be under way (e.g GE Astronautics & Martin Marietta, Hughes & General Dynamics, both of which have already occurred). This has created some concern within the industry that the technological base which created the most advance weapons systems in this century may be undermined by the severity of DOD funding problems. Nevertheless, the defense industry has gotten the message loud and clear and is now in the process of diversifying itself (i.e going commercial also). In a recent speech by Hughes' CEO the company will now be marketing cellular phones ($70 million investment), propulsion systems for electric vehicles ($60 million investment), and direct-to-home TVbroadcast satellites ($400 million investment). As grave as the DOD funding may look at present however, there are two items that may show some reason for hope: 1) technology will be last to be sacrificed, and that is good for R&D funding, and 2) in this unpredictable world the reverse process (i.e the need to re-arm again) has an equal probability of occurring within the next few years.

If the present funding problems for R&D were only a consequence of those aforementioned external factors I would probably not be very much concerned, but the real issue in funding lies with our problem within the federal budget deficit. In the best of times, Washington's annual budget ritual is variously described as disturbing, disorderly and on occasions even disgusting. The combination of the most obdurate economic recession since the 1930's, the severe limits the White House and Congress imposed on discretionary spending (called the 1990 White House-Congress budget agreement), and the inability to stanch the flow of red ink now suggests that severe budget battles lie ahead. The budget presented to congress last October of $1.52 trillion is one of no real growth, after taking inflation into account. The budget deficit is reckoned to approach $400 billion - a figure never approached by the US or any other nation. Cumulative debt is about 4 trillion and rising at the rate of $6000/second. If these figures do not boggle your mind, consider that about 52% (about $800 billion) goes to mandatory entitlement programs such as Social Security, Medicare and Medicaid. Another 19% (about $290 billion) would be spent on defense. What is left is 15%, some $230 billion, to cover all the domestic discretionary programs - from classes and school lunches for poor kids to space exploration and engineering/physics research. We have not yet added the money government spends on interest for the national debt and the money spent on bailing out the savings and loans.

R&D is not very popular in congress these days. As stated by one House budget committee senior staffer, Michael L. Telson (PhD in Engineering from MIT), there is going to be "a lot of pain" for the science community in 1993. For example, when Walter Massey head of the National Science Foundation (NSF) went to a hearing in Congress to request an 18% increase in his agency budget, as suggested by President Bush, he was told by a committee member..."I have to tell you there will be hard times ahead for research programs." In the scrambling for funds, congressmen have a few favorite "targets" for cuts: topping the list is DOD, followed by NSF, NASA and the Environmental Protection Agency (EPA). Of these the only one that survived this year without cuts is NSF with a 6.4 % increase (1.5% above inflation). NASA and EPA experienced zero growth. The Department of Energy which finances most of the energy related physics research and which is usually not a target, also experienced no real growth. The new administration coming to Washington has made no promises about budget increases for funding basic research and has said nothing about ensuring the health of the research community. In an era of flat or diminishing budgets for academic and industrial research, the new administration's agenda calls for shifting funds (about $60 billion) from defense R&D to civilian R&D, to support generic industrial technologies, to accelerate the effort of the national labs in creating R&D partnerships with industry and academia, and improve pre-college schooling. However, as Allan Bromley, President's Bush science adviser, recently declared..." we are in a zero-sum budget, the only game plan is to rob Peter to pay Paul."

In the second part of this article the editor will present recent trends in R&D funding which may help us stay one step ahead in the funding search. The editor will also discuss the present future of R&D funding for Electromagnetics.

MAKING DOWNLOADED FILES USABLE

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Recap & Overview

To date, we have learned how to access the Internet, find files of interest and download them. In time, you'll find that familiarity with the ARCHIE server(s) is crucial to finding specific software among the thousands of nodes that comprise the Internet. This article will begin to tackle the issue of making the files we download through the Internet usable. First, we'll distinguish between file conversion and file compression. Then, we'll discuss file compression and list some of the programs that will allow us to carry out the compression and/or decompression process. Finally, we'll point to where to find these programs. Also, since the last article was written (Sept 92), there have been several interesting events in the networking community. Because these will have an impact on how we EM practitioners "do business" over the network, we'll take a brief look at them and consider their impact. This information is included especially to benefit our overseas friends, (or those who currently can't afford many of the IEEE services) who may not have access to the resources some of us take for granted here in "the States".

Conversion vs. Compression

Before we can use the files that we download from the Internet, we often have to process them for one of two reasons. The first reason is that when files are initially created on various machines, they are normally stored in the native format of that machine. Often, we we want to pass this file on to others, we find that need to convert from one format to another, for instance from Macintosh to DOS, or from DOS to UNIX. There are a multitude of packages and programs that can accomplish this task, some better than others. For want of space and time, we will leave this discussion to a later time.

The second reason is that to save valuable disk space on the various network servers, as well as time when transferring files from point A to point B, the files are stored in a compressed format. This results in the file taking up much less space, and is very useful for long term storage of seldom used files. To make things even more efficient, especially during file transfer, many files are often grouped together into an archive. An archive may consist of anything from a group of related files, to an entire hard disk, backed up to some storage medium.

When you download files from the Internet, You'll notice that they often have one or more three letter extensions tacked on at the end of the file name. Some examples of these cryptic letters are **.ARC**, **.Z**, **.CPT**, **.SIT**, **.ZIP**, etc. These extensions indicate which file compression routines have been used on the files. Each machine has compression formats that are optimized for its particular operating system. To decompress these files, we need decompression software that is compatible both with the format that the file is compressed in, and with the operating system of the target machine. Again, there are many programs, each with its strengths and weaknesses.

With apologies to those that have other types of machines, let's touch on some of the compression, decompression, and archiving programs used on the three main types of operating systems that most people are likely to run into: Macintosh, DOS and UNIX. We'll concentrate on getting the programs we download into a form that our machines can use.

A couple of cautions are called for here. First, it is possible that some of the compression formats that you run into will not have any way to convert from one machine to another. This is especially true when new formats first come out. For instance, there is a new version of ARC that has been released which currently has no Macintosh equivalent. Thus, it is worth your while to hold on to older versions of programs to create files that can be read by a greater number of people. Second, always check to see if you have the latest version of these programs. Sometimes it takes a while for new versions to propagate around on the bulletin boards. It is a good idea to use ARCHIE or keep up with some of the useers groups to see what versions are where. Finally, I should add the caveat that it is quite possible that some of these comments may be superseded by the time you read this, as software authors are continually modifying and updating their programs.

Currently, the most common formats for compression programs on the Macintosh are Compact Pro (**.CPT**) and some variation of the program StuffIt (**.SIT**). Once in a while, you will run into a file created by PackIt (**.PIT**). For DOS machines, the common formats are PKZIP (**.ZIP**) and PKARC (**.ARC**). Other formats include zoo (**.ZOO**), lharc (**.LHZ**) and pak (**.PAK**). Finally we come to UNIX machines. In one of those strange quirks of nature that seem to occur every so often, the individuals that came up with the name of the command for compression chose COMPRESS (**.Z**). This is quite extraordinary, given the other commands that UNIX has for performing relatively simple functions.

Macintosh: The Macintosh is somewhat unique in that its files are made up of two separate parts called "forks". Each fork contains information that the Mac needs to keep its head on straight when it is working with its files. To transfer this in one convenient package, the MacBinary standard was created. This works fine when you transfer files from one Mac to another. Most Mac telecommunications software takes care of this automatically. However, if you want to send a file to a PC BBS by way of a file server or local area network, you need to do the conversion manually. The programs MacBinary or BinHex 5.0 will allow you to do this. To confuse the matter, there is a program called BinHex 4.0. This generates files with the extension **.HQX**. This program is used to create files to send over networks that only allow 7-bit transfers, just like Kermit. For example, to send a file to someone using UNIX UUCP mail, use BinHex 4.0. Thus, you'll often download a Mac program, say Program.HQX for instance. After you use BinHex 4.0 or DeHQX on it, you'll end up with something like Program.srr. Then you need to use a decompression program on it to get back to the native Mac format.

If you are sticking to working with straight Mac to Mac transfers of files, I would recommend either Compactor (**.CPT**) or one of the multitude of flavors of StuffIt (**.SIT**). These programs also have the advantage of reading many of the other formats that are proliferating. Currently, I believe StuffIt has a slight edge in this category, although Compactor tends to do a somewhat better job of reduction. Both of these programs are widely available on the network archives and they come in many forms. If you are interested mostly in Mac to UNIX transfers, the program MacCompress will handle regular compress (**.z**) files. To read HQX files on a UNIX machine, you can use the program McVert. This will put the file into a format that can be read with compress.

PC/DOS: There are many compression programs available for the DOS machines. One of the most common formats is the **.ZIP** format, which is created by PKZIP. To read these files on the PC, use PKZIP which can both compress and decompress. On the Mac, the programs UnZip v1.1 or StuffIt Deluxe will read the format. On UNIX machines, the program unzip4.1 will read this. Another common format is **.ARC**, which is created by the programs ARC and PKARC. On Mac machines, StuffIt Deluxe and ArcPop will decompress files created by ARC v6.2 or earlier and PKARC v3.6 or earlier. Another format that you might find is **.LHZ** which are created by the programs LHA and LHarc. On Mac machines, MacLHarc will read these, while on UNIX machines, you can use lharc102.

UNIX: The result of using COMPRESS on a FORTRAN source file named test.f is a compressed file with the extension (**.Z**) appended to it. To decompress the file, use the command 'uncompress filename'. For additional information, use the UNIX manual command 'man compress'. If the file has the extension (**.TAR**), it has been archived. To see the directory of the archive, use the command 'tar tvf filename.tar'. To extract all files in the archive, use the command 'tar vxf filename.tar'. As in all things associated with computers, the standard disclaimers hold (i.e.. your mileage may vary). To get more information on the archiving capability of your machine's operating system, use the command 'man tar'.

This is only a quick and dirty look at these file compression formats. For a more complete list, check out the report "compression-util-table.txt", located at the INFO-MAC server at Stanford University (sumex-aim.stanford.edu or 36.44.0.6). This is in the directory info-mac/report. Not only does this report list most of the various compression and decompression routines, it also details where the routines can be found. Also, check out chapter 33 of the very readable and useful book, "The BMUG Guide to Bulletin Boards and Beyond", by Bernard Aboba. Much of the information presented here has come from these sources, as well as others.

Finally, if the software you are using is shareware, do yourself a favor and register it with the author. In the long run, you'll be better off, as you will usually receive the latest version, as well as a manual. While many people don't believe in manuals, other than to line bird cages or wrap fish, occasionally there is some useful information in them. Also, the authors have often invested substantial amounts of time in the care and feeding of these programs. They deserve some compensation for their efforts, as well as encouragement to continue upgrading and improving their products.

IEEE and E-mail

For those of you who may have missed it or are not members of the IEEE, they have begun a major push to use E-mail for connectivity between members. The IEEE has implemented a system that allows you to send a "message" to an address which represents an "alias" for a particular service or document that contains information the requester desires. IEEE E-mail services make use of several types of aliases. IEEE aliases are dummy addresses of the form "xxx.yyy@ieee.org". When a message arrives at the IEEE Internet node "ieee.org", the message is automatically forwarded to the appropriate mailbox whether it be at the IEEE service center or around the other side of the world.

These aliases can represent anything from the address of an individual who is an IEEE member or volunteer, to the address of an IEEE unit, to an auto-response text file containing information about some aspect of the IEEE. For additional information on what services are available, send a message to:

email.guide@ieee.org

and you will receive an 8 page guide on the various capabilities of the IEEE E-mail system. A message to:

info.info@ieee.org

will return a list of all the E-mail services available through the IEEE E-mail service. I would suggest that you check this service out. It promises to be quite useful in demonstrating the utility of working through E-mail.

EMLIB

For those of you who are not members of the IEEE Antennas and Propagation Society, you may have missed the announcement in the December 1992 issue of the IEEE Antennas and Propagation Magazine (pp. 49-50) of the activation of EMLIB - an Internet server for the distribution of EM software and related information. This server is the result of the work of Tom Cwik (Jet Propulsion Lab, Pasadena, CA) and Scott Ray, (formerly of Lawrence Livermore National Laboratory and now associated with Dow Chemical in Indianapolis, IN). The server is located at JPL and has the Internet address:

128.149.76.31 or microwave.jpl.nasa.gov

The server is relatively new, so currently, there isn't much on it. However, if the community supports it, this could turn out to be a useful mechanism for distributing EM codes, utilities and reports. A good way to support this effort is to use what is there and contribute codes and information. Start by accessing EMLIB and downloading copies of the two next files:

README.DIR
README.EMLIB

The first file lists the file structure and current contests of EMLIB. As of 21 Jan 93, there were several files containing source code. Among these were codes concerning scattering and a plotting routine. By the time you read this, there should be even more to choose from. The second file, an introduction to EMLIB, lists what sort of material is expected to be found on it, and explains in greater detail the procedures for using this server. After familiarizing yourself with what is there, contribute something that you have found useful.

I strongly support this effort and would suggest the ACES membership do likewise. I would suggest that this is a good location to maintain the ACES database and other lists of EM workers. With the approval of the ACES leadership, I'll be investigating this possibility, as well as some others, so stay tuned for further developments.

ACES Database

Speaking of the ACES database, (how's that for a transition?), I intend to attend the ACES symposium this March. We are currently working on setting aside a small space in the registration area (or some such area) where I can hand out copies of the database, as well as download copies onto disks. I would suggest that attendees bring along several 3.5" disks to the conference for downloading software. I can provide the database in either text or Filemaker Pro format. My Macintosh will work with either Mac or DOS formatted disks. Also, the 93 Symposium will be a good place for you to check your information and update it as needed.

Conclusion

Well, that wraps it up for this installment. Next issue, we'll take a look at Newsgroups, and how discussion groups for various areas of EM interest can be formed. Also, we'll start a discussion on the conversion of files from one format to another. Hope to see you in Monterey.

For Further Information

1) "The BMUG Guide to Bulletin Boards and Beyond" by Bernard Aboba. Available for $20 (+ $4.00 S&H) from BMUG Inc., 1442A Walnut St. #62, Berkeley, CA 94709. Phone (510) 549-2684; fax (510) 849-9026.

2) The archive sumex-aim.stanford.edu maintains several files in the subdirectory "report" that contain information about the Internet, ftp sites, and the downloading of files. Several of these have provided information for this series of articles. Among these are the following:

info-mac/report/compression-util-table.txt
info-mac/report/e-mail-gateways.txt
info-mac/report/ftp-primer.txt
info-mac/report/ftp-sites.txt
info-mac/report/how-do-i-find.txt
info-mac/report/internet-access-11,hqx
info-mac/report/internet-acronyms.txt
info-mac/report/internet-dial-in.txt

Although this archive is oriented toward Macintoshes, these are all text or ASCII files, and are readable by non-Macintosh machines as well.

HIGHLIGHTS

OF THE

9TH REVIEW OF PROGRESS IN APPLIED COMPUTATIONAL ELECTROMAGNETICS

22-26 MARCH 1993

- Canonical Problems Session
- A CAEME Posters and Software Demonstration
- Interactive Forum Papers
- Vendor Demonstrations 1600-1745 Tuesday 23 March, Barbara McNitt Ballroom, Herrmann Hall.
- Wine and Cheese Buffet 1600-1745 Tuesday 23 March, Barbara McNitt Ballroom, Hermann Hall
- Committee and User Group Meetings will be held at 1730 Wednesday 24 March.
- Eight short courses are offered this year on 22 through 26 March.

Full-day Courses:

1. "Solving Practical Problems with GEMACS"
2. "EM Modeling Using the TSAR FDTD Code Suite"
3. "Wire Antenna Modeling: 20 Years of Successes, Failures and Lessons Learned, Modeling Guidelines and Some Useful Utility Programs"
4. "TLM Techniques for Electromagnetic Wave Modeling"
5. "Reflector Antenna Code Modeling"

Half-day Courses:

6. "The Generalized Multipole Techniques (GMT) and the Multiple Multipole Program (MMP): Theory and Practical Use in Computational Electromagnetics"
7. "CEM Modeling Options and Tradeoffs"
8. "Starting Your Own Small Business"

(Full details are contained elsewhere in this Newsletter)

PRELIMINARY AGENDA

The Ninth Annual Review of Progress in Applied Computational Electromagnetics

NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA
22 26 MARCH 1993

Perry Wheless
Chairman, Technical Program Committee

MONDAY MARCH 22

0830-1630	**SHORT COURSE (FULL-DAY)** "Solving Practical Problems with GEMACS" by Buddy Coffey		
0830-1630	**SHORT COURSE (FULL-DAY)** "EM Modeling Using TSAR FDTD Code Suite" by Dr. K.S. Kunz and S.T. Pennock		
0830-1130	**SHORT COURSE (MORNING HALF-DAY)** "The Generalized Multipole Technique (GMT) and the Multipole Program (MMP: Theory and Practical Use in Computational Electromagnetics" by Dr. Pascal Leuchtmann		
1300-1630	**SHORT COURSE (AFTERNOON HALF-DAY)** "CEM Modeling Options and Tradeoffs" by E.K. Miller		
1800-2030	**CONFERENCE REGISTRATION**		103 Glasgow Hall
1300-1700	**BOARD OF DIRECTORS MEETING** (Members are invited to observe)		200 C Root Hall
1800	**BOARD OF DIRECTORS DINNER**		

TUESDAY MARCH 23

0715	**CONFERENCE REGISTRATION**		103 Glasgow Hall
0730	**ACES BUSINESS MEETING**	Pres. Hal Sabbagh	109 Glasgow Hall
0800	**WELCOME**	Perry Wheless	109 Glasgow Hall
1300-1630	**SHORT COURSE (AFTERNOON HALF-DAY)** "Starting Your Own Small Business" by Buddy Coffey		

SESSION 1: CANONICAL PROBLEMS FOR SOFTWARE VALIDATION
Chair: Dr. Andrew Peterson, Co-Chair: Capt. Dennis Andersh

0810 "RCS of High Permittivity Cubes by FDTD and by Measurement" by C.W. Trueman, S.J. Kubina, R.J. Luebbers, S.R. Mishra, and C. Larose

0830 "Asymptotic Prediction Validation Using Measured Data" by B.B. Halama, D.J Andersh, and A.J. Terzouli, Jr.

0850 "TLM Computation of an Iris-Coupled Waveguide Cavity - A Canonical Problem" by Qi Zhang and W.J.R. Hoefer

SESSION 1 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #1 "A Technique for Determining Non-Integer Eigenvalues for Canonical Analysis of Boundary Value Problems" by D. Reuster and M. Kaye

IF #2 "Evaluation of Method of Moments Codes: University of Houston JUNCTION and Numerical Electromagnetic Code, Version 4" by C.A. Deneris, J.C. Logan, and J.W. Rockway

IF #3 "NEC2, NEC3, and NEC4 on a Convex Mini-Supercomputer" by Lance Koyama

SESSION 2: CANONICAL PROBLEMS WORKSHOP (parallel with Sessions 3 and 4)

0930-1130

SESSION 3: MOMENT METHOD THEORY AND APPLICATIONS (parallel with Session 2). **Chair: Dr. Paul M. Goggans**

0915 "Development of a Bandlimited Basis Set for Thin Wire Method of Moments Scattering Problems" by G.E. Mortensen and C.C. Cha

0935 "A Moment Method Formulation for Electromagnetic Radiation and Scattering from Composite Bodies of Revolution" by Pierre Steyn and David B. Davidson

0955 **BREAK**

1015 "Scattering and Radiation from Partially Coated 3-D Triangular Patched Bodies" by J.M. Putnam

1035 TO BE ANNOUNCED

SESSION 3 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #4 "Calculation of Transient Scattering from Two-Dimensional Objects using a Frequency Domain Method of Moments Approach" by Paul M. Goggans

IF #5 "RCS of Structures with Apertures and Slots" by S. Kashyap, A. Louie, S. Mishra, and C. Larose

SESSION 4: GTD/UTD/PO Analysis (parallel with Session 2)
Chair: Dr. A.K. (Tony) Brown, Co-Chair: Dr. Shian U. Hwu

1100 "Overview of Analytic Techniques used in OSU Reflector Antenna Code" by Teh-Hong Lee and Roger C. Rudduck

1120 "Space Station Freedom (SSF) Antenna Pattern Predictions Using Geometrical Theory of Diffraction" by Shian U. Hwu, Jon S. Fournet, Robert J. Panneton, and G. Dickey Arndt

1140 "An 'Object-Oriented' Approach to GTD/UTD Modeling" by Edgar L. Coffey, III

1200 "The Multi-Point GTD and Extended Aperture Integration Techniques for Analysis of Reflector Antenna" by Roger C. Rudduck, Yueh-Chi Chang, and Teh-Hong Lee

1220 **LUNCH**

SESSION 5: COMPUTATIONAL ELECTROMAGNETICS - THE NEXT GENERATION - Chair: Mr. Kenneth R. Siarkiewicz

1320 "The Electromagnetic Modeling and Simulation Environment for Systems (EMSES)" by Kenneth R. Siarkiewicz

1340 "A Proposed Approach for Developing Next-Generation Computational Electromagnetics Software" by E.K. Miller, R.P. Kruger, and Steve Moraites

1400 "Hybrid Approach for Large 3-D Platforms" by L.N. Medgyesi-Mitschang, J.M. Putnam, and Dau-Sing Wang

SESSION 6: TRANSIENTS **Chair: Dr. Paul M. Goggans**

SESSION 6 PAPER PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #6 "Transient Internal and Scattered Fields of a Sphere Illuminated with a Pulsed Gaussian Beam" by Elsayed Esam M. Khaled, Dipakbin Q. Chowdhury, Steven C. Hill, and Peter W. Barber

SESSION 7: HIGH-FREQUENCY TECHNIQUES AND ASYMPTOTIC SOLUTIONS
Chair: Dr. A.K. (Tony) Brown, Co-Chair: Dr. Shian U. Hwu

SESSION 7 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #7 "ISAR Image Formation Using Bistatic Data from 'XPATCH'" by Rajan Bhalla and Hao Ling

IF #8 "Time Domain Smyth-Kirchhoff Approximation to Aperture Coupling" by K.S. Kunz and S.A. Blocher

IF #9 "A Hybrid Approach to Trailing Edges and Trailing Ends by David Ingham

IF #10 "High Frequency Approximations to the Physical Optics Scattering Integral for Curved Edged Surfaces" by William B. Gordon

TUESDAY MARCH 23

1430-1600: **INTERACTIVE FORUM** **Coordinator: Frank Walker**
NOTE: I.F. papers are identified under their respective "home" session.

1430-1800 **VENDOR DEMONSTRATIONS** **Coordinator: Frank Walker**

1615-1800 **WINE AND CHEESE BUFFET**

WEDNESDAY, MARCH 24

SESSION 8: VISUALIZATION AND I/O ISSUES (parallel with Session 9)
Chair: Dr. Ed Miller, Co-Chair: Dr. Stan Kubina

0800 "Numerical Imaging of Finite Element Frequency Domain Solutions" by R. Craig Baucke and John D'Angelo

0820 "Visualization of Electromagnetic Fields Using the Finite Difference Time Domain Method" by John H. Beggs, Deirdre A. Ryan, and Raymond J. Luebbers

0840 "Creation, Visualization and Analysis - The Dynamics of Complex Models" by S.J. Kubina, C.W. Trueman, D. Gaudine and A. Ramos

0900 "Scientific Visualization of 3D Radar Cross Section Data" by Thomas G. Wojszynski, Andrew J. Terzouli, Jr and Martin R. Stytz

0920 "Rapid Visual Computation of Physical Optics Backscattering" (Invited Paper) by R.A. Shepherd, T.D. Olson, and C.S. Liang

SESSION 8 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #11 "EM Visualization on a SGI 4D Workstation" by L.C Russell and J.W. Rockway

IF #12 "WinGAUGE Graphical Aids for the Users of GEMACS for the Windows Environment" by Jeffrey A. Evans

IF #13 "NECDRAW for 3-D Images of NEC Wire Grid Models" by Ron Bardarson and Robert Just

IF #14 "The Electromagnetic Modeler's Workbench for GEMACS" by Edgar L. Coffey, III and Robert Fisher

IF #15 "Graphical Shell for Numerical Electromagnetics Code" by M.J. Packer, R.A. Powers, and A.P. Tsitsopoulos

SESSION 9: MICROWAVE CIRCUITS (parallel with Session 8)
Chair: Dr. Peter Russer Co-Chair: Prof. Linda P.B. Katehi

0800 "Field Matching Analysis of Complex Waveguides with Anisotropic Materials" by M. Okoniewski

0820 "Advances in Analyzing Passive Planar Radiating Structures with Method of Moments Matrices" by Sebastian Sattler and Peter Russer

0840 "S-Parameter Modeling of Planar Transmission Line Discontinuities and MMIC Module Interconnections" by Hang Jin, Rediger Vahldieck and Peter Russer

0900 "Theoretical Analysis of Microshield Transmission Lines With Dual-Plane Discontinuities" (Invited Paper) by T.M. Weller and P.B. Katehi

0920 "Symmetry Analysis of Large Two-Dimensional Clusters of Coupled Cavity Resonators" by Ross A. Speciale

0940 "Analysis of a Millimeter-wave Filter using Transmission Line Matrix and Mode Matching Methods and Comparison with the Measurements" (Invited Paper) by W. Menzel, F. Alessandri, M. Mongiardo, R. Sorrentino, C. Eswarappa, P.P.M. So, and W.J.R. Hoefer

SESSION 9 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday)

IF #16 "Coupling-of-Modes Analysis of SAW-Multistrip Coupler" by R. Weigel, G. Scholl, and P. Russer

IF #17 "Description of Conductor-Loss Effects in Planar Transmission Lines" by Wolfgang Heinrich

IF #18 "Dynamic Electrical Modeling of Gap Discontinuities on Lossy Monolithic Microstrip Line" by Anne Vilcot and Smail Tedjini

1000 **BREAK**

SESSION 10: TIME-DOMAIN TECHNIQUES I (FEATURING FDTD) (parallel with Session 11)
Chair: Dr. Ray Luebbers, Co-Chair: Dr. Jiayuan Fang

1020 "Absorbing Boundary Treatments in the Simulation of Wave Propagation in Microwave Integrated-Circuits" by Jiayuan Fang

1040 "A Hybrid Ray/FDTD Method for Computing Electromagnetic Scattering from an Engine Cavity with a Complex Termination" by R. Lee and T.T. Chia

1100 "FDTD Modeling of the Resonance Characteristics of Realistic Enclosures" by Kent Chamberlin, Lauchlan Gordon, and Bruce Archambeault

1120 "A Method for Reducing Run-Times of Out-of-Core FDTD Problems" by J. Raley Marek and Jeff MacGillivray

1140 "Investigation of the Use of Chimera for Solving Maxwell's Equations for Electromagnetic Propagation in the Time Domain" by M.D. White and J.J. Chattot

SESSION 10 PAPER PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #20 "Radar-Cross-Section and Aerodynamic-Force Calculations using Finite-Difference Methods" by H. Vinh, C.P. van Dam, and H.A. Dwyer

SESSION 11: REMOTE SENSING AND MONTE CARLO TECHNIQUES (parallel with Session 10)
Chair: Professor Leung Tsang, Co-Chair: Dr. Chi Chan

1020 "Monte Carlo PO Simulation of Scattering from Rough Surfaces Near Grazing Incidence" by H. Bender, R. Suchar, and P. Russer

1040 "Polarimetric Thermal Emission from Rough Ocean Surfaces: A Numerical Study" (Invited Paper) by J.T. Johnson, J.A. Kong, R.T. Shin, S.H. Yueh, S.V. Nghiem, and R. Kwok

1100 "A Banded Matrix Iterative Approach to Monte Carlo Simulations of Large-Scale Random Rough Surface Scattering: TE Case" (Invited Paper) by Leung Tsang, Chi H. Chan and Haresh Sangani

1120 "A Banded Matrix Iterative Approach to Monte Carlo Simulations of Large-Scale Random Rough Surface Scattering Penetrable Case" (Invited Paper) by C.H. Chan, L. Li and L. Tsang

1200 **LUNCH**

SESSION 12: BIOELECTROMAGNETIC COMPUTATIONS (parallel with Session 13) **Chair: Dr. Imre Gyuk**

1300 "Bio-electromagnetic Computation in the Low Frequency Range: An Introduction" (Invited Paper) by Imre Gyuk

1320 "Calculation of Electric and Magnetic Fields near Ground Level in 187KV AC Substation" (Invited Paper) by K. Isaka, N. Hayashi, and Y. Yokoi

1340 "Numerical Methods for Dosimetric Calculations: ELF to Microwave Frequencies" (Invited Paper) by Om P. Gandhi

1400 "Current Distribution Tomography for Determination of Internal Current Density Distributions" (Invited Paper) by Paul C. Gailey

1420 "A Matrix Formulation of Dielectric Imaging, Dosimetry and Computation of Vector Electromagnetic Fields" (Invited Paper) by Wendy W. Guo and Theodore C. Guo

1440 "Explanation of Biological Effects of Low-intensity Electric, Magnetic and Electromagnetic Fields by Nonlinear Dynamics" (Invited Paper) by F. Kaiser

SESSION 12 PAPER PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #21 "Calculation of Absorbed Power Density in the Human Arm Due to Induced Currents at 1-30 MHz" by P.R. Wainwright

SESSION 13: TIME-DOMAIN TECHNIQUES II (FEATURING TLM) (parallel with session 12)
Chair: Dr. Wolfgang J.R. Hoefer, Co-Chair: Dr. Fred German

1300 "A Comparison of Currents Induced on Scattering Bodies Using the Transmission Line Modeling (TLM) Method and the Method of Moments (MOM)" by Griffin K. Gothard and Sadasiva M. Rao

SESSION 13: TIME-DOMAIN TECHNIQUES II (FEATURING TLM) (CONT)(parallel with session 12)

1320 "Transmission Line Matrix (TLM) Modeling of a Stepped-Septum Square-Waveguide Polarizer" by Lloyd S. Riggs, G.K. Gothard, Fred J. German, and Chuck Chandler

1340 "Discrete Time-Domain Greens Functions for Three-Dimensional TLM Modelling of the Radiating Boundary Conditions" (Invited Paper) by M. Krumpholz and P. Russer

1400 "Transmission Line Matrix Method on Massively Parallel Processor Computers" by Poman P.M. So, Channabasappa

1420 "Fast Frequency-Domain TLM Analysis of 3D Circuit Discontinuities" (Invited Paper) by Jifu Huang, Ruediger Vahldieck and Hang Jin

1440 "Infinitesimally Adjustable Boundaries in Symmetrical Condensed Node TLM Simulations" (Invited Paper) by Fred J. German

1500 **BREAK**

SESSION 14: GENERAL PURPOSE CODE APPLICATIONS (parallel with Session 15)
Chair: Dr. Jim Breakall, Co-Chair: George Haga

1520 TO BE ANNOUNCED

1540 "Rhombic Illuminator Performance at High Frequency" by J. Patrick Donohoe and Clayborne D. Taylor

1600 "Recent Enhancements to GEMACS 5.2" by Edgar L. Coffey, III

1620 "High Resolution Spectral Analysis of HF Coupling Modes on the EC-130 Aircraft" by Q.C. Luu, S.J. Kubina, C.W. Trueman, and D. De Carlo

1640 "Helicopter Antenna Pattern Analysis Using NEC-BSC" by .M. Herkert, J.A. Woody, D.W. Acree, and D.P. Millard

SESSION 14 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #22 Airborne TX/RX Antenna Pair Location Investigation - Experimental and NEC-BSC Results" by Scott Townley

IF #23 "The Analysis of Asymmetric Log-Periodic Dipole Antennas Using NEC" by Jacqueline A. Schaefer

SESSION 15: CAEME (parallel with session 14) **Chair: Dr. Magdy Iskander**

1520 "Interactive Video Lessons for Electromagnetic Education" by Magdy F. Iskander and Thomas Reed

1540 "A Generic Finite Element Model for Plane Problems" by Kyran D. Mish and LaDawn Haws

1600 "Analysis of Electromagnetic Fields in Electrical Machines from Experimental Data for Educational Purposes" by Osama A. Mohammed, Howard Gordon, and Abd A. Arkadan

1620 "Learning About EM Theory and EM Modeling by Analyzing Printed Circuit Boards in an Enclosure" by T.H. Hubing and M.W. Ali

1640 "EMAG - Electromagnetic Software Development at Rose-Hulman Institute of Technology" (Invited Paper) by J. Lebaric and R. Manke

1700 "Relativistic Foundation of Electric Current - A Model for Transmission Lines" (Invited Paper) by Zvonko Fazarinc

SESSION 15 PAPERS PRESENTED IN THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #24 "Making Computer Tutorials in Electrodynamics With The CAEME Software" by Rodney Cole, Curtis Brune, and Scott Tooker

IF #25 "Reflector Antenna Analysis Software: An Educational Approach" by B. Houshmand and Y. Rahmat-Samii

IF #26 "Computer-Graphics-Aided Teaching and Learning Tool for Antennas" by Hamid Moradi, Swapan Chakrabarti, and Prasad Gogineni

IF #27 "Introducing Spherical Harmonics to Undergraduates" by Glen Erickson

IF #28 "Interactive Analysis of Antenna Arrays with a Personal Computer" by Atef Z. Elsherbeni and Patrick H. Ginn

SESSION 16: RCS (parallel with Session 18) **Chair: Dr. Shian U. Hwu, Co-Chair: Dr. A.K. (Tony) Brown**

0800 TO BE ANNOUNCED

0820 "Xpatch: A High Frequency RCS Code" by S.W. Lee and Dennis J. Andersh

0840 "Computing the Time Domain EM Scattering from Large Open-Ended Cavities Using the SBR and GRE Ray Shooting Methods" by Robert J. Burkholder and Prabhakar H. Pathak

0900 "Target Facetization Level and the Effect on Xpatch Predictions" by E.M. Miller, D.J. Andersh, and A.J. Terzouli, Jr.

SESSION 17: MULTIPOLE TECHNIQUES (parallel with Session 18) **Chair: Dr. Richard K. Gordon**

0925 "Comparison of Multipole and Multifilament Techniques" by D. Reuster and M. Kaye

0945 "New Thin Wire Expansions for Long Wires in the MMP-Code" by Pascal Leuchtmann and Marcel Gnos

SESSION 18: NUMERICAL MODELLING IN COMPLEX MEDIA (parallel with Sessions 16 and 17)
Chair: Dr. Weng Chew

0800 "Toward an FDTD Analysis of the Standard Approximations for Propagation in Randomly Structured Ionization" by L.J. Nickisch and P.M. Franke

0820 "A Ray-Based Approach to Scattering from Inhomogeneous Dielectric Objects" by Hao Ling and Hyeongdong Kim

0840 "Applications of Discrete Methods to Optical Pulse Propagation in Linear and Nonlinear Materials" by Richard W. Ziolkowski and Justin B. Judkins

0900 "Heirarchical Basis Functions for 3D Finite Element Methods" by John R. Lovell

0920 "NEPAL - The Use of Huygens' Equivalence Principle for Solving the Volume Integral Equation of Scattering" by Weng Cho Chew and Cai-Cheng Lu

0940 "A CG-FFHT Method for the Solution of EM Field in Axisymmetric Inhomogeneous Media" by Qing-Huo Liu and Weng Cho Chew

SESSION 18 PAPER PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #29 "Scattering Computations for Multi-Region Cylindrical Objects" by Michael A. Morgan

1000 **BREAK**

SESSION 19: LOW-FREQUENCY TECHNIQUES AND APPLICATIONS (parallel with Session 20)
Chair: Dr. Osama Mohammed, Co-Chair: Dr. Abd A. Arkadan

1020 "Computation of Electric Machines Parameters in the ABC Frame of Reference Using Finite Element Analysis" by A.A. Arkadan and R.H. VanderHeiden

SESSION 19: LOW-FREQUENCY TECHNIQUES AND APPLICATIONS (CONT)

1040 "An Efficient 3-D Finite Element Mesh Generator for Electromagnetic Analysis in Complex Volumes" by Fuat G. Uler and Osama A. Mohammed

1100 "Modern Numerical Techniques for High Precision MRI Magnet Design" (Invited Paper) by Sergio Pissanetzky

1120 "An Artificial Neural Network Environment for the Optimal Design of Geometric Boundaries in Electromagnetic Devices" by Osama A. Mohammed, Dong C. Park, Riaz Merchant, and Fuat Uler

SESSION 19 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #30 "Sensitivity Analysis of the Integrodifferential Finite Element - Green's Function Method" by Qiushi Chen, A. Konrad and P.P. Biringer

SESSION 20: EMC/EMI (parallel with Session 19) **Chair: Dr. Todd Hubing, Co-Chair: Dr. Reinaldo Perez**

1020 "EMI Analysis of Transient Events via Method of Moments on the Titan IV/Centaur Rocket Main Batteries" by Reinaldo Perez

SESSION 20: EMC/EMI (parallel with Session 19) **Chair: Dr. Todd Hubing, Co-Chair: Dr. Reinaldo Perez**

1040 "Detailed Analysis of a Realistic Canonical Structure in Electromagnetic Radiation Problems" by Shahrokh Daijavad and Barry J. Rubin

1100 "EMI Prediction Using Wire Mesh Boxes in NEC" by Bruce Archambeault and Richard Mellitz

1120 "The Application of Different Meshing Techniques to EMC Problems" by J.L. Herring and C. Christopoulos

SESSION 20 PAPERS PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #33 "Optimization of FDTD for EMI Modeling Applications" by Bruce Archambeault and Louise Lemaire

IF #34 "Applications of MiniNEC to EMI Modeling" by Colin E. Brench

IF #35 "Nonlinear Effects Errors Encountered in Performing Interference Analysis Using an RF Circuit Analysis Code" by Frank E. Walker and Sperry H. Goodman.

1140 **LUNCH**

SESSION 21: ANTENNAS **Chair: Dr. Roger Radcliff, Co-Chair: Dr. Al Christman**

1240 "Computer Model for Axially Symmetric Dielectric Radomes in the Near Field of a Circular Aperture" by D.C. Jenn, R.M. Francis, and K.A. Klopp

1300 "An Exact Expression for the Vector Potential of a Uniform Current Cylindrical Antenna" by D.H. Werner and P.L. Werner

1320 "A Simplified Approach for Modeling a Log Periodic Antenna" by Steven C. Merrill and Malcolm J. Packer

1340 "Phased Array Radiating Element Design Software" by H.K. Schuman

1400 "Spectral-Domain Analysis of Patch Radiators on Lossy Ferrite Substrates" by Zhenglian Cai and Jens Bornemann

1420 **BREAK**

SESSION 22: FINITE ELEMENT METHOD AND APPLICATIONS AT HIGH FREQUENCIES
Chair: Dr. Richard K. Gordon, Co-Chair: Dr.Jin-Fa Lee

1440 "ABC Finite Elements for Open Boundary Electromagnetic Problems of Frequencies from DC to GHz" by John R. Brauer, Brian S. Brown and Mark M. Jenich

1500 "Application of Explicit Finite Elements to Maxwell's Equations" by M. Hafez and P. English

1520 "Microstrip Discontinuity Analysis by Time Domain Finite Elements" by J.O.Y. Lo, A. Konrad, J.L. Coulomb, and J.C. Sabonnadiere

1540 "On the Optimization of a Finite Element Code for 3D Scattering Computation" by A. Chatterjee, J.L. Volakis, and D. Windheiser

1600 "Performance Evaluation of MEI-Based Mesh Truncation Conditions for Finite Element Modeling of Electromagnetic Scattering by Penetrable Bodies" by Diana B. Wright and Andreas C. Cangellaris

1620 "Finite Element Method for Determining the Scattering from Lossy Cylinders Illuminated by Obliquely Incident Plane Waves" by Richard K. Gordon and Ahmed A. Kishk

SESSION 22 PAPER PRESENTED AT THE INTERACTIVE FORUM (1430-1600 Tuesday):

IF #36 "Numerical Analysis of Microwave Cavities with Anisotropic Materials" by Shirley Min, Jin-Fa Lee and Richard Gordon

1640 **CLOSE**

FRIDAY MARCH 26

0830-1630 **SHORT COURSE (FULL-DAY)**
"Wire Antenna Modeling: 20 years of Successes, Failures and Lessons Learned, Modeling Guidelines and Some Useful Utility Programs" by R. W. Adler, J .K. Breakall and G.J. Burke

0830-1630 **SHORT COURSE (FULL-DAY)**
"TLM Techniques for Electromagnetic Wave Modeling" by W.J.R. Hoefer

0830-1630 **SHORT COURSE (FULL-DAY)**
"Reflector Antenna Code Modeling" by R.C. Rudduck and Teh Hong Lee

SHORT COURSES AT THE 9TH ANNUAL REVIEW OF PROGRESS IN APPLIED COMPUTATIONAL ELECTROMAGNETICS

The Applied Computational Electromagnetics Society (ACES) is pleased to announce eight short courses to be offered with its annual meeting of March 22-26, 1993. Times of the individual short courses are noted. Registration begins at 7:30 AM on Monday, March 22, 1993. ACES has the right to cancel a course at any time with full refund. For further information contact Richard W. Adler (408)656-2352, (408)649-0300 FAX, E-mail: 5541304@mcimail.com

COURSE INFORMATION

FULL-DAY COURSE (Monday, March 22, 8:30-11:30, 1:00-4:30PM)

"Solving Practical Problems with GEMACS" by Buddy Coffey, Advanced Electromagnetics

The GEMACS (General Electromagnetic Model for the Analysis of Complex Systems), computer program includes physics and mathematics features for method of moments (MoM), finite differences (FD), uniform theory of diffraction (UTD/GTD), as well as self- consistent hybrids of these methods. Coupled with its auxiliary graphics support (GAUGE and/or WINGAUGE) and analysis/database front end (Electromagnetic's Modeler's Workbench), the GEMACS package offers capabilities not found in other codes. Participants will learn how to formulate and solve practical EM problems with GEMACS and will include some usage of GAUGE and the EM Modeler's Workbench. Emphasis will be on multi-region problems (cavities, penetrations, etc.) and new features just released with GEMACS version 5.2 antenna pattern database, analytical source types, pattern sources, aperture-patch commands and physics. Participants should have basic background in EM numerical modeling with NEC, BSC, GEMACS or similar multipurpose software. Participants may contact the instructor in advance with problem types of particular interest.

FULL-DAY COURSE (Monday, March 22, 8:30-11:30, 1:00-4:30PM)

"EM Modeling Using the TSAR FDTD Code Suite" by Dr. K.S. Kunz, Pennsylvania State University and S.T. Pennock, Lawrence Livermore National Laboratory

This course will provide an introduction to the use of TSAR for solving practical EM problems. Fundamentals of the FDTD method will be discussed, including resource requirements and allocation, and the art of FDTD modeling will be addressed. The process of solving realistic problems will then be covered including: building a solid model; creating an FD mesh; compiling TSAR; setting up an input file; and post-processing code results. Demonstrations will include use of the graphical user interfaces as well as videotaped examples of coupling and scattering from canonical scatterers, waveguides and commercial aircraft.

MORNING HALF-DAY COURSE (Monday, March 22, 8:30-11:30AM)

"The Generalized Multipole Technique (GMT) and the Multiple Multipole Program (MMP): Theory and Practical Use in Computational Electromagnetics" by Dr. Pascal Leuchtmann, Swss Federal Institute of Technology

This short course gives a brief overview on the the theoretical background of GMT in comparison with other techniques such as MoM, Finite Difference/Finite Elements, GTD, etc. In the main part the various MMP features and their specific practical applications are explained. The goal of the course is to provide a good knowledge of what kind of problems may be solved by the MMP, and how this is done. No specific experience in GMT is required, except for basics in electromagnetics.

AFTERNOON HALF-DAY COURSE (Monday, March 22, 1:00-4:30PM)

"CEM Modeling Options and Tradeoffs" by E.K. Miller, Los Alamos National Laboratory

The growing variety of computational electromagnetic (CEM) codes that is becoming available makes choosing a specific model for a given application increasingly confusing for the electromagneticist who is concerned with solving problems but not with becoming a software expert. This short course will compare the generic approaches on which all CEM models are based in terms of their analytical formulation, numerical implementation, and computational requirements. The relative advantages and limitations of the various model types will be summarized to identify the best modeling approach to a given problem. The goal will be to provide a basis for making more informed choices when making modeling decisions for practical applications.

AFTERNOON HALF-DAY COURSE (Tuesday, March 23, 12:30-4:00PM)

"Starting Your Own Small Business" by Buddy Coffey, Advanced Electromagnetics

There's a little bit of entrepreneur in each of us. Ever wonder what it would take to branch out on your own? This half-day course will introduce you to the ins and outs of owning your own small EM consulting/software business. We'll cover such topics as financing, marketing, and advertising, dealing with the Government alphabet soup, intellectual property rights, day-to-day business activities, rules and regulations, taxes, employees, product development, etc. To focus on a particular scenario, we'll examine EM/numerical software development, marketing, and sales as a case study. We'll try to give you a feel for just what are the issues and concerns in bringing a software product to market. The instructor is the founder and owner of Advanced Electromagnetics, a three-person EM consulting and software firm. AE has been in business since 1985, and much of the course content is gleaned from "lessons learned" over the past eight years. The software case study will be a discussion of how AE took a mainframe computer program (GEMACS) and turned it into a successful and lucrative commercial product.

FULL-DAY COURSE (Friday, March 26, 8:30-11:30, 1:00-4:30PM)

"Wire Antenna Modeling: 20 Years of Successes, Failures and Lessons Learned, Modeling Guidelines and Some Useful Utility Programs" by R.W. Adler, Naval Postgraduate School, J. Breakall, Pennsylvania State University, and G.J. Burke, Lawrence Livermore National Laboratory.

The three instructors, together, have accumulated over 61 years of hands-on experience in developing and using versions of NEC and MININEC to solve thin-wire radiating systems. Course topics include a brief overview of thin-wire numerical modeling, features and comparisons of the various NEC and MININEC code families, limitations to and pitfalls when modeling (i.e., antennas near-ground and loops), "tricks of the trade", broadcast antenna applications, solution checks, buried wire modeling, proper use of networks and transmission lines, and the use of convenient utility codes. Students will receive a diskette containing a collection of useful support programs. In addition, students will be given an opportunity to present their wire antenna modeling problems to the instructors for guidance in laying out a NEC/MININEC modeling approach.

SHORT COURSE INFORMATION

FULL-DAY COURSE (Friday, March 26, 8:30-11:30, 1:00-4:30PM)

"TLM Techniques for Electromagnetic Wave Modeling" by Wolfgang J.R. Hoefer, Professor, University of Victoria

This one-day short course consists of two parts. The first part is an introduction to the various time domain modeling (TLM) techniques and algorithms, including the modeling of nondispersive linear media and boundaries, John Matrix techniques, passive and active nonlinear devices and basic signal processing. The second part focuses on recently developed enhancements of the method, such as corner and edge nodes, dispersive media and wideband absorbing boundaries, and numerical synthesis by time reversal of the TLM process. Elements of parallel processing of the TLM code on SIMD-type machines will also be described. These features will be demonstrated on a computer, and a number of representative guided and radiated wave problems will be solved during the course. The course will be suitable both for participants who want to gain an overview of TLM capabilities, and for researchers familiar with basic TLM developments in the fields.

FULL-DAY COURSE (Friday, March 26, 8:30-11:30, 1:00-4:30PM)

"Reflector Antenna Code Modeling" by Dr. Roger C. Rudduck and Teh Hong Lee, The Ohio State University Electroscience Laboratory

The theory and capabilities for an enhanced version of the NEC Reflector Antenna Code will be presented. The basic approach is similar to the original NEC Reflector Antenna Code which uses aperture integration for the main beam and near sidelobes, while GTD (UTD) is used for the far sidelobes. However, a more efficient GTD approach is now used to model the general reflector rim shape. More recent capabilities including modeling of subreflectors and reflector surface distortions. Improved modeling will be described for conical horn feeds and obstacles in the reflector aperture.

SHORT COURSE FEES: / DISCOUNTS FOR EARLY PAYMENT		
PAYMENT DATE	FULL-DAY COURSES	HALF-DAY COURSES
By March 8, 1993	$130	$ 80
After March 8, but by March 21, 1993	$140	$ 90
After March 21, 1993	$150	$100

MOTELS / HOTELS LIST FOR 1993 ACES CONFERENCE

FIRESIDE LODGE (**) (1 star)
1131 10th St. Monterey, CA
(408) 373-4172 Govt. Rate $55 + 10% tax
POC: Ms. Dianne Northcutt/mention "ACES"
Block of rooms reserved for ACES
Make reservations by 17 Feb. 1993

HOLIDAY INN (**) (3 Star)
1000 Aguajito Rd. Monterey, CA
(408) 373-6141 Govt. Rate $66 + 10% tax
Conference Rate: $79 + 10% tax/mention "ACES
POC: Sales Director
Block of rooms reserved for ACES.
Make reservations by 22 Feb. 1993

HYATT HOTEL & RESORT (**) (4 Star)
1 Old Golf Course Rd. Monterey, CA
(408) 372-1234 Govt. Rate: $74
Conference Rate: $118
24-30 rooms reserved for ACES
Make reservations by 15 Feb. 1993

NOTE: THERE IS NO PARKING ON CAMPUS, AND NO STREET PARKING WITHIN SEVERAL BLOCKS OF NPS.

•WITHIN WALKING DISTANCE OF NPS

- **MOTELS LISTED BELOW ARE TAKEN FROM THE CALIFORNIA TRIPLE A DIRECTORY.**
- **SOME ROOMS HAVE BEEN SET ASIDE FOR ACES CONFERENCE.**
- **GOVERNMENT, CONFERENCE & PROMOTIONAL RATES ARE LISTED.**
- **POC'S REFER TO TRAVELERS ON GOVERNMENT ORDERS.**
- **MOST ROOMS SHOULD BE BOOKED AT LEAST 1 MONTH BEFORE CONFERENCE COMMENCES.**
- **REMEMBER TO MENTION THAT YOU ARE ATTENDING "ACES" CONFERENCE AT THE NAVAL POSTGRADUATE SCHOOL.**
- **ASK FOR GOVERNMENT, PROMOTIONAL, OR CONFERENCE RATE.**

DOUBLETREE (3 Star)
2 Portola Plaza, Monterey, CA
(408) 649-4511 Govt. Rate $74+10% tax
Regular rate: $105 + 10% tax/S or D
POC: Mary Fall/*Mention "ACES" Conference*

BAY PARK HOTEL *(Formerly Ramada)* (3 Star)
1425 Munras Ave. Monterey, CA
(408) 649-1020 Govt. Rate $59 + 10% tax
Conference rate: $59 + 10% tax
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FAIRGROUNDS TRAVELODGE (2 Star)
2030 Fremont St. Monterey, CA
(408) 373-3381 Govt. Rate $32 + 10% tax
All rates: $32 + 10% tax / *Mention "ACES" Conference*
POC: Ms. Mary O'Neal/book at least 1 week before conference)

CYPRESS TREE INN (2 Star)
2227 Fremont St. Monterey, CA
(408) 372-7586 Govt. Rate $40 + 10% tax
Conference rate: $45 + 10% tax / book by 2/22/93
POC: Mr. Steve Meyer/*mention "ACES" Conference*

MARIPOSA INN (2 Star)
1386 Munras Ave. Monterey, CA -
(408) 649-1414 Govt. Rate $48 + 10% tax
Conference rate: $48 Single, $58 Double + tax
POC: Ms. Dawn Dull / book by 3/1/93/*Mention ACES*

STAGECOACH MOTEL (**) (1 Star)
1111 10th St. Monterey, CA
(408) 373-3632 Govt. Rate $49
Regular rate: $49 Single, $59 Double
POC: Mr. Steve Kim/*Mention "ACES" Conference*

MUNRAS LODGE (3 Star)
1010 Munras Ave. Monterey, CA
(408) 646-9696/AAA rate for all: $49-$59 + 10% tax
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Book 6-8 weeks before Conference

MARRIOTT (3 Star)
350 Calle Principal, Monterey, CA
(408) 649-4234 Govt. Rate: $74 + 10% tax
Regular rate: $120 + tax / 10 rooms blocked
POC: Jennifer Sutherland/ book 3 weeks prior
Mention "ACES" Conference

BEST WESTERN (3 Star)
1100 Munras St, Monterey, CA
(408) 372-4576, Govt. Rate ?
Regular rate: $69-$149 + tax
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DEL MONTE PINES (2 Star)
1298 Munras St. Monterey, CA
(408) 375-2323 Govt. Rate: $44 + 10% tax
Regular rate: $49 + tax (single)
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EL ADOBE INN (2 Star)
936 Munras Ave. Monterey, CA
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Promotional rate $74-$89
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CYPRESS GARDENS MOTEL (2 Star)
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(408) 373-2761, *Promotional Rate* $63 + 10% tax
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Mention "ACES" Conf. & ask for Promotional rate

WHEN YOU CALL TO MAKE MOTEL RESERVATIONS, MENTION THAT YOU ARE ATTENDING THE "ACES" CONFERENCE AT THE NAVAL POSTGRADUATE SCHOOL, AND IF YOU ARE TRAVELING ON GOVERNMENT ORDERS, INDICATE SO. BEFORE ARRIVAL AT NPS TRAVELERS MUST CONTACT THE NPS BOQ OFFICE TO RECEIVE A NON-AVAILABILITY CERTIFICATION NUMBER. WITHOUT THIS NUMBER PREASSIGNED, THE BOQ WILL NOT STAMP TRAVEL ORDERS WITH NON-AVAILABILITY CONFIRMATION. NPS BOQ OFFICE IS AV 878-2060/9 OR (408) 656-2060/9.

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY
9TH ANNUAL REVIEW OF PROGRESS
IN APPLIED COMPUTATIONAL ELECTROMAGNETICS

March 22 - 26, 1993
Naval Postgraduate School
Monterey, CA

Registration Form

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LAST NAME ________ FIRST NAME ________ MIDDLE INITIAL ________

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Registration

Please check applicable boxes.

		Registration Fees: By 3/8	After 3/8
☐ ACES MEMBER	Includes Sessions, Exhibits, Wine & Cheese Buffet, and Proceedings	☐ $195	☐ $210
☐ NON-MEMBER	Includes Sessions, Exhibits, Wine & Cheese Buffet, and Proceedings	☐ $220	☐ $235
☐ STUDENT	Includes Sessions, Exhibits, Wine & Cheese Buffet, and Proceedings	☐ $135	☐ $135
☐ BANQUET	March 24, 1993 ☐ Fish/Seafood ☐ Meat	☐ $ 23	

Short Courses

COURSE FEES: FULL-DAY: $130 if received **by** 3/8; $140 **after** 3/8 **to** 3/21; $150 **after** 3/21/93.
HALF-DAY: $ 80 if received **by** 3/8; $ 90 **after** 3/8 **to** 3/21; $100 **after** 3/21/93.

☐ "SOLVING PRACTICAL PROBLEMS WITH GEMACS" by Buddy Coffey FULL-DAY Monday March 22.	☐ $130	☐$140	☐ $150
☐ "EM MODELING USING THE TSAR FDTD CODE SUITE" by K Kunz & S Pennock, FULL-DAY Monday March 22.	☐ $130	☐$140	☐ $150
☐ "THE GENERALIZED MULTIPOLE TECHNIQUE (GMT) AND THE MULTIPLE MULTIPOLE PROGRAM (MMP): THEORY AND PRACTICAL USE IN COMPUTATIONAL ELECTROMAGNETICS", by Pascal Leuchtmann MORNING HALF-DAY Monday March 22.	☐ $ 80	☐$ 90	☐ $100
☐ "CEM MODELING OPTIONS & TRADEOFFS" by E K Miller AFTERNOON HALF-DAY Monday March 22.	☐ $ 80	☐$ 90	☐ $100
☐ "STARTING YOUR OWN BUSINESS", by Buddy Coffey AFTERNOON HALF-DAY Tuesday March 23.	☐ $ 80	☐$ 90	☐ $100
☐ "WIRE ANTENNA MODELING: 20 YEARS OF SUCCESSES, FAILURES AND LESSONS LEARNED; MODELING GUIDELINES AND SOME USEFUL UTILITY PROGRAMS" by R W Adler, J K Breakall, and G J Burke FULL-DAY Friday March 26.	☐ $130	☐$140	☐ $150
☐ "TLM TECHNIQUES FOR ELECTROMAGNETIC WAVE MODELING" By W. Hoefer, FULL-DAY Friday March 26.	☐ $130	☐$140	☐ $150
☐ "REFLECTOR ANTENNA CODE MODELING" by R Rudduck and T H Lee FULL-DAY Friday March 26.	☐ $130	☐$140	☐ $150

SEE PAGES 37 - 39 OF THIS NEWSLETTER FOR DETAILS OF SHORT COURSES

RETURN COMPLETED FORM WITH PAYMENT BY MARCH 8, 1993 to:
Dr. Richard W. Adler, ACES Secretary
Naval Postgraduate School
Code EC/AB, Monterey, CA 93943
Phone: (408)646-1111 FAX: (408)649-0300
Make Checks/Bank Drafts payable to ACES.
(Checks drawn on a US bank)

Total Remittance (U.S. Dollars Only) $ ________

For information regarding ACES or to become a member in the Applied Computational Electromagnetics Society, contact ACES Secretary, Dr. Richard W. Adler, Code EC/AB, Naval Postgraduate School, Monterey, CA. 93943, telephone (408) 646-1111, Fax: (408) 649-0300. E-mail 5541304@mcimail.com. You can subscribe to the Journal and become a member of ACES by completing and returning the form below.

ACES MEMBERSHIP / SUBSCRIPTION FORM

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E-MAIL ADDRESS ______ E-MAIL ADDRESS CAN BE INCLUDED IN ACES DATABASE YES ☐ NO ☐

CURRENT MEMBERSHIP PRICES ARE VALID THROUGH 31 MARCH 1993
EFFECTIVE 4/1/93 ALL PRICES / EXCEPT STUDENTS/WILL INCREASE BY $5.00

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EUROPE FORMER USSR TURKEY SCANDINAVIA	( ) $58	( ) $68	( ) $105
ASIA, AFRICA MIDDLE EAST & PACIFIC RIM	( ) $58	( ) $75	( ) $105

*** FULL-TIME STUDENT RATE IS $25.00 FOR ALL COUNTRIES/NO INCREASE ***
*** PLEASE NOTE THAT A $5.00 INCREASE WILL BE EFFECTIVE 1 APRIL 1993 ***

REMIT PAYMENT WITH THIS FORM PAYABLE TO:
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Dr. Richard W. Adler
Naval Postgraduate School
Code EC/AB
Monterey, CA 93943 U.S.A.

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(4) ELECTRONIC TRANSFER *
* (CONTACT ACES SECRETARY)

MEMBERSHIP PRICES ARE ADJUSTED EACH YEAR EFFECTIVE 1 APRIL

CALL FOR PAPERS

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY
ANNOUNCES A SPECIAL ISSUE OF THE ACES JOURNAL ON:

ADVANCES IN THE NUMERICAL COMPUTATION OF LOW FREQUENCY ELECTROMAGNETIC FIELDS

The Applied Computational Electromagnetics Society is pleased to announce the publication of a 1993 special issue in the area of static and low frequency numerical electromagnetic field computation. This special issue has three goals: (1) to keep the high frequency community informed of advances made in the numerical solution of low frequency and static field problems in the hope that this will promote cross fertilization of ideas between the two groups; (2) show concrete examples where methods used in high frequency areas have been adapted successfully to low frequency field problems and vice versa; and (3) to focus attention on the need for educational tools for the computation of low frequency electromagnetic fields. Papers of archival value addressing these goals and dealing with the following suggested topics are welcome for submission.

SUGGESTED TOPICS

- Electrostatic Fields and Applications
- Magnetostatic Fields and Applications
- Eddy Current, Skin Effect and Proximity Problems
- Electric Machines and Other Devices
- Transformers and Inductors
- Finite Difference and Related Methods
- Finite Element and Related Methods
- Integral Equation Methods
- Gaseous Discharges and Corona
- Other Static and Low Frequency Phenomena
- Electromagnetic Brakes, Bearings, Levitation
- Electromagnetic Launchers
- Power Transmission
- Nonlinear Materials
- Unbounded Problems
- Coupled Problems
- Multigrid Methods
- Time Domain Methods
- Code Validation
- CAD
- Efficient Equation Solvers
- NDE and NDT
- Automatic Mesh Generation
- Accelerator Magnets

DEADLINE FOR PAPERS IS MAY 31, 1993

Send papers and inquiries to:

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Tel: (416)978-1808
Tel: (416)978-6842
Fax: (416)978-7423
Email:konrad@power.ele.toronto.edu
lavers@power.ele.toronto.edu

COMPUMAG - MIAMI

October 31 to November 4, 1993

The aim of the 9th COMPUMAG Conference on the Computation of Electromagnetic Fields is to discuss recent developments and practical applications in the numerical computation of electromagnetic fields in the design and analysis of electromagnetic devices.

Topics for Presentation include:

- Magnetostatic and electrostatic field calculations for both linear and non-linear problems
- Time-dependent fields, including transient and steady state behavior of electromagnetic de-devices, eddy currents, and skin effect
- Wave propagation problems including microwaves and antennas
- Optimization using deterministic and stochastic methods, artificial intelligence applications
- Modeling of material properties covering superconducting, composite, and microwave absorbing materials and numerical treatment of anisotrophy, hysteresis, permanent magnets
- Moving boundary problems, as well as electromagnetic fields coupled to mechanical, electronic, thermal, and/or flow systems
- Numerical methods and techniques, including mesh generation, adaptive meshing, error estimation, eigenvalue problems, solution of algebraic systems of equations, parallel and vector computations, and hybrid methods
- Software methodology and interactive computer aided design for electromagnetics including visualization, knowledge based systems, AI-techniques, and massively parallel algorithms
- Original applications of computer programs in the areas of electric machines and drives, high magnetic field devices, superconducting magnets, waveguides, microwave resonators, biomedical applications, inductive heating, and calculation of local and integral parameters

Conference Program

The Conference Program will consist of four full days of oral, poster, and panel sessions, and invited speakers. Companies and research organizations will have technical and commercial exhibitions during the Conference.

Post Conference Activities

The Final ACES/TEAM Workshop of the IVth Round will follow COMPUMAG-Miami on November 5-6, 1993.

Additional Information: Please contact: COMPUMAG - Secretariat
Department of Electrical & Computer Engineering
Florida International University
Miami, FL 33199, U.S.A.
Phone: (305) 348-3711 Fax: (305)348-3707
E-mail: ulerf@servax.fiu.edu

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY

1994 CALL FOR PAPERS 1994

The Tenth Annual Review of Progress in Applied Computational Electromagnetics March 21-25, 1994 at the Doubletree Hotel at Fisherman's Wharf and Convention Center (Tentative) Monterey, California

Share your knowledge and expertise with your colleagues

The Naval Postgraduate School has hosted the conference for the last eight years. Plan on joining our 10th Anniversary Celebration tentatively scheduled for the Doubletree Hotel and Convention Center.

The 1994 Annual Review of Progress in Applied Computational Electromagnetics will be the tenth yearly Symposium to bring analysts together to share information and experience about the practical application of EM analysis using computational methods. All aspects of computational electromagnetic analysis will be represented but particular emphasis at the 1994 Symposium will be placed on general purpose code applications, code performance analysis, and validation. Attendance and professional program paper participation from non-ACES and from outside North America are encouraged and welcome. The Symposium features four areas of interest to the EM analysis enthusiast: short courses, demonstrations, vendors' booths and technical paper sessions which are solicited from all areas of electromagnetic computation. The Symposium will also include invited speakers and interactive forums.

1994 ACES Symposium Chairman
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In cooperation with: The IEEE Antennas and Propagation Society, the IEEE Electromagnetic Compatibility Society, USNC/URSI and the CEFC

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY

1994 CALL FOR PAPERS 1994

The Tenth Annual Review of Progress in Applied Computational Electromagnetics

Papers may address general issues in applied computational electromagnetics, or may focus on specific applications, techniques, codes, or computational issues of potential interest to the Applied Computational Electromagnetics Society membership. Areas and topics include:

- Code validation
- Code performance analysis
- Computational studies of basic physics
- "Tricks of the Trade" in selecting and applying codes and techniques
- New Codes, algorithms, code enhancements, and code fixes
- Code input/output issues
- Computer hardware issues
- Partial List of applications:

antennas	*eddy currents*
static fields	*radar cross section*
shielding	*bioelectromagnetics*
EMP,EMI/EMC	*power transmission*
charge transport	*inverse scattering*
microwave components	*MMIC technology*
fiberoptics	*remote sensing & geophysics*
communications systems	*plasmas*
particle accelerators	*generators & motors*
wave propagation	*non-destructive evaluation*
dielectric & magnetic materials	*networks*

- Partial list of techniques:

frequency-domain & time-domain techniques
integral equation & differential equation techniques
finite differences & finite element techniques

diffraction theories	*physical optics*
modal expansions	*perturbation methods*
hybrid methods	*moment methods*

TIMETABLE

October 1, 1993	Summary Submission Submit four (4) copies of a 300-500 word summary to the Symposium Chairman (Address on other side of this sheet).
November 17, 1993	Authors notified of acceptance
January 12, 1994	Submission deadline for camera-ready copy, not more than eight (8) pages including all figures. For both summary and final paper, please supply the following data for the principal author - name, address, e-mail address, FAX, and telephone numbers for both work and home.

Registration fee per person for the Symposium will be approximately $200. The exact fee amount will be announced later.

SHORT COURSES

Short courses will be offered in conjunction with the Symposium, covering numerical techniques, computational methods, surveys of EM analysis and code usage instruction. It is anticipated that short courses will be conducted principally on Monday, March 21, and Friday, March 25. Fee for a short course is expected to be approximately $80.00 per person for a half-day course and $130.00 for a full-day course, if booked before March 4, 1994. Full details of 1994 Symposium will be available by November of 1993.

EXHIBITS

Vendor booths and demonstrations will feature commercial products, computer hardware and software demonstrations, and small company capabilities.

ADVERTISING RATES

	FEE	PRINTED SIZE
Full page	$200.	7.5" x 10.0"
1/2 page	$100.	7.5" x 4.7" or 3.5" x 10.0"
1/4 page	$ 50	3.5" x 4.7"

All ads must be camera ready copy.

Ad deadlines are same as Newsletter copy deadlines.

Place ads with Paul Elliot, Newsletter Editor, ARCO, 1250 24th St. NW, Suite 850, Washington, D.C. 20037 USA. The editor reserves the right to reject ads.