APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY (ACES)

NEWSLETTER

Vol. 4 No. 2 September 1989

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EDITOR'S COMMENTS

My mission as your new editor is to include interesting material and news in every issue. This issue includes a description of a FORTRAN translation of MININEC, a modeling note on common pitfalls when using the BSC code and a modeling note on GEMACS waveguide terminations, a tutorial on data base management, an initiative on AI for EM (see Letters to the Editor), plans for a European ACES Workshop, Ed Miller's descriptions of some AP/S Workshops, and proposals for two joint IEEE - ACES activities (see the President's letter and the two questionnaires). For the next issue (December 1989) we expect to feature a Modeling Note by code developer Gerry Burke, and another Rendezvous with Computer Scientist Virginia Stover.

The value of this newsletter is dependent on the material sent in by you: the newsletter readers. I encourage you to send in any material of interest. Informal, short write-ups on a very limited topic are fine, as well as more in-depth pieces. Some suggested topics we would like to hear from you about and include in the newsletter are the following:

- Successful or unsuccessful EM computer modeling attempts. These are interesting and could also
- save others time.
- Hint, shortcut, observation, idea, or tip for EM modeling.
- Description of software you tried for modeling, plotting, graphics, technical word processing, etc.
- Description of computer program you wrote or modified.
- Description of meeting, symposium, or workshop.
- Discussion of algorithms and methods used for computational EM.
- Computer graphics showing fields, currents and other EM observables.
- Suggestions of how ACES could facilitate computational EM work.
- Letter to the Editor.
- Book review.
- Any other article of interest to ACES members.

So don't be shy: share your experiences. Send material to 2817 Hall Drive, Smyrna, GA 30080. I can also be reached for discussions at (404)431-9494.

Paul Elliot

Newsletter Editor

NOTICE TO CONTRIBUTORS

The ACES Newsletter is published in March, June, September, and December. Material must be received before the first of the month for inclusion in that month's issue. It is helpful if the material is sent in photo-ready condition, or on an IBM-PC diskette as a Microsoft Word, WordPerfect or Wordstar file. We can accept generic wordprocessor and ASCII text files, but the conversion work required is a burden.

LETTERS TO THE EDITOR

Dear Jim:

The following is submitted as a "Letter to the Editor".

I am wondering if there is another area where ACES can make an impact in the EM community. There are a number of applications today where Artificial Intelligence (AI) is an important factor. Expert Systems are used in diagnostic systems, manufacturing planning, data interpretation, etc. Why can't they be of use in our arena of EM analysis/design. Why not??

A particular roadblock to accumulating and applying EM analysis/design information is the storage, retrieval, sharing, and maintenance of documentation. To be useful documentation must be accurate yet flexible and responsive to change. However, traditional hardcopy documentation is non-dynamic, fragmented in content and format, inconsistent between related functions, and often out of date. Consequently these data become unused and because they are not used, they are constantly being "reinvented" and not iteratively improved.

The computer is a tool that can facilitate the development, storage, retrieval, maintenance (in the face of change), and communication of the documentation that complex subjects like EM requires. AI allows the combining of EM analysis/design information and communication which is the central issue. Anyone have any ideas or better yet experience, in this area and should ACES be a place for this forum?

I will offer to be at least an interim focal point for this issue until we decide the future of this question. Contact me at the following address and I will compile the results and submit them to the ACES ADCOM.

Wayne Harader
Ball Communication Systems Division
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Broomfield, CO 80020-8235

Dear Wayne:

I share your interest in the application of artificial intelligence/expert systems to problems in electromagnetics analysis and design. I would hazard a guess that you and I are not alone among ACES members. I for one believe that ACES should foster activities that will provide information along these lines to interested members. But let us find out how much interest there really is.

I appreciate your willingness to act in an interim capacity until an ACES group can be formed. I am therefore appointing you to be Chairman of an ad hoc committee to determine how much interest there is in ACES on the use of artificial intelligence and expert systems in electromagnetics. As Chairman of the Committee on Artificial Intelligence and Expert Systems, you are entitled to participate in ADCOM meetings. Your term will be until the next ADCOM meeting in March, at which time we can decide whether there is sufficient interest in this area to formalize the Committee.

James C. Logan

OFFICER'S REPORTS

PRESIDENT'S REPORT

I am pleased to announce the appointment of Paul Elliot as Newsletter Editor. Officially, the Newsletter Editor will be part of the Publishing Committee Staff, under the direction of Dave Stein. This has been done to facilitate coordination between the Journal and Newsletter until such time that both publications are clearly established with their own character.

In recognition, however, of the importance of the Newsletter, and the need to assemble and report the latest ACES activities, the Newsletter Editor will be recognized as a non-voting member of ADCOM, along with the other appointed committee chairmen.

At least a few members have read our first Newsletter and taken the time to voice their opinions in writing and via the telephone. I have taken action on one idea voiced by Wayne Harader. (Please see the column LETTERS TO THE EDITOR in this Newsletter). Mr. Harader has agreed to be the focal point in an effort to determine the interest among ACES members in the application of artificial intelligence and expert systems technologies to electromagnetics. I have asked Mr. Harader to act as temporary Chairman of the Committee on Artificial Intelligence and Expert Systems. In March, we will see whether there is sufficient interest to continue this committee.

Bob Noel has resigned from the Chair of the Meetings Committee citing current and future obligations at work. Bob organized the Meetings Committee and provided the leadership to develop a five year plan for future meeting sites. He solicited proposals for hosting our Symposium from Pennsylvania State and Washington State Universities and enthusiastically presented the proposals to ADCOM last March. Bob has done an excellent job as Chairman of this Committee, and we on ADCOM will miss his participation.

Prof. Ray Luebbers of the Pennsylvania State University has agreed to assume the Chair of the Meetings Committee. The Committee is now working out the plans for ACES workshops to be given in the Fall starting in 1990. If successful, the workshops will be a drawing card for new members as well as providing a service to ACES members who cannot otherwise participate in the March Symposium. This project is part of the commitment ACES is making towards EM education. (Please see the Editorial on EM Education in the last issue).

Along these lines, Prof. Magdy Iskander of the University of Utah presented a proposal at the June ACES ADCOM Meeting, from the IEEE AP-S CAEME Committee. (A June ADCOM Meeting was held during the 1989 Symposium of the IEEE Antennas and Propagation Society in San Jose). The Committee for Computer Aided Applications in Electromagnetic Education (CAEME) is asking for financial support and participation in its activities to promote the advancement of EM educational techniques. I, for one, believe it is a good idea and should be supported by ACES. CAEME is asking for $5000 per year in financial support. ACES would be allotted a seat on the board of directors of the Committee and receive copies of reports and materials that are produced by CAEME. The ACES ADCOM has asked that we negotiate for a smaller contribution from ACES, offering access to the ACES software library as partial compensation for the difference. ADCOM is interested in the opinions and comments from our members. Please take the time to fill out and mail the questionnaire on this subject found at the end of this newsletter. (See Ed Miller's description of the CAEME workshop in this issue).

At the June ADCOM Meeting, we also received a proposal from the 1992 IEEE AP-S Symposium Committee. This proposal is for a joint meeting with APS (and perhaps MTT) in June 1992 in Chicago. If we decide to participate, there would be no cash outlay required from ACES other than the usual costs for the call for papers and publication of agendas and Proceedings. A revenue sharing agreement would also have to be worked out. This of course means we would not have our usual meeting in Monterey in March of that year and we would have to abandon our single session format and adopt the normal parallel session format of AP-S. We would probably also want to consider separating our membership dues from the Symposium fees--not everyone attending the AP-S Symposium would necessarily be interested in joining and participating in ACES. ADCOM is very interested in the opinions and comments from our members on this proposal. Please take the time to fill out and mail the questionnaire on this subject found at the end of this newsletter.

Jim Breakall presented a financial report to ADCOM at the June meeting with the intent of developing a 5 year budget. It became obvious that we did not have sufficient time to clear up all aspects of the budget in one meeting, so Jim and I were charged with putting together a strawman 5 year budget to be in effect until modified by ADCOM. After a marathon session that afternoon, Jim and I completed the necessary budget. We had to estimate the effects of inflation and predict the membership growth rate. Hence, we now have a 5 year budget which has been submitted to ADCOM for further consideration. I have taken the necessary steps to ensure that we comply with the budget.

Upon study of the budget figures, I found that at the current level of membership dues, we will soon be losing money and will have to dip into our reserves. I also concluded that we should maintain our reserves at three times our yearly income. We presently have about one year's reserves. Therefore, I have concluded that an increase in dues and other fees is warranted. I have developed a fee schedule and have submitted it to ADCOM for approval. The new fee schedule will be effective, starting January 1, 1990. Membership dues will be increased from $25 to $35 per year. Other fee increases will be announced after ADCOM approval.

James C. Logan
ACES President

SECRETARY'S REPORT

Membership continues to rise - 640 as of 1 September! We are coming on-line with Aldus PageMaker Desktop Publishing Software and can now accept articles on PC diskettes from your word processor. We can accept Microsoft Word, WordPerfect, Microsoft Windows Write, WordStar and generic ASCII formats (No hard returns at line ends). During this quarter we will experiment with a new HP ScanJet Plus scanner and a heap of supporting software, in preparation for importing graphics and figures into text.

Fixes for NEC81 (NEC2-PC), from NEEDS 2.0, are being verified and will be shipped as soon as testing is complete. ACES will also offer the FORTRAN version of MININEC3, reported in this newsletter, as a library item.

Richard W. Adler
ACES Secretary

BERNE COPYRIGHT CONVENTION

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. This policy will most likely be continued in future issues of the ACES Newsletter.

PUBLICATIONS COMMITTEE

We have been pleased with your comments regarding our newly launched (separate) ACES Newsletter. Apparently, the first issue was an overwhelming success--in spite of not having had an Editor! We are even more pleased to announce the appointment of Paul Elliot to the post of ACES Newsletter Editor, effective with the current issue. Under his leadership, the new ACES Newsletter will soon assume its rightful place as a unique and highly-regarded publication.

Meanwhile, the ACES Journal is now starting to attract papers on its own merit, and as a result, we expect to publish on schedule in the future. At least, there will be less of a need to delay publication until we receive a sufficient number of "last minute" papers. We have reached this point because of your continued support, in conjunction with various promotional activities (discussed below, in part). With persistence, we can finally overcome these "growing pains". (The "low-volume" problem is not unique to ACES but instead is experienced by many new publications, especially the non-commercial ones. It is also noted that unlike ACES, many professional societies do not publish full conference proceedings. As a result, speakers who wish to publish their full-length papers must submit them to the respective journal).

However, even after we become completely self-sustaining (in terms of attracting papers), we shall continue featuring invited papers. For this reason, we are asking the Associate Editors to continue seeking quality papers for the ACES Journal. The Associate Editors, in turn, would be most grateful for your recommendations regarding prospective authors or topics.

We spearhead various activities of critical importance to our publications--though the benefits extend far beyond. Your publications team has expended considerable effort in identifying prospective ACES members (and hopefully, authors). As a result, over 2000 professionals, representing several countries and various areas of application-interest, have received ACES literature, much of which we authored. We believe that this effort has contributed substantially to our recent membership increase. Our objective is not growth as an end unto itself. Instead, we find it necessary to infuse new points of view into our publication, on a continuing basis, such that it retains its uniqueness and vitality.

ACES Journal special issues remain a primary means to promote not only ACES but also technical activities within the professional community. Our first special issue on Electromagnetics Computer Code Validation, a smashing success, has attracted considerable attention within prestigious research institutions worldwide. For upcoming special issues, Hal Sabbagh of the USA and Fulvio Bessi of Italy have each agreed to serve as a special guest editor.

Furthermore, we are arranging the inclusion of ACES in various directories of professional science and engineering societies. This may someday extend to research directories, if we pursue formal funding for activities as several of you have suggested. (Another committee is considering this possibility). In addition, we have affiliated with the European Association of Science Editors, the Society for Scholarly Publishing, and similar professional associations. These affiliations not only will enhance our stature but also will bring to our attention the latest issues and innovations in technical publishing. In turn, we will be better prepared for our role as a leading professional publication.

Finally, as a possible solution to issues of professional appearance (as discussed in the previous ACES Newsletter), we shall consider teaming up with a commercial publisher to print the ACES Journal. The combined resources of an established commercial publisher and a professional society are almost unbeatable--IF WE NEITHER RAISE PRODUCTION COSTS TO UNACCEPTABLE LEVELS NOR CREATE DISINCENTIVES FOR AUTHORS TO PUBLISH WITH US.

These initiatives, together with projects of a more mundane nature such as streamlining the paper review and publications process, have made it possible to report favorably on "that which has been" and "that which is". Nonetheless, unfulfilled computational electromagnetics needs the potential of our publications to serve those needs, and remaining problem areas do not permit us to rest on our laurels. Therefore, and in keeping with our visionary spirit, the next Publications Committee report will focus on "that which is to be".

David E. Stein
Editor-in-Chief

NOMINATING COMMITTEE

The Nominating Committee is accepting nominations for ACES President, Vice-President, Secretary, Treasurer and Members at Large. The term of office is 2 years each, except the Member at Large, which is 3 years. Nominations must be received before October 15, 1989 to be considered. Please contact one of the following committee members:

Peter Cunningham (201) 544-4189
USACECOM
AMSEL-RD-TR-4
Ft. Monmouth, NJ 07703

Stan Kubina (514) 848-3093
Concordia University
7141 Sherbrooke St. West
Montreal, Quebec, Canada H4B1R6

Michael Thorburn (503) 754-3448
Oregon State University
Electrical & Computer Engineering Dept.
Corvallis, OR 97331-3202

You may suggest any qualified ACES member to run for office or volunteer yourself. The Nominating Committee is seeking two or more candidates for each office.

Peter Cunningham

Chairman, ACES Nominating Committee

OTHER COMMITTEE REPORTS

Next issue (December 1989) we hope to include reports from the following committees:

- Software Performance Standards
- Software Exchange
- Meetings
- AI and Expert Systems
- Constitution and Bylaws
- Awards
- Historical

ACES EUROPEAN COMMITTEE

(Editors note: The following paragraphs are excerpted from a letter from Dr. Anders to the European ACES membership)

I am happy to bring to your attention, that a EUROPEAN chapter of ACES has been established at the 5th annual ACES meeting in Monterey, CA , Mar 22-24, 1989.

Although a large number of ACES members exist in Europe, over the past five years very few European members (3 - 8) have been able to attend the Annual Review of Progress in Electromagnetics.

Rather than compete with the annual ACES meeting, which may take place permanently at the Naval Postgraduate School in Monterey, during the same time of year as in the past, I propose our European activity in terms of coordinated workshops once or twice a year, organized in alternating locations with "high" membership accumulation.

As a unique feature of the ACES Europe workshops, I plan a 2 day event with only a hand full of invited papers (practically and user oriented) but at least a 50% time allotment for the audience to share their experience with applications, common problems and bugs, or modeling capabilities of particular codes with emphasis on "hands on computers" during the workshop.

Attempts are also being made to have all major EM related codes and software packages that are available on the market or used in the EM community (including the ACES software library) ported to the hardware platforms and made accessible to the workshop audience. Attendees may also bring their own machines and software.

The 1st European workshop is scheduled tentatively for the beginning of November of this year in the Ulm-Stuttgard area. This area currently serves as the geographical population center of the ACES community in Europe. Once the details are stationary a special announcement will follow. Plan to attend to make the 1st European ACES workshop a success.

Hewlett-Packard GMBH, Germany has gratefully offered active support of our 1st workshop by providing workstations and PCs. I hope to attract other hardware vendors to join this effort for the next workshops.

Give ACES Europe the chance for a head start, spread the gospel and promote ACES as

"THE LINK BETWEEN DEVELOPERS AND USERS OF
COMPUTATIONAL ELECTROMAGNETIC TECHNIQUES".

And keep it that way through active support and participating in our activities.

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A FORTRAN TRANSLATION OF MININEC

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Abstract

This paper discusses the translation of MININEC 3.12 [1] from BASIC to FORTRAN. This translation was performed because FORTRAN is the standard numerical language used in industry and because FORTRAN is available on most mainframe computers. The translation resulted in a significant decrease in run time compared with the original BASIC version.

Introduction

MININEC is a computer program written by J. C. Logan and J. W. Rockway that solves thin wire antenna problems by the method of moments. Details of the MININEC system can be found in [2].

MININEC was originally written in BASIC, probably because most small computers only supported BASIC at the time. We selected FORTRAN as the target language for several reasons.

- FORTRAN is the standard language used for scientific computation.
- FORTRAN is inherently more efficient than BASIC.
- FORTRAN compilers are available on most mainframe computers.
- Mainframe computers have moved toward support of interactive processing environments, and thus, can now support interactive programs such as MININEC.
- Microcomputer technology has matured to the point where high quality compilers are now available.

Translation Details

The main goal of the translation was to produce a FORTRAN version that mirrored the BASIC version of the code, both in the internal structure of the code and in its user interface. This section of the paper discusses issues related to the translation.

The major steps of the translation include:

- All unnecessary labels were purged from the code.
- Looping and control statements were manually transformed from the BASIC syntax to FORTRAN syntax.
- The BASIC input and output statements were replaced by properly formatted FORTRAN equivalents.
- Translation of BASIC READ-DATA statements to FORTRAN DATA statements.
- Implementation of BASIC functions not available in FORTRAN, e.g. SGN.

Since a BASIC program consists of a monolithic section of code in which all variables are global, it would have been very difficult to convert the GOSUB statements and routines into FORTRAN subroutines. We chose, instead, to implement GOSUBs and RETURNs using ASSIGNed GOTOs. The labels to return to are stored on a stack. Hence, the code for GOSUBs and RETURNs was replaced by the following:

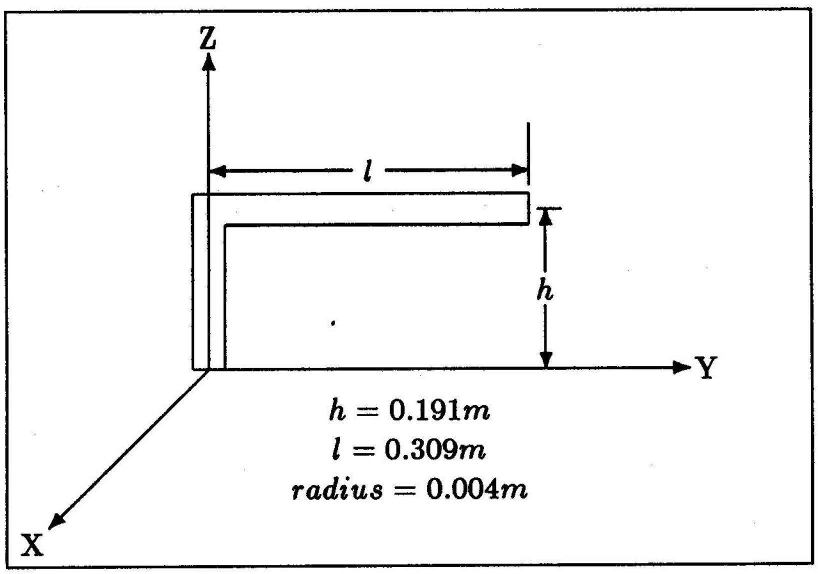
```
GOSUB 66 -->          ASSIGN 5000 TO RETTMP
                      RETSTK(RETNDX) = RETTMP
                      RETNDX = RETNDX + 1
                      GO TO 66
         5000         CONTINUE

RETURN  -->           RETNDX = RETNDX - 1
                      RETTMP = RETSTK(RETNDX)
                      GO TO RETTMP
```

The other major difficulty encounted in this translation was that BASIC is very relaxed in its handling of variable types. BASIC allows real expressions to index arrays and integer expressions to be the parameter of subroutine that expects a real argument. Standard FORTRAN, however, requires that only integer expressions index array elements. It also does not perform compile-time checking on the type of arguments sent to a subroutine.

Validation of the Translation

To validate the translated version of MININEC, we ran the simple example given in [2] with 20 pulses on the vertical and 30 pulses on the horizontal segment. The wavelength was 1m. The geometry is shown below.



The currents in the antenna were calculated using each version of the program. The output from a sample run of the FORTRAN version of MININEC can be found in Appendix A. The FORTRAN version of the code was run on an IBM PC microcomputer[1] and on a VAX 6320. These times are compared to a run of the same geometry using a single precision version of NEC2 on the same VAX 6320. The cpu time required to calculate the currents for each run are shown in the table below.

[1]Compiled with Microsoft FORTRAN version 4.10. The Computer used was an 8 MHz IBM PC clone with an 8088 CPU and an 8087 coprocessor.

Code Version	CPU time (seconds)
PC BASIC	1191
PC FORTRAN	197
VAX FORTRAN	6
VAX NEC	4.7

Additional extensive testing was performed on each section of the MININEC code to assure that the new FORTRAN version of the code produced outputs equivalent to the BASIC version output. The numerical accuracy and the format of the output were compared.

Conclusions

The MININEC program, originally written in BASIC, has been translated to FORTRAN due to the higher availability and better speed considerations of current FORTRAN compilers. The translation has resulted in a FORTRAN version of the code capable of producing equivalent results at much higher speeds than possible with the original version. Even on the same machine the new code demonstrated faster calculation times. The ability to transport the code to a mainframe computer system allows the user to even further enhance the computational speed of the MININEC program.

References

[1] J. C. Logan, J. W. Rockway, and D. Wilton, "An Improved Exact Kernel for MININEC", Applied Computational Electromagnetics Society Conference Proceedings, Monterey, CA, March 1988.

[2] J. C. Logan and J. W. Rockway, The New MININEC (Version 3): A Mini-Numerical Electromagnetic Code, NOSC TD 938, September 1986.

Appendix A

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MINI-NUMERICAL ELECTROMAGNETICS CODE

MININEC (3)

****

FREQUENCY (MHZ): 299.800
WAVE LENGTH = 1 .000 METERS

ENVIRONMENT (+1 FOR FREE SPACE, -1 FOR GROUND PLANE) : -1
NUMBER OF MEDIA (0 FOR PERFECTLY CONDUCTING GROUND) : 0

NO. OF WIRES: 2

WIRE NO. 1

COORDINATES X	Y	Z	RADIUS	END CONNECTION	NO. OF SEGMENTS
0. 000	0. 000	0 . 000		-1	
0. 000	0. 000	0 . 191	0. 004	0	4

WIRE NO. 2

COORDINATES X	Y	Z	RADIUS	END CONNECTION	NO. OF SEGMENTS
0. 000	0. 000	0 . 191		-1	
0. 000	0. 309	0 . 191	0. 004	0	6

* * * * ANTENNA GEOMETRY * * * *

WIRE NO. 1 X	COORDINATES Y	Z	RADIUS	CONNECTION END 1	END 2	PULSE NO.
0. 0000	0. 0000	0 . 0000	0 .0040	-1	1	1
0. 0000	0 .0000	0 . 0477	0 .0040	1	1	2
0. 0000	0 .0000	0 . 0955	0 .0040	1	1	3
0. 0000	0 .0000	0 . 1433	0 .0040	1	0	4

WIRE NO. 2 X	COORDINATES Y	Z	RADIUS	CONNECTION END 1	END 2	PULSE NO.
0. 0000	0. 0000	0. 1910	0 .0040	1	2	5
0. 0000	0. 0615	0 . 1910	0 .0040	2	2	6
0. 0000	0. 1030	0 . 1910	0 .0040	2	2	7
0. 0000	0. 1545	0 . 1910	0. 0040	2	2	8
0. 0000	0. 2060	0. 1910	0. 0040	2	2	9
0. 0000	0. 2575	0. 1910	0. 0040	2	0	10

NO. OF SOURCES : 1
PULSE NO. , VOLTAGE MAGNITUDE, PHASE (DEGREES) : 1.00 , 1.00 , 0.00
NUMBER OF LOADS 0

********************** SOURCE DATA **********************

PULSE 1 VOLTAGE = (1 . 0000000 , 0 . 0000000J)
CURRENT = (0 . 98E227E-03 , 0 . 147998E - 02J)
IMPEDANCE = (311. 6815, - 468. 1983J)
POWER = 0. 492614E-03 WATTS

********************** CURRENT DATA **********************

WIRE NO. 1:

PULSE NO .	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
1	0. 985227E-03	0. 147998E-02	0.177792E-02	56.34813
2	0. 961999E-03	- . 788055E-03	0.124357E-02	-39.32379
3	0. 894095E-03	- .218639E-02	0.236214E-02	-67.75856
4	0. 786773E-03	- .324865E-02	0.334256E-02	-76.38596
J	0. 645714E-03	- .394369E-02	0.399620E-02	-80.70127

WIRE NO. 2:

PULSE NO .	REAL (AMPS)	IMAGINARY (AMPS)	MAGNITUDE (AMPS)	PHASE (DEGREES)
J	0.645714E-03	-.394369E-02	0.399620E-02	-80.70127
6	0.516031E-03	-.446638E-02	0.449609E-02	-83.40945
7	0.375679E-03	-.451985E-02	0.453544E-02	-85.24863
8	0.240805E-03	-.409305E-02	0.410013E-02	-86.63302
9	0.125221E-03	-.320149E-02	0.320394E-02	-87.76011
10	0.412143E-04	-.189171E-02	0.189218E-02	-88.76191
E	0.000000E+00	0.000000E+00	0.000000E+00	0.00000

RENDEZVOUS WITH A COMPUTER SCIENTIST

Virginia Stover
University of San Diego
Department of Mathematics and Computer Science

Do you find yourself struggling with input and output files? Do you find yourself rewriting code each time you decide to change the format of a data file? Do you ever need to interface several application programs, each of which has its own file formats and its own private subroutines for reading and writing files? Do you find yourself duplicating data in more than one place? Are you forced to write programs to translate from one file format to another? If so, there is an answer to your prayers!

What you need is a common format for your data and a common set of procedures to access that data. A complete set of data is called a "database" (or DB for all you acronym fanatics). A system which provides a centralized database and a common set of access methods is called a "database management system" (or DBMS, if you must). The most popular approach to database management is the "relational database management system" (that's right, an RDBMS!). RDBMS's were proposed by E. F. Codd [1] in the late 1960's.

In a relational database, each type of object is represented by a table. The columns of the table are the attributes which describe the object type. Each row of the table represents an actual object of that type. For example, in a world geography database we might store the name, capital city, population (in millions), and type of government of various countries, as follows:

COUNTRIES

Name	Capital	Population	Government
USA	Washington	240	democracy
Great Britain	London	56	democracy
USSR	Moscow	290	communism
Japan	Tokyo	122	democracy
Iran	Teheran	51	theocracy
Saudi Arabia	Riyadh	13	monarchy
China	Beijing	1100	communism

The name, capital city, population, and type of government are the attributes of each country that we choose to incorporate into our database. Each row in the table represents a different country.

In modeling the real world, it is necessary to model not only objects but also relationships between objects. Relationships between objects can be modeled using links or pointers from one table to another. This is the method used by both hierarchical and network databases. But a relational database uses a simpler approach. A relational database uses tables to represent relationships. Thus, both objects and their relationships are represented by tables. This simplifies the database and its access methods.

In the example above, countries are related if they are trading partners. We represent this relationship using another table.

TRADING_PARTNERS

Exporter	Importer	Commodity
USA	USSR	wheat
Japan	USA	automobiles
Japan	USA	electronics
Iran	USA	terrorism
Saudi Arabia	USA	oil

Notice that the table representing this relationship is created by taking a key for each object in the relationship. In this case, the name of the importer country and the name of the exporter country are used since the name uniquely identifies each country. Notice also that relationships, as well as objects, can be given attributes by adding additional columns to the relationship table. In this case, the commodity traded is an attribute of the trading partners relationship.

From the user's viewpoint, the most important part of a database management system is its query language. A query language is a high level language which allows the user to retrieve data from the database. One of the most popular commercial query languages is the Structured Query Language or SQL introduced by IBM for its System R. SQL has since become an industry standard and has been adopted by many other commercial systems including Oracle and Ingres.

A query language allows users to retrieve any subset of the rows of a table from any subset of its columns. For example, the following SQL query retrieves the names and capital cities of all the communist countries:

```
SELECT Name, Capital
FROM   Countries
WHERE  Government = "Communism"
```

In the SELECT clause, "SELECT Name, Capital" causes only the first two columns to be retrieved. In the WHERE clause, the boolean condition "Government = 'Communism'", select only those countries which have a communist form of government. The result of this query is a new table with two rows and two columns:

Name	Capital
USSR	Moscow
China	Beijing

Users can also retrieve data which spans multiple tables. Suppose, for example, we want to know which democracies export wheat. This requires information from two different tables, COUNTRIES and TRADING_PARTNERS. Therefore, we need to combine rows from the COUNTRIES table with rows from the TRADING_PARTNERS table. Since we want to know the type of government of the exporter, we want to combine a row from COUNTRIES only if its "Name" is the same as the "Exporter" in TRADING_PARTNERS. This is accomplished in SQL as follows:

```
SELECT  Name, Capital, Population,
          government, Importer, Commodity
FROM    Countries, Trading_partners
WHERE   Name = Exporter
```

The query produces this table:

Name	Capital	Pop	Government	Importer	Commodity
USA	Washington	240	democracy	USSR	wheat
Japan	Tokyo	122	democracy	USA	automobiles
Japan	Tokyo	122	democracy	USA	electronics
Iran	Teheran	51	theocracy	USA	terrorism
Saudi Arabia	Riyadh	13	monarchy	USA	oil

This is an example of a "join" operation. Notice that not all rows of the COUNTRIES table appear in the join, since not all countries appear as exporters in the TRADING_PARTNERS table. To get only those democracies which export wheat, we need additional boolean conditions in the WHERE clause. (Let's also drop the

Government and Commodity columns since their values will be pre-specified).

```
SELECT Name, Capital, Population, Importer
FROM   Countries, Trading_partners
WHERE  Name = Exporter and
              Government = "democracy" and
              Commodity = "wheat"
```

This query gives us the required information:

Name	Capital	Pop	Importer
USA	Washington	240	USSR

Queries can be quite complex with multiple SELECT clauses, set operations like "union" and "intersection", logical operations like "and" and "or", and aggregate operations like "maximum", "sum", and "average". Most commercial database management systems allow queries to be imbedded into general-purpose programming languages like FORTRAN or Pascal for use in application programs.

Notice that a query language allows users to specify what data will be retrieved without worrying about how data will be retrieved. A query will retrieve the same information regardless of how the database is actually stored and regardless of what other information might be in the database. Thus, as the database evolves over time, there is no need to rewrite the application programs which access the database. This concept is called "data independence". It guarantees that any changes in the physical structure or organization of the database will not require changes in the application programs accessing that database.

A relational database is actually a time-varying set of tables. At any given time, users can define new tables or delete old ones. The database management system must be able to handle tables of any size, with any number of attributes of any type. This is accomplished through the use of a Data Dictionary. The Data Dictionary keeps track of all the tables in the database at any one time. It includes the names of the tables, the number of attributes belonging to each table, the name of each attribute, and the type of data that can be stored in each column. The Data Dictionary itself is actually just another table in the database. It changes over time as new tables are created and old tables discarded. Finally, a database management system must contain a unit for mapping the database tables to the physical disk files which store the actual data (i.e. the rows of the tables). These implementation details, however, involve operations which are usually transparent to the user.

In summary, the following are the major reasons for using a relational database management system:

1. A centralized database provides a uniform view of the data. This eliminates the need for each application program to define its own private data files. It also helps to eliminate unnecessary redundancy.

2. Data can be retrieved independent of the physical structure of the data by using a high-level query language. Thus, application programs do not need to be rewritten every time the database changes.

3. By providing common data access methods, the database manager can more easily provide for the efficiency, security, reliability, and correctness of the database.

4. Relational databases are easy to implement in a network environment, thus allowing multiple users to share the same databases across different machines.

Now, in order to appear knowledgeable to friends and colleagues, it is essential to get the terminology right. In "computerese", objects are called "entities", tables are called "relations", columns are called "attributes", and rows are called "tuples". Tuples take their legal attribute values from a "domain". A description of a set of tables is called a "database scheme", whereas the actual information stored in the tables at any given time is called a "database instance". A description of a single table in the database is called a "relation scheme", and the actual information in the table is called a "relation instance". Got it ?!?

Be sure to look below for your personalized ACES horoscope.

References

1. E. F. Codd, "A Relational Model for Large Shared Data Banks," Communication of the ACM, Vol. 13, No. 6, June 1970, pp. 377-387.

2. E. F. Codd, "The 1981 ACM Turing Award Lecture: Relational Database: A Practical Foundation for Productivity, "Communications of the ACM, Vol. 25, No. 2, Feb. 1982, pp. 109-117.

3. H. Korth and A. Silberschatz, Database System Concepts, McGraw- Hill, 1986. (A good introductory textbook on relational database management systems).

4. R. Finkelstein and F. Pascal, "SQL Database Management Systems", Byte Magazine, Vol. 13, No.1, Jan. 1988, pp. 111 - 118. (A look at six IBM PC based database management systems using SQL).

**** ACES Horoscope ****

You will soon join in an exciting relationship with an old, familiar entity. Your union will be blessed with many little tuples. The key to this relationship is consistency. Your relations will flock to your domain to gain new insight into your schemes.

REPORT ON AP/S CAEME AND SOFTWARE VALIDATION WORKSHOPS

by Ed Miller

(Editors note: The following is excerpted with permission from "PCs for AP" which appears in the IEEE AP/S Newsletter. The material on Computer Applications in EM Education (CAEME) is particularly relevant to the proposed joint ACES-IEEE CAEME activities described in the President's Report).

CAEME COMMITTEE AND WORKSHOP

The CAEME Committee, chaired by Professor Magdy Iskander of The University of Utah, submitted a proposal to the National Science Foundation for AP-S under auspices of the IEEE, to seek funding for developing computer-based EM courseware. Magdy, principal author of the proposal, AP-S President Professor Irene Peden and Professor Arlon "Bud" Adams, Chairman of the Education Committee, both of whom contributed to the proposal, together organized the workshop at our 1989 meeting. Although put together rather late and held on Sunday because of scheduling problems, the workshop attracted about 40 participants, with about 15 making presentations and/or demonstrating software they developed. The workshop generated a high level of enthusiasm among those attending and confirmed in various ways the need for taking advantage of computer technology in E&M instruction to not only improve the "product" but also to attract more students to its study.

It seems apparent that there are two distinct ways by which computer-based technology can be exploited in EM instruction. One is incorporation as part of their regular courses of specially designed or adapted software for realtime, interactive use by students. Such software can help in ways ranging from solving and displaying the results of exercises in which the computer, by replacing routine mathematical "drudgery", permits the student to spend more time thinking about the physics involved, to conducting computer "experiments" where conceptual understanding is the primary goal. The other is to develop and display the results of solutions to problems whose complexity renders them presently unsuitable for realtime development, which therefore must be stored in some appropriate form. As computer technology continues to advance, the boundary between these two extremes will also continue to move from the latter, which I have described as the "stored-solution" mode (SSM) towards the former which is called similarly the "generated-solution" mode (GSM).

For either the GSM or SSM, a key ingredient is the graphical display of the electromagnetic physics being solved. In this connection then, the visualization aspects of electromagnetics are becoming ever more important, and not only for teaching. As workers in the field of computational electromagnetics (CEM), we have seen the size of "large" problems move from the realm of a few dozen of unknowns in the early 1960s to a few thousand now, when using standard integral-equation models. And, with the growing use being made of differential-equation models in both the frequency domain and time domain, problems having up to hundreds of millions of field samples are beginning to become more common. Describing such problems to the computer, let alone interpreting the results obtained, obviously requires "massively graphical" displays systems as well.

Examples of both approaches were demonstrated at the CAEME workshop. In many ways, the GSM is the more attractive because of the greater control over doing computer experiments it offers to the student. From an operational viewpoint however, I feel that the SSM is the more practical. Among the reasons for this observation are [Miller, Cole, Chakrabarti and Gogineni, "Learning about Fields and Waves Using Visual Electromagnetics", IEEE Trans. Education, October 1989] that, using the SSM:

1. More complex and more realistic problems and graphics can be employed.

2. The software needed for the computations and displays need not be optimized.

3. The output is inherently less perishable in its dependence on changing technology.

4. Through media such as laser video disks, the SSM can be made nearly equivalent in interactivity to the GSM.

It seems to me that with the growing interest and use being made of graphics in EM modeling, mostly as a matter of necessity I suppose, much useful material for instructional purposes could be obtained by CAEME at no cost if the various workers and organizations involved in CEM could be persuaded to provide solutions in graphical form for appropriate problems. An example of the kind of "product" this could lead to was demonstrated by the computer movie shown in San Jose by Vaughn Cable and his colleagues L.A. Takacs and M.N. Kosma from Lockheed [Joint AP-S, URSI-B Session 26: Numerical Techniques for Computer Architectures--Large & Small].

However, security and other considerations would probably limit what could be available if we had to depend solely on "real-work" analysis and design applications of this sort. If the computer model and hardware used for real work might be adapted to developing results for problems relevant to CAEME needs at acceptable cost, then everyone could benefit. This would certainly include students and teachers who could gain access to computer simulations that might not otherwise be available to them, thus enriching the instructional environment. Benefit would also accrue to those companies and individuals who provided the simulations, not least of which might be in recruiting and retaining students in a discipline hard-pressed to compete with the glamors of computers. If you and your company might be able to join CAEME in this context, please let Professor Iskander know, whose address is Department of Electrical Engineering, University of Utah, Salt Lake City, UT 84112, telephone (801) 581-6994.

SOFTWARE-VALIDATION WORKSHOP

Attendance at the Software Validation Workshop was about 50 overall, during which 22 prepared presentations were made and several working groups were begun whose leaders made verbal reports before adjournment. The workshop was "kicked off" by Dr. A.C. Schell, Chief Scientist of the USAF Systems Command who provided a DoD perspective concerning the critical nature of software quality control and computational output. Speakers followed who represented US government sponsors, code developers, and code users, addressing the general question "What validation means to me and my organization". The presentations concluded with 12 sample validation exercises.

After hearing the presentations, workshop participants were asked to indicate their preference for forming working groups to develop recommendations and action items in various specialty areas. The working groups formed, and their leaders are:

Policy and Procedures--Leo B. Felsen
Wires--James C. Logan
Surface and/or Penetrable Bodies--Donald R. Wilton
Finite-Difference Time Domain--Allen Taflove
Database Issues--Janet McDonald

The working groups held separate meetings for about 45 minutes, a too-short time admittedly but we had a very full day, after which we convened to hear reports from their leaders, have some wrap-up discussion, and adjourn. The working-group discussions will be summarized in a report which we intend to synopsis in an upcoming issue of the AP-S Newsletter/Magazine.

We are beginning to collect benchmark solutions, and plan on holding another workshop at next year's meeting in Dallas. In this activity, we also intend to cooperate with any other related activities such as the Joint Services Electromagnetic Code Consortium which is developing a set of benchmark solutions for RCS models. In addition, the Spring 1990 issue of the ACES Journal will be devoted to presentation of benchmark and canonical problems, an exercise with which our AP-S Committee plans to collaborate. If you are interested in participating in software validation, particularly about developing solutions for selected problems, please contact me.

The need for a validation protocol whose purpose is to provide an objective indication of modeling-software performance, and one of the outputs the Software Validation Committee expects to develop, is becoming more important with the exponential growth occurring in the sheer volume of numerical results being produced. Of the kinds of error types that arise in any numerical modeling:

Type 0 -- Code "bombs"
Type 1 -- Code runs but produces obviously wrong results
Type 2 -- Code produces physically plausible results that are wrong.
Type 3 -- Code results are correct but misused or misinterpreted by the user.

Type 2 is most unsettling. As a personal example, quite a few years ago I was working with Fred Deadrick of LLNL on applying an early version of NEC to modeling a US Coast Guard Loran-C antenna. After the model had been developed and the type 1 and type 2 errors worked out, Fred showed me some unusual (to me) results which I couldn't explain but weren't obviously wrong either. After thinking about them for a few days, I was prepared to explain to Fred why the results must be correct based on my newfound understanding of the physics involved. Before I could properly launch into this explanation next time I saw him however, Fred informed me that he had found the error in the program! At least the new results he had seemed consistent with our original expectations. One point of this story is that physical intuition is not always dependable, at least not mine, and computer-model results should be "slept on" for some appropriate time before being accepted as any sort of reality, especially when a new problem and/or a new code is being run.

While we're on the topic, some other experiences in running and validating model results may be worth repeating. When I first became involved in Moment-Method applications a few (I wish!) years ago, there were few solved problems and guidelines from which to develop confidence in these "new failed" numerical results. Every problem was a new one where, in the event of a discrepancy between the numerical result and measurement, there was a saying "Everyone believes the measurement but the experimentalist, while no one believes the computation but the modeler", because experiments are thought to reveal the truth, at least by those who are not directly involved in their conduct. On one occasion, we (a group at MBA in San Ramon, CA) had computed the RCS of straight wires a few wavelengths long, getting good agreement with some measurements by Val Liepa of the University of Michigan Radiation Laboratory. We then did calculations for some longer wires which we presented to our sponsors, but who were appropriately skeptical because three or four wavelengths was not 10 or 20.

Lacking our own experimental facilities, we were fortunate shortly thereafter to obtain a measurement from Keith Hazard, then of AVCO, for the RCS of a wire about 11 wavelengths long. We were chagrined to find that our model results, although tantalizingly similar, were shifted in both amplitude and angle from the experimental data. Upon being unable to find an explanation in the computer code (a forerunner of NEC) or model data, we finally reluctantly admitted that to Keith and asked if there was anything about the measurement that might be relevant. Further discussion revealed that the "thin wire" being measured was really thin, and not being stiff enough to be self supporting, had been attached to a thin styrofoam rod for the measurement. Upon repeating the model computation using a frequency scaled upward by the square root of the rod's relative permittivity, we were tremendously pleased to find this new result in much closer, albeit not perfect, agreement with the experimental data.

The point in this case is that knowing the experimental conditions is vitally important to the modeler, and that the numerical result can be just as correct in its way as the measurement is in its. It has been my lot (together with numerous colleagues with whom I've worked) to encounter various other similar experiences that I may describe from time to time. If any of you have had these kinds of things happen to you and would be willing to share them with others, please let me know. I plan to include a continuing dialog on the general problem of software validation in future columns, including examples of "what can go wrong" from other's experiences, if such are received.

MODELING NOTE

GEMACS WAVEGUIDE TERMINATION

Paul Elliot
Georgia Tech Research Institute
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GEMACS is an electromagnetics modeling code which some ACES members may have already used or heard about. Version 4 of GEMACS, released in 1987, includes finite element computations for enclosed regions as well as moment method and GTD solutions for open radiating regions. The different regions may be coupled together. GEMACS is available from Ken Siarkiewicz, RADC/RBCT, Griffiss AFB, NY 13441-5700 (export restricted). Versions for IBM-PC
and for larger computers are available.

A useful feature in the GEMACS finite element modeling is that the plates enclosing the interior region may be given a finite conductivity. With a judicious selection of conductivity value, the plate impedance will absorb incident radiation much like the walls of an anechoic chamber. When the volume enclosed by the plates is large enough to permit free space radiation, then 377 ohms is the plate impedance recommended to provide the most absorption of incident radiation (I believe there would still be some reflection for oblique incidence).

This approach can be used with good results to create a matched termination for a waveguide, if the required plate conductivity can be determined. The plate impedance required is the characteristic impedance of the TE_{10} waveguide mode. When the finite element grid consists of cubical cells ($\Delta x = \Delta y = \Delta z$) the following formula determines the required conductivity σ for the plate[2 3] :

$$\sigma = 2\omega\mu/Zc^2$$

where

σ = plate conductivity for GEMACS COND command.
ω = the angular frequency: $2\pi f$
μ = permeability of free space: $4\pi \times 10^{-7}$
Zc = impedance desired for plate: waveguide mode impedance

Zc is different for each waveguide mode, so the absorbing end wall will only work for one mode. This is not a problem in most applications since waveguide sizes are normally selected so only the TE_{10} mode will propagate. The absorbing end wall should therefore be placed far enough (probably about .1 to .25 guide wavelengths) from any discontinuities or sources in the guide which might excite higher order modes in the model, so that all higher order modes will be attenuated. Also, in the vicinity of discontinuities, the shorter wavelengths of the higher order modes would require a finer grid to be accurately modeled.

For the waveguide cavity example given in the GEMACS manual[4,5] the TE_{10} mode impedance is 519 ohms. However, since the finite element cells are not cubical, I was not able to readily determine from the equations in the manual what the plate conductivity should be to yield 519 ohms. The conductivity was empirically determined to be .0294 by noting the VSWR for a couple of cases, converting the VSWR to a reflection coefficient, and then using a Smith chart or formulas to determine how much the impedance needed to change for a match. An end plate conductivity of .0294 yielded a VSWR of 1.02.

1. E. L. Coffey, N. W. Coffey, D.L. Kadlec, GEMACS SOURCE BOOK, page C.5-17. Final Technical Report RADC-TR-88-102. Advanced Electromagnetics, Albuquerque, NM. April 1988.

2. ibid.

3. E. L. Coffey, D. L. Kadlec General Electromagnetic Model for the Analysis of Complex Systems (GEMACS) Version 4, Engineering Manual, page 100.39. Final Technical Report RADC-TR-87-68, Volume II (of three), BDM Corp, Albuquerque, NM. For RADC, Griffis AFB, NY 13441-5700, May 1987.

4. ibid, page 174.1.

5. E. L. Coffey, N. W. Coffey, D. L. Kadlec, GEMACS SOURCE BOOK, page B.6-28. Final Technical Report RADC-TR-88-102. Advanced Electromagnetics, Albuquerque, NM. April 1988.

COMMON PITFALLS WHEN USING BSC

Paul G. Elliot
Georgia Tech Research Institute
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The Basic Scattering Code (BSC) is an implementation of UTD (the Uniform Theory of Diffraction, an enhancement to GTD). It was developed at, and is available from, the ElectroScience Laboratory of The Ohio State University, Columbus, Ohio, 43212. The current version is export restricted. Several other EM codes are also available from Ohio State.

I have found the BSC to be an excellent electromagnetics code that produces useful results without alot of computer time.e. Therefore I have used it quite a bit, and have personal experience with several problems that are prone to pop up, especially when the User's Manual is no longer fresh in one's memory.

1. No version of the BSC exists for PCs to my knowledge; and the source code is too big to compile using current PC FORTRAN compilers (except perhaps the new Lahey 32 bit compiler). We encountered problems porting it from the VAX to a SUN, but had good results porting it to a Data General.

2. An easy error to make is to ignore the "right hand rule" that requires the plate normal to point towards the side of the plate containing the source. Ignoring this sometimes causes a large error, sometimes not.

3. Using plate edges that are less than a wavelength long is tempting and is usually alright, but can produce large errors for some geometries. As pointed out in the BSC manual, good engineering results can often be obtained with edges as short as 1/4 wavelengths, but there are cases where results obtained at potential resonance frequencies of the scatterer are highly questionable.

4. Errors in entering coordinates, particularly for the source location since the origin is redefined for the source.

5. If more than 3 digits are used for some data input, then an "input conversion error" can result.

FIRST CALL FOR PAPERS

THE 6TH ANNUAL REVIEW OF PROGRESS IN APPLIED COMPUTATIONAL ELECTROMAGNETICS

AT THE NAVAL POSTGRADUATE SCHOOL
Monterey, CA 93943

MARCH 19 - 23 1990

Sponsored by: The Applied Computational Electromagnetics Society and DOD/USA ECOM, USAISESA, NOSC, DOE/LLNL. In cooperation with: The IEEE Antennas and Propagation Society, The IEEE Electromagnetic Compatibility Society, and URSI Commissions A and B.

"LINKING ELECTROMAGNETIC CODE DEVELOPERS AND USERS"

The purpose of this Sixth Annual Review is to provide a forum for information exchange among practitioners of applied computational electromagnetics. Contributions by both users and developers of electromagnetic computer modeling codes are solicited, addressing topics pertaining to experience gained in practical applications. The Review will highlight topics related to the design, selection, performance, and implementation of current and emerging electromagnetic modeling codes and techniques.

<u>SUGGESTED TOPICS INCLUDE:</u>

Codes, Modifications, and Applications
- Moment Methods
- Finite Elements and Finite Differences
- Spectral Domain Techniques
- GTD and Asymptotic Techniques

Graphical Input/Output Issues
Code Validation
New Mathematical Algorithms

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Prospective Authors are requested to submit a one-page abstract of their presentations by January 6, 1990 to the Program Committee Chairman. A camera-ready summary of the presentation will be required later.

THE APPLIED COMPUTATIONAL ELECTROMAGNETICS SOCIETY

ANNOUNCES

A CALL FOR CANONICAL PROBLEMS

IN COMPUTATIONAL ELECTROMAGNETICS

FOR A SPECIAL ISSUE OF THE ACES JOURNAL

A set of canonical problems will be offered to the ACES membership. Interested members may attempt to solve problems of their choice and compare their solutions and techniques -- OLYMPICS-STYLE.

The OBJECTIVE is to compare the effectiveness of numerical techniques and particular computer codes -- as implemented on various machines -- involving various problems. For each problem, papers will be written and published in a special issue of the ACES JOURNAL. (In some cases, these papers may be a team effort by all participants in the solution of a particular problem).

Each attempted and submitted solution will specify (as applicable) the meshes, input variables, number of unknowns, computational method (FDTD, perturbation methods, hybrid methods, etc.), basis functions, solution technique (Gaussian elimination, LU factorization, single-value decomposition, etc.), a'priori assumptions/simplifications, the solution time, and the memory used -- as well as the code and machine used. It is anticipated that a "revised" ACES Modeling Short Note form will be used for this purpose. Furthermore, for each problem, we shall attempt to standardize the graphs and other outputs.

EXAMPLES OF CANDIDATE CANONICAL PROBLEMS INCLUDE:

- Transient coupling into a box with imperfectly conducting metallic walls, with a wire connecting the top and bottom of the box.

- Transient coupling into a box with advanced-composite (anisotropic) walls, with a wire connecting the top and bottom of the box.

- Penetration of EM fields into biological material forming a canonical shape, with canonical organ placement.

- Scattering from a canonical object buried in a uniform half-space of imperfectly conducting material (useful for nondestructive evaluation, and geophysics).

- Antenna radiation in the presence of an advanced-composite ground plane.

- Transient/steady-state scattering from a perfectly conducting cube.

- Transient coupling into a box with an aperture in perfectly conducting walls.

HOWEVER, WE NEED ADDITIONAL PROBLEMS IN THE FOLLOWING AREAS:

Antennas (and their EM environments)

Networks; microwave components

Static fields

EM machines and devices

Dielectric and Magnetic materials

Radar cross section

Shielding, radiation hazards, and EMP

Power transmission

Charge transport

TO SUBMIT OTHER CANONICAL PROBLEMS OR FOR ADDITIONAL INFORMATION, PLEASE CONTACT:

Harold A. Sabbagh
Special Guest Editor
Sabbagh Associates, Inc.
4639 Morningside Drive
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DEADLINE for CANONICAL PROBLEM SUBMISSIONS is November 15, 1989.

ACES SOFTWARE LIBRARY

CURRENT INDEX OF ITEMS IN LIBRARY:

Item#	Description	Computer
002	MININEC2F frequency sweep	IBM-PC
003	ENHANCED MININEC2 double ARRAY size to 20 wires, etc.	IBM-PC
004	ENHANCED MININEC2	IBM-PC
005	THIN WIRE MININEC2	IBM-PC
006	NEC2	DEC VAX
007	NEC3 buried wires	DEC VAX
008	NEEDS 2.0 (MININEC3.13, IGUANA 5.4, GRAPS 2.0, NEC81 2.2)	IBM-PC/XT or AT
009	MININEC3.13, GRAPS 2.0	IBM-PC/XT or AT
011	NAC-3 ver. 1.3 Thin-wire code	IBM-PC/AT or XT
012	SIGDEMO	IBM-PC
013	Misc BASIC programs RF Designers Toolbox	IBM-PC
014	AT-ESP OSU EM Surface Patch Code	IBM-PC/XT or AT
015	VMAP 2-D vector field plot	IBM-PC
016	DRESP,DRESV2 Dielectric resonators, field distribution plots	IBM-PC
017	NEC-AM AM Broadcast array design	IBM-PC/XT or AT
018	RF65FT v2.0 RF power density for FM/TV via FCC OST BULL.65	IBM-PC/XT or AT

ANNOUNCING

"THE NUMERICAL ELECTROMAGNETIC ENGINEERING DESIGN SYSTEM"

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An upgraded version of the integrated, menu driven PC software package combining:

MININEC3.13

NEC81 2.2 (NEC-2 with SOMNEC)

IGUANA 5.4

GRAPS 2.0

ANTMAT 87

MININEC3.13

The latest version of MININEC, which includes geometry and impedance file-saving.

NEC81 2.2

A Microsoft FORTRAN 4.1 version of NEC-2 featuring 90 segment in-core solutions for faster runtime, new plotting output file options, a helix generator which will build flat spirals, and a selective move card option. (Still under development, but faster, more accuracy and more capability than the NEC-2 PC from NEEDS 1.0). (NGF files are currently limited to 180 segments in version 2.2, but non-NGF use of 300 segments is supported).

IGUANA 5.4

The Integrated Graphics Utility for Automated NEC Analysis partially automates the data entry process for NEC2 and MININEC3. The most painless way to learn the input data setup for NEC. This version improves file handling, allows the use of a mouse to replace the digitizer if desired, and surface patch construction in the model maker.

GRAPS 2.0

A simple rectangular, polar, Smith Chart and 2D contour (new addition) plotting package.

ANTMAT 87

The latest version of the ANTMAT broadband antenna matching program with Smith Chart displays.

DOCUMENTATION

User Manuals for all four programs, and ANTMAT are supplied as part of the NEEDS 2.0 package. An update package which brings NEEDS 1.0 up to NEEDS 2.0 contains new IGUANA, GRAPS, and ANTMAT manuals and revisions for the NEC manual. The MININEC3 manual remains the same).

SOFTWARE

Ten 5 1/4" 360k floppy diskettes supplied.

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Required:	IBM PC-XT/640K RAM CGA graphics Math Co-Processor	Optional:	Graphics compatible dot-matrix printer (Ex: Epson compatible or HP ThinkJet are specifically supported) HPGL - compatible pen plotter Microsoft Mouse (bus version) Parallel and 2 serial ports Graph-Bar Sonic Digitizer

COST:

1. $140 to ACES members only. Foreign members add $25 . Bank drafts (which must be drawn on a US Bank, showing a US address and routing numbers) or International Money Orders only. Make checks payable to The Applied Computational Electromagnetics Society. Update from NEEDS 1.0: Includes new documentation pages for 3-hole or spiral-punched manuals plus 10 new diskettes. $65. Foreign members add $15. (Current membership required).

2. Updated diskettes for NEC81 will be automatically shipped to all registered NEEDS 2.0 users as fixes to the NGF option are completed.

Order from: Dr. Richard W. Adler
Code 62AB
Naval Postgraduate School
Monterey, CA 93943