Can / Am EMTP News

Voice of the Canadian/American EMTP User Group

Publishers and Mailers:
Kwang-yi and Kwang-chien Ger
3179 Oak Tree Court
West Linn, Oregon 97068
United States of America

Authorized by Co-chairmen :
Dr. W. Scott Meyer, Editor
Dr. Tsu - huei Liu

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Salford Compiler & DOS Extender

The eagerly-awaited new compiler FTN77/486 and DOS extender DBOS/486 --- both Revision 2.66 --- have been used at BPA since early June. The update was requested from Salford distributor OTG Systems of Clifford, Pennsylvania, on May 29th following the unsolicited observation by Brad Frazer of Tucson Electric Power that Rev. 2.66 already was in use at his company! Distribution to the general public began on July 2nd after repackaging had been completed.

Microsoft Windows 3.0 or 3.1 does support Salford EMTP and TPPLOT execution in **enhanced** mode using DBOS / 486 Rev. 2.66. See a separate story for details about this important development. No, your Editor does **not** believe that Microsoft Windows 3.1 is better than Quarterdeck's DESQview. But MS Windows **are** much more widely used. This is the principal reason the development is important, in your Editor's opinion. An analogy could be made with the operating system. On average, DR-DOS by Digital Research, as used by Harald Wehrend and associates at the University of Hannover, does seem to be better than Microsoft's MS - DOS ; but DR - DOS is less commonly used. Your Editor must remind readers that popularity does not imply superiority (IBM proved definitively long ago that a product does not have to be better to be more widely used) !

Hewlett-Packard LaserJet series II printers now can be used directly and without extra cost (i.e., without reliance upon extra publishing software such as WordPerfect) for high-resolution hard copy the same way Epson printers have been used for the past two years. In fact, for either Epson or LaserJet, this can be done in the background on a time-shared basis so as not to delay noticeably interactive usage of the program (initially, just Salford TPPLOT) . As with the story of the preceding paragraph, this is important enough to warrant a separate headline (look for details later).

Full compatibility with Quarterdeck's DESQview has returned according to FAX from Harald Wehrend of the University of Hannover in Germany. On July 30th, Mr. Wehrend wrote: *"Swapping under DesqView is running again, ..."* Whatever the trouble with Rev. 2.60 was, it would seem no longer to be a problem now that we have passed to the newer Rev. 2.66.

The need for virtual scratch files (see page 2, column 1 of the January issue) was greatly diminished by the use of /DISK_CACHE to provide disk caching (see page 2, column 2 of the April issue). Nonetheless, there remained interest in testing virtual scratch files using the new Rev. 2.66 compiler. First, the translator was modified to use them, and operation was proven to be correct (all standard test cases were solved correctly). Next, scratch files of Salford EMTP were made virtual. Unfortunately, two test cases then had erroneous solutions: 1) DC-36 that involves DATA BASE MODULE use; and 2) DC-14 that involves NETWORK EQUIVALENT use. There was enough similarity in the associated blocks of coding (in SATURA and NETEQV, respectively) to suggest that the Salford compiler was having trouble with temporary storage of unit LUNIT1 . Reprogramming to avoid the suspected structure did correct the two solutions. Salford EMTP does finally use virtual scratch files!

Simulation speed has improved as a result of the preceding changes. This can be illustrated by the elapsed times at the end of the biggest of all standard BENCHMARK test cases, DC-1. The following output was pasted from disk file DC1.LIS as produced by BPA's 33-MHz 80486:

Seconds for overlays 1- 5 :	6.426
Seconds for overlays 6-11 :	1.211

Seconds for overlays 12-15 :	1.539
Seconds for time-step loop :	64.504
Seconds after DELTAT-loop :	0.660
Totals :	74.340

The front-end (pre-simulation) time has been greatly reduced. Now, total time is not much greater than the time spent within the time-step loop (i.e., simulation proper)! In fact, the total time now is shorter than just the simulation time of 75 sec as first reported for 33-MHz 486-based computers by Prof. Dennis Carroll.

Errors with C-like files can be confusing, the user is warned. Slowly, as sources of trouble are recognized, more protection and explanation will be provided. This was illustrated by trouble with BENCHMARK DC-46 on March 28th. Actually, the trouble was with the preceding companion case DC-45 that at the time did not create a correct output file DC45.PL4 for reasons that no longer are of interest to anyone. If the user of an old program version wants to see the trouble, he need only extend the ending-time TMAX of DC-46 beyond the available data, and watch the resulting infinite loop (send output to the screen to avoid filling the disk as happened to your Editor).

Compilation with /DEBUG affects the precision of subsequent execution. Program developers at BPA were astounded to discover this on March 27th during final testing of LMFS (see pages 8 and 9 of the preceding issue). Previously, it had been noted that roundoff properties would change from time to time or version to version. Until March, no one ever offered a plausible explanation, however. Now we understand that the /DEBUG switch is the likely culprit. When this was suggested to David Vallance of Salford, there was no surprise at all. Apparently this is a well-known phenomenon. Hereafter, for validation using standard BENCHMARK DC-XX test cases, Salford EMTP always should be compiled without any use of the /DEBUG switch. This should make much easier the methodical comparison of DC*.LIS output files using file-comparison utilities such as Mike Albert's superior shareware utility FC . Of course, STARTUP switch KOMPAR is set to unity so dimensioning will not substantially affect the comparisons. There still are some differences of floating-point numbers, but far fewer than before. Batch file FCSALFOR . BAT produces the single differences file DIFF.LIS for all test cases, and this decreased in size by some 40% as a result of the just-stated rule. This is progress!

Utility BPATOATP (see the preceding issue, the middle of column 2 on page 10) will be made available to other licensed users who might need to convert their non-ATP .PL4 files for use with some other software such as Schweitzer's relay simulator. This was the offer made to Timothy Tibbals on May 29th during a telephone call concerning B.C. Hydro, which might have .PL4 files produced by the DCG/EPRI EMTP. If these have the same format as BPA's EMTP files dating to the .M39 version of July 1984, the same utility should work for B.C. Hydro as was used on Dan Goldsworthy's files at BPA. If not (if DCG or EPRI has modified the .PL4 file format), B.C. Hydro and others in a similar position are on their own. Also, note carefully that utility BPATOATP is offered only for the purpose of converting .PL4 files to something else (in this case, Schweitzer hardware or software) that is not a part of *"EMTP commerce."* Permission is **not** being granted to use BPATOATP to convert .PL4 files of the DCG/EPRI EMTP in order that they can be plotted using superior ATP graphics such as Salford TPPLOT. There already had been a request for this, and the answer was **no**! A utility such as BPATOATP is accompanied by special restrictions; it is available only to certain users, and for limited purposes.

132-column SPY output was requested by Harald Wehrend of the University of Hannover during a telephone conversation about his FAX dated July 30th. As higher resolution monitors become more common, your Editor agrees with Mr. Wehrend that there should be a 132-column alternative for the LUNIT6 output that is requested by the F2 function key. Wider output really is not an issue for the F1 window of SPY dialogue since such output always has been limited to 80 columns, even for Apollo workstations. But the LUNIT6 output is normally 132 columns in width, and the display of only the left-most or the right-most 80 of those columns was a special feature of Salford EMTP that was designed to accommodate the common, lower-resolution monitors. Mr. Wehrend argues that 132-column output now is readable with the right (higher-resolution) hardware, so Salford EMTP users should have the choice of seeing full-width LUNIT6 output. the suggestion is a good one, although the required modification has not yet been made.

Improvements to Salford TPPLOT

A breakthrough with 768 x 1024-pixel screen graphics was learned about just in time to add two sentences to the preceding issue: "But it works in Budapest! See Laszlo Prikler's report in March *EMTP News*, pages 57-68." Direct contact was established in 3 pages of FAX dated May 7th, to which author Prikler responded with 6 pages on May 22nd. Unfortunately, Dr. Bruce Mork in Fargo did nothing obviously wrong. Dr. Prikler was able to demonstrate Dr. Mork's trouble by switching to a newer copy of the Salford DOS extender. Dr. Prikler's nearly-perfect results were produced using DBOS / 386 Rev. 2.42, which was retired from distribution in this country at the Dallas short course (late September, 1991) when we switched to LEC's DBOS / 486 Rev. 2.51. With the newer Rev. 2.60 or 2.66 (yes, Dr. Mork did try this without success), errors become gross, making the higher resolution unusable. To conclude, Dr. Prikler was just very lucky to have begun with the older Rev. 2.42 for which

errors are inconspicuous and easily tolerated for some unknown reason. No, the user group will not distribute the older DBOS just to solve this problem, which is not viewed as being important for many users. Instead, we all will simply wait for resolution at the factory in Salford.

Practically infinite storage for points to be plotted became available on June 23rd when maximum size of the single, large, REAL*4 working vector EV was increased by a factor of 100 from its original 285K cells. That's right, readers, this working space now occupies 114 Mbytes of virtual address space! Yet, the user who continues to plot much smaller files probably can not notice the difference. No disadvantage of the massive increase has yet been detected. For example, the disk file storing the program is no bigger, the delay at the beginning of program execution seems to be no longer, and plotting seems to be no slower, despite the enormous increase. Nor does there seem to be any need for increased RAM or free disk space --- unless, of course, it actually is used as part of an expanded plot. One does pay for what one uses, but no more, it would seem. In this sense, the Salford FORTRAN compiler and DOS extender are clearly superior to the compilers and operating systems of other manufacturers with which your Editor has had experience over the past two decades. For the historical record, inspiration for this important change came during the weekend of June 20-21 as your Editor studied Salford disk file THREADS . DOC . About working space for SPAWN@ : *"It is suggested that the array be made very large (say 10 Megabytes) and put in an uninitialised common block so that DBOS will only allocate memory for it as it is actually used."* Why no EMTP researcher previously noted or understood the significance of this important detail (that memory is allocated only as it is actually used) is a surprise at this late date.

The card cache, used by HELP, TYPE, and SET DATA commands, was increased in size on June 30th from 1250 to 4550 card images. As with the preceding storage for data points, it now is understood that there is no obvious practical upper limit on such dimensioning. Without difficulty, the limit could have been made 10K or 20K. Yet, it is not clear that this is what should be done. Would the user want to pay in virtual address space for an entire file that he will be inspecting using the TYPE command? The answer probably is *yes* for small files, but *no* for really big files. Consider the single-file UTPF which is some 6 Mbytes in size. The user who would TYPE this file would have to wait for all six Mbytes to be read from disk before anything would be seen, and he would lose the same amount of space from his virtual page reserve. Admittedly this is an extreme example, but it illustrates the potential dangers of nearly unlimited usage of DIMENSIONed storage. Operation from disk, as used so effectively by Vernon Buerg's shareware utility LIST, clearly would be more appropriate. To conclude, some program restructuring must be given serious thought.

An uninitialised array does not expand disk file size if it is placed in a COMMON block separate from any variable involving a DATA statement. Although nothing new, this principle never was applied to all significant arrays of TPPLOT prior to June 30th when disk file size of the executable program was decreased from 513 Kbytes to 406 Kbytes as a result. The gain is not great, but it is significant and worthwhile for every user who is not dynamically compressing files. Perhaps for DR-DOS there might be no gain, but for MS-DOS, this is real disk space that has been saved!

PAPER is a new command that provides a super-structure for the four former hard copy commands HPGL, POST, EPSON, and LJ2. The new PAPER command unifies hard copy requests at the same time it reduces by three the number of entries in the MENU display. Yet, the old commands have not been removed from the program; they continue to be available via the keyboard (or batch files), and they remain in the aqua, pulldown, OUTPUT submenu to which the new command PAPER has been added. The new unified structure minimizes redundancy of the HELP instructions, which could be shortened as a result. Finally, the separate plot command (e.g., GO or ALL TIME) that was required by EPSON or LJ2 has been removed --- whether or not the hard copy was requested from the PAPER command. In summary, the latest change is mainly organizational, to improve the convenience of use. It entered TPPLOT over the 4th of July weekend.

The reader might well ask why .PCX files were not included in the new PAPER command. After all, publishing software will accept them, too. Well, unlike the other four alternatives for hard copy, .PCX files are not nearly disconnected from other functions. The manipulation of .PCX files now is a complicated and integral part of the BITMAP command, which was deemed to be beyond the scope of the present reforms. Even later modification seems unlikely.

The WINDOW command for window plotting (see the last paragraph on page 3 of the preceding issue) has replaced the DEBUG command as an entry of the MENU display (the yellow MENU button). This happened May 9th. However, DEBUG can still be found and accessed in the CONTROL submenu, which has been augmented by WINDOW.

Another screen editor has been provided for mouse users. This third and latest editor is associated with the WINDOW command, following earlier ones for the LABEL and CURVE commands. Sophistication is noteworthy. Whereas the flashing COPY button of CURVE is not used, five new techniques have been pioneered. First, the edit window is clearly divided into three distinct areas (panes) by horizontal separating lines. Second, the biggest of these, the bottom one, can be

paged. The **Page Up** and **Page Down** keys are used to switch to the next higher or lower window number (between 1 and 9, as presently dimensioned). For any one window number of the window plot, there are 7 classes of data to be displayed in the 9 available lines: the numbers of curves to be plotted, window and Y-axis labels, Y-axis limits, grid colors, etc. Third, the editing window is no bigger than it need be to display all relevant information. I.e., the size is variable, depending on the data (the number of curves that have been selected for possible plotting will change from plot to plot). Fourth, when window plotting is toggled **Off** (a clickable button), the bottom pane is filled with summary information about use. Fifth and finally, a **Save** button has been provided to allow the user to preserve on disk current parameters of the window plot for later reuse. Just as HPGL*.LIS or POST*.LIS are used for the output files of HP-GL or PostScript, so WINDOW*.WIN is used for the just-mentioned output. The same double-digit serialization is used, along with a similar reminder in the dialogue window of any lower-numbered versions of the file that might exist. In conclusion, the new screen editor has made window plotting much easier and faster for interactive users. But a mouse is required. Once again, any reader who does not already have one is strongly advised to acquire one. Certainly cost is not a plausible reason to delay (as little as $10 should suffice if one can believe advertising in Portland newspapers).

JFGAIN is a new binary switch that controls the output of transfer function gain as the month of April ends . This is the interactive equivalent of the FOURIER GAIN ON and FOURIER GAIN OFF declarations of batch-mode plotting of the EMTP. Being controlled in either case is a possible additional column of the harmonic table that is produced by the FOURIER command. If it exists for TPPLOT , it will be found to the right of column 80, so will be invisible for the typical user unless the window is scrolled to the right. A value of unity for JFGAIN will add the column of gains whereas the default value of zero will suppress such additional, special output. Later access might be made more convenient, but for now, it is possible to request the gains only by using SET DATA : JFGAIN is integer cell 200 as explained in the TPPARAM.HLP file. By definition, gain for a particular harmonic is defined to be the present amplitude divided by the corresponding amplitude from the immediately-preceding harmonic table.

The LOG command continues to function as before. It toggles the binary switch that either uses or ignores the 10** operand that might apply to "time" values as they are read from a .PL4 file while number 6 (Frequency in Hz) is the choice of the TIME UNITS command. But the default status of the switch was changed on May 5th to agree with the description of HELP LOG (before, it did not agree). If the user does nothing, the program now will do nothing to the "time" value of the .PL4 file (i.e., the exponential function will not be used). The first LOG command now is viewed as a request to treat the "time" values of the .PL4 file as logarithms, so the exponential function is used to recover the frequency in Hz (if this is what is wanted). This seems more logical, and it should be easier to remember. Finally, the binary switch of the LOG command is a variable named NOALOG that is accessed using integer number 98 of the SET DATA command. Documentation is readily available in computer files : either look in disk file TPPARAM . HLP or use HELP LOG .

The HPGL command prompts for an output file name. Alternatively, the user is able to abort the command at this point if he wants. Prior to May 27th, this was done by sending character string -1, or by clicking with the mouse on the 2nd of two alternatives within square brackets: "-1 to abort". This has been changed to the text button ABORT following criticism by Dr. Mustafa Kizilcay of Lahmeyer International in Frankfurt, Germany. Dr. Kizilcay had wanted to name his file something such as FIG5-12.HPG (note the imbedded minus one), and was obviously disappointed to observe that the HPGL command was aborted as a result. Well, the switch to the ABORT button was easy and logical enough; it already was being used with the POST command. Logically, HPGL should be treated the same way.

MAXBIT is a new variable limit on the number of screen bit maps that can be saved for scrolling on the screen (using **Page Up** and **Page Dn** keys). It is connected to SET DATA by integer index number 60, and a default value of 20 has been provided for any program dated no earlier than Saturday, May 30th (the real Memorial Day, which this year politicians had us celebrate on the 25th!). Previously, the bit maps would just accumulate. For standard VGA they might require about 60 Kbytes each, so those with small amounts of paging memory (e.g., 4 Mbytes -- an amount that is adequate to run TP3 for all standard test cases) could conceivably run out of resources after many plots. The trouble would be fatal, of course: that famous DBOS termination of execution mentions *"Page memory exhausted"* as best your Editor can recall. Of course, the user could protect himself by regularly erasing the storage of bit maps himself prior to overflow (DEL ALL within BITMAP is all that would be required). Alternatively, now the user need only tell the program what limit to use (MAXBIT) , and bit maps will not accumulate beyond this. First, they will accumulate to the limit. Unless the user tampers with indexing, this will be in natural order. Thereafter, there would be wrap-around (e.g., from the default limit of 20 to the initial index of unity), with the old bit map deleted (the page memory is released) before a new one takes its place. At any point during this overlaying, if the user ever erases one or more bit map on his own, the associated newly-freed slots will be used before overlaying is resumed. To conclude, the logic is simple-minded but

effective. It should satisfy Dr. Kizilcay's needs at Lahmeyer International (the same FAX dated May 27th raised the problem). It is interesting to mention that Salford TPPLOT is being used in Frankfurt to plot so-called *swing curves* of transient stability (not EMTP output!), and there might be many, many such plots, of course.

MINPAG is a new minimum on the number of free pages (4 Kbytes is the size of each Salford page) of virtual memory that must exist in order that a screen bit map be saved in RAM. This is a second, different protection against running out of storage for screen bit maps. The new MINPAG differs from the preceding MAXBIT in that there is no overwriting of an old bit map when the limit is reached. Rather, a warning message will simply be dispatched to the dialogue window: *Note: Page memory is insufficient to store another bit map. Erase an old one 1st. Key values J17, MINPAG = ...* Here J17 is the inadequate number of unused pages (in fact, only the sum of free pages in extended memory and the swap file). Variable MINPAG is connected to SET DATA by integer index number 246, and a default value of 25 has been provided for any program dated no earlier than Sunday, July 26th.

The BOLD command of Apollo TPPLOT was added to Salford TPPLOT, and was generalized, on August 2nd. This was in response to an observation by Ralph Folkers of Iowa Public Service in Sioux City. The EPSON plot worked fine, he said, but was weak. Well, now curves can be widened arbitrarily to a maximum of one inch (as measured vertically by NYINCH pixels). No addition to MENU has been made, although the CONTROL submenu has been expanded to include BOLD. The mouse user will find full control within the editing window of CURVE where the former binary controls of connectivity have been generalized to be the pixel widths of the curves. The button NONE continues to produce all zeros whereas the original ALL has been changed to LINE (meaning a line having one-pixel width) and a new button UNIFORM has been added to extend to all later curves whatever value the user keys for the first curve.

New variable KOLCMD allows repetition of the command name for each associated line of the HELP display. In fact, KOLCMD is a Salford color number for the repetition (if used, it is aesthetically pleasing to use some color other than yellow in order to provide visual separation). The default value is zero, an illegal color number, which is interpreted as a request for no such extra, repetitive filling of the left margin. But the user can request the extra output using SET DATA : Integer index 245 is connected to KOLCMD as can be seen from the ineffective entry for this variable within the VGA subset of TPPARAM.DAT) . Your Editor prefers green, which is requested by color number 10, for the repetition. Concerning speed, the added labeling is free only if it has the same yellow color (corresponding to number 14) as the contents of the HELP window. For any other color, overpainting in the second color is required, and this slows the scrolling significantly.

Background color for graphics was added early in the morning of August 6th immediately following the telephone inquiry about this by Dr. Kizilcay in Frankfurt. Any reader who remembers PCPLOT of the University of Hannover will remember that Dr. Kizilcay has become accustomed to plotting on a blue background for years. So, a new variable named KOLBAK (color number of the background) has been connected to integer index 249. The default value is zero (an illegal color number), meaning a black background (your Editor's preference). But now Dr. Kizilcay can put the value of unity in the appropriate subset of TPPARAM . DAT in order to change the background color to dim blue.

It is worth documenting the high rate of speed at which HELP text can be scrolled on a 486-based PC using Salford TPPLOT, and explaining why this beats MIT's X Window System that typically is used with Unix. Using the mouse at maximum speed (digit zero of the **Speed=** control) with BPA's 33-MHz, 486-based computer, the 948 lines of text can be scrolled from one end to the other in just under 4 seconds. This is with**out** the added, repetitive labeling. **With** the added, green labeling, 6 seconds are required, reducing the rate to 154 lines/sec from the original 231 lines/sec. Of course, this still is extremely fast, and will beat any X Window System display of which the author has ever heard. The reason is simple: Salford windows display only text whereas the X Window System is graphical. I.e., even though window contents are pure ASCII text, the X Window System must display a bit map, which requires much more information. The Apollo Display Manager dating to a dozen years ago was decidedly superior for EMTP use because it kept the text as text and the graphics as graphics (but not bit-mapped as stored on disk). The two could be mixed in a window, although the two could not be displayed simultaneously. It was like paging a book: one had either graphical pages or text pages; one could not have a page with both text and graphics. In spite of weak hardware (originally 16-bit and 8-MHz or thereabouts), Apollo windows could be scrolled very quickly. In retrospect, this really was the ideal windowing system for EMTP use. Unfortunately, Apollo lost the workstation war to Unix-based and cheaper Sun Microsystems.

Cursor movement off the bottom edge of the screen when in text mode has been a problem of the 386-based computer used by Dr. Kizilcay at Lahmeyer in Frankfurt, Germany. Because a mouse driver that would properly constrained the cursor could not be located, drastic remedial measures were attempted on August 7th. Now, if the cursor ever is noted to be too far down, the program will force it vertically upward onto the final row.

LEC 's TPPLOT, an Interactive Plotting Program is the title of an 11-page paper by LEC staff, presented at the spring meeting in Greece (see next section). It is not known what prompted the references to *"BPA's TPPLOT"* in the fourth paragraph, which begins as follows: *"LEC's TPPLOT differs in several ways form (sic) BPA's TPPLOT (as being used on a PC386 / 486, for instance)."* Perhaps LEC is referring to what is called Salford TPPLOT by your Editor. For the record, there is a BPA version of TPPLOT, but it is used today only on DEC VAX / VMS computers, and has never been used on any Intel-based micro-computer to the best of your Editor's knowledge. Yes, Salford EMTP and TPPLOT are used **at** BPA, but that does not justify the confusing reference by LEC. The minutes at the front of the book states: *"Following observations/critical remarks were made by the audience: - desire to enable the comparison of curves, belonging to different plot files ... - Desire to be able to export ASCII files ... - It is desirable to offer the user a numbered list of variables out of which he should select by number ..."* It is surprising to read of such requests since each of these named features was available in the TPPLOT code for Apollo during 1990 (when Apollo was last used at BPA). If your Editor's TPPLOT for Apollo was not the starting point, from where did LEC begin, and why? For Apollo, it is not obvious that LEC has improved plotting with its new program.

News from Outside USA and Canada

Those 13 UTPF segments from LEC (see column 1 on page 4 of the preceding issue) have not yet been merged with our own, unfortunately. But they will be. The plan remains to return our revised UTPF to Leuven when the operation has been completed.

The Korean EMTP Committee (KEC) agreed to license Salford EMTP users in that country using a modified version of our North American form letter dated 30 Jan 1992. This was in FAX dated May 7th from Sang Kee Park, who has signed as Chairman of KEC and Director of the KEPCO (Korea Electric Power Corporation) R & D Center. BPA responded by Air Mailing Salford EMTP (including the fourth disk for TP20) to Korea on May 11th.

Doshisha University, the home of Prof. Akihiro Ametani and his former student Naoto Nagaoka, has been added to the EMTP mailing list of BPA. Note carefully that it is the university, not the user group (the Japanese EMTP Committee, abbreviated JEC), that will be receiving ATP materials from BPA. Yet, with Can/Am blessing, copies of this newsletter are being passed to JEC (headed by Prof. Ametani) for reproduction and the dissemination to anyone having interest. So, our writing about ATP is available to anyone having interest in Japan.

A VISA card can not be used by those overseas to order ATP materials from the Can/Am user group! This is the latest addition to the list of ways (see preceding issue, top of column 2 on page 4) recipients have been trying to modify the conditions of the user group offer. The latest creative attempt came from the eastern Mediterranean attached to a letter dated April 24th.

Switzerland and Saudi Arabia followed Yugoslavia and Germany (see page 4 of the preceding issue) as countries from which requests for information about ATP were received. Large international companies (ABB and Aramco, respectively) were involved, so offices in this country served as natural relay points to forward materials. Then Prof. Mohan advertised his short course in Europe, and many European inquiries were received (see separate story). In addition, there has been one from Australia and two from Bolivia.

The Indian and South African EMTP user groups have not yet responded to two separate mailings from BPA. First there was the 80-page mailing that included old newsletters (see previous mention). Second, on May 11th, there was the just-printed April issue and an official preprint of Laurent Dubé's paper in ETEP (the European Transactions on Electrical Power Engineering). Until there is an acknowledgement of reception, and an expression of interest, no more EMTP material will be sent by BPA to these two contacts of years past: 1) George Mijne of Electricity Supply Commission in Johannesburg; 2) M. Arjunamani of National Thermal Power Corporation (NTPC) in New Delhi.

The Greek island of Crete was to be the site of the European spring meeting June 5th through the 7th as announced by advertising that was mailed to BPA by N. D. Hatziargyriom of National Technical University in Athens (NTUA), Greece. Enclosed was an 11-page (half pages, actually) program entitled *"21st EMTP Users Group Meeting,"* and one sheet of illustrated color advertising of the Orthodox Academy of Crete (OAC) . The VENUE section of the program summarizes the OAC as *"... a well organized Conference Center situated at Kolympari. Kolympari is a small village of unique natural beauty on the North-western coast of Crete, about 15 km west of Chania."* One change from past meetings is the weekend format: the initial socializing was scheduled for Friday evening between 20:00 and 22:00 rather than Sunday evening. The schedule for Saturday certainly is full. It begins with Breakfast from 7:30 to 8:30 and ends with an *"Official Dinner"* from 20:00 to 24:00. In between is included *"Free Time (swimming, etc.)"* between 12:00 and 13:15 (no, this is **not** lunch, which was scheduled from 13:15 to 14:30!). There also was an abundance of technical material. The program shows 25 separate, titled presentations, with each item scheduled for an interval of 15-minutes. For those who attended, that Saturday, June 6th, must have been one of the more exhausting and memorable on record! The associated,

bound conference proceedings would seem to set a new standard for size and sophistication, too. Your Editor can not remember a more voluminous collection. More authors are using electronic publishing, so the average paper appears more professional than in years past. If your Editor criticizes some politics and computer work of LEC, it is important to emphasize that there is nothing but praise for the technical content of the biannual European EMTP User Group meetings and the way copies of papers are distributed to others.

FGH in Mannheim, Germany, will be giving some workshop on September 22nd that will include a 12-page introductory paper about EMTP. Coauthored by Ir. Bernd Stein of that organization and Dr. Kizilcay of Lahmeyer, the presentation will include color VGA projection of Salford EMTP and TPPLOT execution under DESQview on a 33-MHz 386-based computer.

IBM mainframes have never been used for the support of ATP in the United States or Canada, to the best of your Editor's knowledge. This was the response to a question by Marco Polo Pereira of FURNAS (the Latin American EMTP User Group) in Rio de Janeiro. It may seem hard for some to believe, but little usage of time-shared computers remains in the United States and Canada for the support of ATP ; and none that does remain involves IBM mainframes.

EMTP News is the journal published by LEC to which members of the Can/Am group can subscribe for $15 for the current calendar year of four issues by mailing a check payable to Tsu-huei Liu. A third order arrived immediately before mailing the March issue, so the figure "2" mentioned in the preceding issue must be corrected. Another five (including two obtained at Prof. Mohan's Seattle short course) were added prior to mailing of the 65-page June issue on July 25th (the once much-larger subscription list is growing back slowly). One of the recent resubscribers attempted to order photocopy of issues from previous years. Do not do this, as it just complicates the process for all (the excess must be refunded by means of a second check).

Kizilcay Frequency Dependence

Dr. Mustafa Kizilcay will be publishing his paper about frequency-dependent network equivalents in ETEP (the *European Transactions on Electrical Power Engineering*) following his unfavorable reception by unknown IEEE PES reviewers earlier this year. The switch from IEEE to ETEP parallels the experience of MODELS developer Laurent Dubé, recall, and it enjoys the enthusiastic support of your Editor. In FAX dated August 5th, Dr. Kizilcay indicates that his modified manuscript already has been accepted, and that he will send an ample supply of preprints as soon as they are available. Just as with the preceding Dubé paper, BPA plans to share copies of the Kizilcay paper with its primary EMTP contacts.

New Salford EMTP FORTRAN was mailed to Dr. Kizilcay on August 7th in response to a request from him in FAX dated August 5th. Following agreement earlier this year with Laurent Dubé, Dr. Kizilcay now writes that he wants *"... to complete and test the modifications and improvements ..."* Your Editor encourages either Mr. Dubé or Dr. Kizilcay to summarize this important change to Kizilcay frequency dependence in some future publication. The story really is not your Editor's to tell.

BPA Likes Trondheim Data Assembly

Hans Kristian Hoidalen is the doctoral student at the university (NTH) in Trondheim, Norway, who has been working for several years on a program to assemble EMTP data graphically. That is, a mouse is used with pop-down menus to assemble a schematic diagram of interest, and the EMTP data cards that correspond to it. Most recently, this work has interested those who are involved with relaying at BPA. Your Editor first heard of the work perhaps two years ago while talking by telephone with Dr. Bruce Mork of North Dakota State University when he was a visiting researcher in Trondheim. Since then, Dr. Mork has been critical to the task of informing BPA more about the work, and connecting BPA with Mr. Hoidalen.

The approach used at NTH in Trondheim has a number of attractions. Critically important is that it avoids royalty payment by the average potential end user. Contrast this with LEC's earlier initiative that was highlighted at the 1988 annual meeting in Leuven. LEC relied upon AutoCAD with its AutoLISP feature, which was expensive (several thousand dollars). The program by Hoidalen requires nothing more than what already is universal: an ordinary MS-DOS computer with VGA graphics and a mouse. For details, see Mr. Hoidalen's article on pages 32-44 of the December, 1991, issue of *EMTP News* .

James L. Hall is the person at BPA who would be most directly involved with all phases of possible BPA support for Mr. Hoidalen's program. Attached to the Division of Substation and Control Engineering, Mr. Hall was the first to suggest to your Editor that existing BPA contractors might be used to work on tasks of common interest. In simplified form, collaboration might work this way. Taking a user's perspective, BPA should be able to recognize what is lacking. Then, Mr. Hoidalen would decide what changes might be required to meet the objective. If this were sufficiently self-contained, it might be passed to a BPA contractor.

Hans Kristian Hoidalen can be contacted at: Hoyspenningsteknologi Institute for Elkraftteknikk;

Norges Tekniske Hogskole (NTH); 7034 Trondheim; NORWAY. The FAX number is: 47 - 759 - 4279.

More about Electronic Mail (E-mail)

CompuServe limits that apply to the flat rate of $7.95 per month (see preceding issue, page 5, column 1) are reasonable according to subscriber Laurent Dubé. This is the excellent news for any ATP user in the United States. Thus far, Mr. Dubé reports that he has never exceeded whatever CompuServe limits apply to the size of messages (there must be some). He has been writing E-mail letters to whomever he wants around the world while paying only the flat rate of just under $8 per month. The final such report, based on an audit of his bills of the last 3 months, was received by voice mail from Mr. Dubé on July 22nd. Having abandoned hope that BPA's computer or telecommu-nications establishment will provide such service for BPA engineers within a reasonable time, your Editor himself subscribed to CompuServe as a private individual on July 27th. Because only a first name and a middle initial were permitted on the registration form, your Editor specified "Scott W". His new CompuServe User ID number is "71155,1153".

Canadians, too, certainly can subscribe. The standard order form includes a footnote that reads as follows: *"* Canadian orders: Please make cheques and money orders payable in U.S. Funds. Add $5.50 U.S. shipping and handling charge per kit, plus 7% G.S.T."* But the critical, unanswered question is about free, local access numbers: Are they scattered across Canada with the same or better frequency as for the United States? Remember, it is the avoidance of long distance telephone charges that makes CompuServe attractive economically to the average American.

Harald Wehrend of the University of Hannover recently noticed advertising for CompuServe in some German publication. During a telephone conversation early in the morning of July 22nd, Mr. Wehrend told your Editor that he had responded in writing with a request for more information, but had not yet received any response. Of course, E-mail service already is available at the University of Hannover just as it is at every other European university with which your Editor has knowledge. But what about those not having such an institutional connection? It will be interesting to learn what a private connection to CompuServe costs overseas. Dr. Liu has asked Taiwan Power Company about availability in Taipei (yes, CompuServe advertising does show a telephone number there).

Dr. Mustafa Kizilcay is a valued collaborator in ATP development who exchanges information with BPA by continuing association with the University of Hannover. Working at Lahmeyer International in Frankfurt, Dr. Kizilcay reports the following in FAX dated August 5th: *"Now, anyone can reach me directly using E-mail. Lahmeyer has a connection to Eu-net. My e-mail address is ... KIZILCAY@LEFRA.LIF.DE"*

WordPerfect 5.1 files for this newsletter, dating back to April, 1990, were mailed to Dr. Bruce Mork at NDSU in Fargo, North Dakota, on June 11th. Along with the conventional ASCII file containing Prof. Ned Mohan's short course advertising, these were used to initialize the library of files that can be copied by any E-mail user. The following description (remainder of this story) came from Dr. Mork on July 27th in a disk file named FTPATP.NWS :

ATP / EMTP MATERIALS NOW AVAILABLE VIA FTP !

An anonymous ftp repository has been established to contain information and utility programs useful to registered ATP users. So far, contents are mostly past issues of Can/Am News, a few utility programs, etc. This is just a start, as more and more will be added.

To access this information, your local ethernet needs to be able to perform ftp transfers. For help, talk to your local computer support expert for details of how to use ftp.

To access these files, do an ftp login to plains.nodak.edu (IP number is 134.129.111.64). Give your e-mail address as the password. Upon login, the default directory is /keeper/anonymous. ATP materials are archived in .ZIP files and kept in several subdirectories as follows:

/keeper/anonymous/pub/atp/canam -- past issues of the Can/Am newsletter in WordPerfect format with Glyphix soft fonts, starting April 1990.

/keeper/anonymous/pub/atp/bpamem --- BPA EMTP Memoranda (none yet available).

/keeper/anonymous/pub/atp/util --- Utility programs useful to the ATP user. These include programs like UUENCODE, WP5LOOK for browsing Word Perfect files, etc . These programs are public domain, shareware, or royalty free to licensed ATP users. Be sure to register shareware software.

/keeper/anonymous/pub/atp/dcase -- Sample data case files, to demonstrate certain capabilities and usage of ATP. Intended to supplement the DC files distributed with ATP. (none are yet available).

/keeper/anonymous/pub/atp/ruleb --- Updated manual pages for ATP rulebook.

/keeper/anonymous/pub/atp/course --- Announcements for past and future ATP courses and seminars.

As registered users of Salford ATP, it is assumed you

already have the PKUNZIP program for unarchiving .ZIP files, so it has not been placed in the util subdirectory.

Later on, readme files will be added to each subdirectory to describe the contents of each of the .ZIP files contained therein. Right now, there are so few files that descriptions are not necessary.

Multi - Phase Transformer Modeling

Both North Dakota State University in Fargo and Seattle University in the state of Washington continue to work on low-frequency, multi-phase, nonlinear transformer modeling under contracts with BPA. Current thinking is that both efforts might terminate around the end of the year.

Prof. Chen was the first to report trouble using the "less than" sign with a Salford program. For example, RUN77 TP3 < DC3. Whereas hundreds of users do this without difficulty, Prof. Chen's computer with MS-DOS Version 3.31 produced an extraneous "^J" at the beginning of each record that was read from the file. Somewhat disbelieving at first, both Co-Chairmen saw for themselves following completion of Prof. Mohan's short course on July 17th. Otherwise, Salford programs seem to execute correctly. So, until Prof. Chen might update his operating system (MS-DOS), the advice is to avoid "<" use with Salford programs.

The interface of Prof. Chen's program to Salford EMTP was constructed by your Editor during the final week of July and the first week of August. It finally was rushed to Seattle by Federal Express on August 5th. As this issue is being frozen for printing on August 9th, Prof. Chen is replacing your Editor's dummy subroutine XFCHEN by his own real code.

IEEE COMTRADE .PL4 Files ?

The IEEE COMTRADE standard for .PL4 files could well be the common interface between ATP and the EMTP of DCG / EPRI. This interesting observation was made by Thomas Grebe of Electrotek Concepts during a telephone conversation with Drs. Liu and Meyer on June 15th. Preceding FAX from Mr. Grebe had requested details of ATP .PL4 file format in order that Electrotek Concept's generalized plotting program (TOP, The Output Processor) could be made compatible and sold in the vast market of ATP users. For the record, the Can/Am user group refused, saying that Electrotek Concepts remains EPRI's agent for EMTP work, and is no longer licensed to receive ATP information. Electrotek is ineligible for **free** licensing, which is limited by current Can/Am rules to those who are **not** voluntarily and substantially involved with *EMTP commerce*. To support the denial, your Editor read to Mr. Grebe the statement by Electrotek that was quoted in the middle of column 2 on page 6 of our newsletter one year ago (July, 1991).

A COMTRADE-compatible format for .PL4 files should be standardized by the IEEE PES working group that is concerned with EMTP. This was the recommendation of an official letter from Robert Hasibar of BPA to Dr. Keri of AEP dated June 26th. The most specific paragraph (remainder of this story) summarizes the need: More than just acceptance of the COMTRADE standard is needed, however, by those who develop and maintain EMTP-like simulation programs. Programmers need to know what output quantities should be provided, and precisely what common format might be acceptable to the largest fraction of potential users. If certain well-known assumptions or limits of existing .PL4 files of EMTP (e.g., the use of a maximum of two 6-character names to identify a signal) are to be removed or modified, this should be agreed to by all. If new output quantities are required (e.g., relay engineers request switching times that are not presently a part of .PL4 files), these should be identified. It is only by means of such detailed specifications that we can maximize the likelihood of compatibility between one program's COMTRADE-compati□□□ output and another program that is supposed to be able to read COMTRADE files.

Thus ended attempts by EMTP developers at BPA and the user group to share with industry the responsibility for formulating specifications of COMTRADE-compatible files of EMTP output. Mr. Hasibar, who attended the working group meeting in Seattle, reported no significant support from others.

Any hope for guidance from G.E. in Philadelphia was abandone□ on July 20th when a programmer who was working with Mr. Adamiak called to request details of ATP .PL4 files --- **not** to cooperate with BPA or other ATP developers, but to do the work herself. Your Editor did promise to supply the existing disk file of documentation, but he reminded the caller that nothing related to COMTRADE specifications ever had been received from Mr. Adamiak (see the first mention on page 5 of July, 1991, issue). Your Editor explained that he was disappointed now to learn that G.E. might do the work itself, and presumably retain (i.e., not share with others) the computer code that would perform the conversion. When asked whether he would FAX the requested documentation, your Editor refused, citing lack of cooperation by G.E. on the subject. For the record, a printed listing of disk file PUGET.LIS was mailed to Philadelphia by First Class the following day.

EMTP developers at BPA have decided to go ahead with COMTRADE compatibility of ATP or TPPLOT on their own. Details should be available in the following issue. The story is important, but there is not sufficient space to complete it in this already-bloated issue.

Criticism of LEC Speed Trials

"ATP5 performance test" is the title of an article by LEC authors Guido Empereur and Marc Mangelschots that occupies pages 4-9 on the June, 1992, issue of LEC's journal, *EMTP News*. According to the opening sentence, this article *"should be considered as a correction of previous articles."* Well, your Editor does not recall reading any previous reports, but he certainly noticed this one, and has serious concerns about how it might misinform readers.

Speed trials would seem to be just one of many subjects about which LEC and BPA have differing opinions or approaches. While not the most important subject, timing nonetheless is of interest to many. Because your Editor's name was mentioned twice in the text of the LEC article, clarification would seem to be appropriate. Your Editor is resolved to take the time to explain fully differences on this subject.

Of course, if some timings previously reported by LEC for the HP9000 / 700 RISC workstation really were in error by a factor of ten, this is reason enough to publish a correction. But the June results certainly should not be considered to be the final word about the speed of different computers. In your Editor's opinion, the basic controls that were applied to the time trials were unreasonable. As a result, it is easy for the unsuspecting reader to draw erroneous conclusions. Most importantly, the simulation speed of Salford EMTP on Intel 486-based computers is not accurately portrayed. That much is known for sure.

LEC's use of total job time rather than just time spent within the time-step loop is a fundamental change from benchmarking by your Editor. The LEC authors explain this change by saying: *"... probably, a user is more interested to know the total job time."* Your Editor would agree **provided** a qualification such as *"of realistic problems of interest"* is added. The problem with LEC's application of the unqualified principle is simple enough: most standard BENCHMARK DC-XX test cases are **not** realistic problems of interest. They never were intended to be. No one knows this better than your Editor, who has maintained the set of test cases over the past 20 years. Rather than test speed, the BENCHMARK DC-XX series of test cases was designed to verify correct operation of the many different alternatives of the program, basically. Most data cases are artificially small in order to make their consideration (including frequent solution) more easily manageable -- particularly for slower computers. Also, for most cases of simulation, the ending time TMAX is artificially short. As a result, one must be extremely careful when using standard DC-XX test cases to evaluate computer speed.

Simulation speed is what is of primary interest to most users of EMTP, your Editor would argue. Yes, one could look at the speed of load flow solution or FREQUENCY SCAN or other use. But for most, the alternatives to simulation are special cases of only marginal interest. So, if simulation speed is of primary interest, it only remains to decide how best to measure it. Your Editor would argue that total job time as used by LEC certainly is **not** a good way for most test cases because the networks simply are too small, or the data is too simplified, or the simulations are too short. In such cases, too little time is spent simulating, and this time interval is masked or overshadowed by other delays such as the time to start the program, or the time to produce output. Proportions are important for timing, and most test cases are deficient in this regard. As an illustration, consider DC-68 which is the first entry in the three pages of LEC tabulations. Times for all seven subcases are shown in seven rows even though the first six are for extremely simple data sets that are simulated for a negligible duration (none takes more than 10 time steps). One can not expect to draw meaningful, real-world conclusions about simulation speed from such trivial experiments --- particularly using total job time as the measure of performance.

An Intel i860 accelerator card was suggested by General Dynamics during early July when your Editor was telephoned to discuss how the speed of EMTP simulation might be increased. There certainly would seem to be plenty of need at the Electric Boat Division in Groton, Connecticut, where a typical simulation may last 4 or more hours on a 33-MHz 486-based computer. These are individual, single simulations, not Monte Carlo studies! So, there has been substantial waiting for EMTP results in Groton, recently. This is the real world of large problems and many time steps for which total time is only slightly larger than time spent within the time-step loop. For readers who are not aware, General Dynamics in Groton has funded Prof. Dennis Carroll's work with the U.M. in Gainesville during the past couple of years. It seems that time-step size DELTAT of 5 microseconds typically is required. Yes, an i860 accelerator board is being given serious thought! It would not be that expensive.

"... output was routed to screen for every system" according to LEC's point 3 on page 4. Your Editor objects strenuously to this control, which effectively changes the performance criterion for some computers from speed of simulation to speed of screen display. Unfortunately, the speed of screen display may be as much a function of output hardware or display software as it is of basic computer power. Critical output hardware of the typical Intel-based microcomputer is the so-called output card, and its connection. Critical display software certainly would include the X Window System from MIT, if it were being used. This bit-mapped standard will slow the display badly if it is used with conventional hardware. Your Editor and Laurent Dubé first saw this during their demonstration of Unix on your Editor's 16-MHz, 80386-based computer

at the Cal Poly short course in San Luis Obispo three years ago. For the larger time-shared computers (a DEC VAX 8530 and an IBM mainframe seem to occupy the final two columns of the LEC table), speed of output typically is limited by the baud rate at which terminals are supported. While not dismissing the importance of speed of display, your Editor would argue that it is an extra, peripheral variable that LEC would better have ignored. The waters of computer output speed are deep, treacherous, and shark infested. In your Editor's opinion, LEC swimmers made a very serious mistake by not sticking close to the well-defined, safe, and proven beach of EMTP simulation speed.

Intel 80486-based computers are **not** favorably portrayed by the LEC article --- even for meaningful tests. The problem is more serious than just the choice of test cases. LEC tabulates results for eight different computers, and the sixth of these has a column heading that reads: "PC 486; SX-25MHz; MS-DOS 5.0". Why anyone would consider a 486-SX at all is beyond your editor's comprehension, but that is a whole other story (about how Intel crippled its regular 486 to produce the 486-SX) for which we don't have time now. The conclusion is this: **Readers should not be misled by the poor Intel microcomputer performance that has been reported by LEC.** As an illustration, consider that previously-excepted 7th of seven subcases of DC-68. This **does** provide a meaningful test requiring 12.98 seconds (LEC's number) on the powerful IBM RS / 6000 RISC workstation. Yet, the 33-MHz 80486-based personal computer used by your Editor at BPA beats this when output is sent to disk! Whereas LEC reports 39.613 seconds for a 486-SX , your Editor found a total job time of only 12.58 seconds in disk file D:\DATA\DC68.LIS ! This was created the last time all test cases were solved by the command file RUN.BAT, which includes one line for each test case. For DC-68 : RUN77 TP3 < DC68.TEX .

"All platforms were situated in a networked environment, except for the PC which was used stand alone. This means that the performance listed is influenced by the network load," LEC writes. This qualification is not well understood. It is assumed that all multi-user systems were reporting **process** time rather than **wall-clock** time, so other tasks or connections of the computer should not affect the EMTP times significantly. Certainly this was your Editor's experience during his years of work with DEC VAX / VMS computers. Much more important for speed trials should be the distinction between process time and wall-clock time. Salford EMTP running under MS-DOS has only wall-clock time. Yet, the LEC authors did not mention this distinction. For any of the other 7 computers of the comparison, wall-clock times would be longer than the reported process times --- even if the time-shared computer was preoccupied with no other work. This is particularly true where significant I/O is involved (remember, most of the LEC tests do not accurately reflect simulation speed).

LEC chose to disable batch-mode vector-graphic plotting. As one who favors the measurement of just simulation speed, it is hard for your Editor to argue with the LEC decision. But where is the consistency? Why should LEC ignore the time to produce graphical output at the same time it emphasizes other I/O? No, it is **not** *"necessary to press a key or wait for a certain period before the calcomp plot will disappear"* in the case of Salford EMTP --- unless one considers zero time to be *"a certain period"* (joke)! As explained in the READ_ME.DOC file on the GIVE2 disk of Salford EMTP distribution, it is STARTUP variable D4FACT that controls the delay following new batch-mode screen graphics. Zero is a legal value for the delay time in seconds.

Footnote [2] on page 9 states that, for Salford EMTP, *"... speed is independent of ... whether paging to disk is used or not."* To save readers the anxiety of wondering whether they are going crazy, your Editor will attempt to clarify this confusing statement. It should be clear to all that paging to disk is much slower than paging to RAM. If LEC observed no significant difference in elapsed times, it simply means there was **no** paging to disk! End of story (it is that simple). Using Salford utility CONFIGDB to allow for possible paging to disk is not the same as actually doing the paging, obviously! This should be clear to anyone who read the first report of successful Salford EMTP execution at the University of Hannover (the 12-page paper by Messrs. Kizilcay and Riedel was published in the December, 1989, issue of *EMTP News*) .

BENCHMARK DC-1 is the largest of the standard test cases. Because its burden is substantial, DC-1 is being used more frequently to time fast computers (see page 2 for the latest Salford EMTP times). But nowhere is an entry for DC-1 seen in the LEC table. Why show the results for numerous trivial subcases while ignoring completely one of the more meaningful cases? It makes no sense.

Mohan Course in Seattle July 16-17

Prof. Ned Mohan of the University of Minnesota again gave his 1.5-day EMTP short course --- this time in Seattle, Washington, immediately following the IEEE PES Summer Meeting. This was July 16th and 17th at the Radisson Hotel next to the airport, where 28 paying (and 2 non-paying) students participated, and Faculty was as advertised: Profs. Mohan, Riaz and Albertson from Minneapolis, John Kappenman from Minnesota Power in Duluth, and your Editor and Dr. Liu from Portland.

The first reply to advertizing came by telephone on

May 15th. During the following 2 months that preceded the course), information about ATP was mailed to a total of 87 new addresses and an unknown number of old ones. The wave of responses was larger this year than it was one year ago (see the end of column 2 on page 6 of the July, 1991, issue), but it was less concentrated, fortunately. New this year were requests from Europe (24 of the 87).

Prof. Akihiro Ametani of Doshisha University in Kyoto, Japan, had hoped to be an unadvertised lecturer about cable modeling. Unfortunately, this had to canceled via FAX on June 9th due to a conflict with regular work (examinations) back home.

Color VGA projection was better in Seattle than it was during previous courses in Dallas and San Diego because this time a special, higher-power projector was brought from Minneapolis. This uses a bulb that costs $550, but is supposed to last 2000 hours! The lights were not dimmed once in Seattle. Two screens were illuminated. On the left were a conventional overhead projector and screen that were used for conventional transparencies; on the right was the special projector that normally supported the plasma overlay that was driven by one of two computers (the portables of Prof. Mohan and Mr. Kappenman both were used). At the same time, Prof. Riaz and Dr. Liu were hard at work using their own 386-based notebook computers at the back of the room. In summary, this was an unprec-edented demonstration of MS-DOS computer power, considering that the course was given on the road.

Most students returned home with a new copy of Salford EMTP. For those who provided 4 floppy disks of their own, TP20 was provided as well as TP3. For those not having disks, a box of 50 user group disks were formatted and copied in the usual sets of three. Prof. Riaz and Dr. Liu where formatting and copying so relentlessly Friday morning that their battery chargers could not keep up with the load (apparently when disks are being copied, there is a drain on the battery even though the ac power supply is in use)!

The superb shareware utilities FC (Mike Albert's File Compare) and LIST (Vernon Buerg's disk file searching and viewing program) were demonstrated, and were made available to anyone requesting copies. This is one advantage to being on the road with only notebook computers: the use of 1.44-Mbyte rather than 1.2-Mbyte disks means there is unusual free space for such extra attractions that come to BPA from Public Software Library in Houston, Texas, via member Laurent Dubé.

Two students were from overseas (one from Madrid, Spain, and the other from Pavia, Italy), and they acquired ATP Rule Books in addition to floppy disks. Your Editor had expected to travel to Seattle by automobile, which would have allowed more room for baggage. But as it turned out, air planes were used instead, and only two copies could be carried easily. The urgent need perfectly matched the supply!

Goldsworthy's BPA hvdc Data

BENCHMARK DC-1 simulates the 1360-Km, 500-Kv, hvdc intertie between Celilo (near the Dalles, Oregon, on the Columbia River) and Sylmar (near Los Angeles in Southern California) as first conceived during the mid '70s. By popular demand, newer, much more detailed data dating to the mid '80s has been provided by Daniel Goldsworthy, BPA's expert hvdc simulator. Salford EMTP users will find all associated files compressed within disk file HVDC.ZIP on the GIVE2 disk beginning May 15th when the first copy was mailed to Rao Atmuri of Teshmont Consultants in Winnipeg (Manitoba, Canada).

Summary statistics of the old and new simulations reveal just how much the modeling has changed:

Old	New	Statistic of interest
1324	4212	Number of input data cards
402	667	Number of network nodes
734	1173	Number of network branches
120	173	Number of EMTP switches
327	1812	486 speed ratio to real time

In part, the modern EMTP data is bigger because the converter hardware is bigger. Voltage of the line was upgraded from 400 kV to 500 kV by the addition of a fourth bridge in series with the original three for each pole at each line end. Yet, most of the increase in complexity is in the controls, which are represented by TACS data. Note the final statistic, which indicates that the new simulation speed is only about 1/6th of the old. This discouraging slowdown is due to more than just an increase in model complexity, however. The time-step size was reduced from 100 to 40 microsec in order to make subsequent transient simulations more accurate. After adjustment to account for size of the time-step, the ratio of simulation rates falls to 2.2 -- a more believable measure of relative complexity.

Several EMTP and TPPLOT limits were enlarged to accommodate the latest hvdc modeling. First, a user is warned that LIMCRD of startup must be expanded from 3000 as distributed by the user group: it must exceed the number of input data cards (by a factor of two if there were sorting by class). Second, list size 7 of VARDIM was expanded from 2140 to 5140 for TP20. This is the number of distinct 6-character names that are used (for nodes, etc.). Third, fixed local storage SWCOLD for the current of Type-12 switches (Triacs) was increased from 10 to 50. Finally, storage for the number of A6 names within Salford TPPLOT was increased from 1375 to 2750.

LISTSIZE.DLG is VARDIM input that is adequate for running the new hvdc simulation. Yes,

the standard TP20 could be used, but when tables are dumped for START AGAIN use, TP20 places an enormous burden on the disk. For Teshmont, a special version was dimensioned. Although the data case is big, it is specialized. Other than much TACS and a healthy number of nodes, branches, and switches, there is not much else. Tables for the redimensioned program are smaller than those of TP3 : they require only 722 Kbytes of disk space!

"Controls modelling and verification for the Pacific Intertie HVDC 4-terminal scheme" is the title of IEEE PES paper number 92 WM 292-3 PWRD that has six authors. The first four, Messrs. Hammad, Minghetti, Hasler, and Eicher, are with ABB Power Systems in Baden, Switzerland. The final two, Messrs. Bunch and Goldsworthy, are with BPA. It is understood that the EMTP data of the present article was used as the starting point for this more recent series of studies by ABB, which was a contractor of BPA.

START AGAIN is particularly valuable for hvdc simulation because such studies take so long (compared with ac simulation) to reach the non-sinusoidal steady state. For an illustration of START AGAIN usage, the reader should consider the matched pair of standard test cases DC-32 and DC-49. For the new hvdc model, the corresponding data cases are DAN1.DAT and DAN2.DAT . The first of these brings the system into the steady state within 200 msec at which point tables are dumped. The second data case reloads tables from disk, modifies one switch (to apply and subsequently clear a fault), and continues the simulation to 400 msec. The recipient can be sure that his answers agree with BPA's by looking in disk files DAN1.LIS and DAN2.LIS (not full output files, but rather just selected key lines that summarize the solution).

OLDTACS is the name of a new utility program that will convert TACS data of vintage 1983 or older to the standard of "M39." (July, 1984). This is needed in the present case because Mr. Goldsworthy's data is old. For BPA's EMTP that was in use at the time, it made no difference because Dr. Liu had written special code to convert old TACS data to new internally. But ATP does not have this code, so the separate utility OLDTACS must be used. This is trivial and quick. First, there will be a prompt for the input file, to which the user will respond by sending "DAN1." (as with ATP, the implied file type is .DAT . Then, as the conversion is performed, one line of output will be seen on the screen for each $INCLUDE that is involved (14 for this case). Finally, there will be a prompt for an output file name (your Editor supplied "OUT." to produce disk file OUT.DAT) .

Dates of all data files are indicated on comment lines by Mr. Goldsworthy. The interested user need only search for the key word "updated" which is followed by dates ranging from 1984 and 1987. For the historical record, what today are named DAN1 and DAN2 were named DC5B20 and DC5B20A (disk files of VAX/VMS storage). Names of $INCLUDE files were not changed, although several did require modification by the Section's VAX / VMS expert, Randy Suhrbier. When first passed to our 486 using PROCOMM , an extra two bytes of garbage preceded each line. This was a shock. We understood well about the loss of a column (the problem with VAX / VMS carriage control by file attribute), but we had never before seen bytes added by the file transmission! Mr. Suhrbier quickly concluded that the problem was caused by use of an old VAX file editor named SOS (the line editor that preceded screen editor EDT) . What a pain, these incompatibilities.

13 pages of schematic diagrams by Mr. Goldsworthy also were provided for Teshmont. Unfortunately, these require photocopying for distribution. Dated between 1983 and 1985, these electrical and control system diagrams are invaluable for anyone wanting to study details of the EMTP data, of course.

Using Microsoft Windows 3.0

Gerald Lee of BPA was the first to report use of Salford EMTP under Microsoft (MS) Windows 3.0 in **Enhanced** mode. This was the long-awaited, basic first step: execution of EMTP in the background (actually, in one of possibly many Microsoft windows) while the interactive user performs other functions in other windows. More than just report, Mr. Lee demonstrated execution for your Editor and others during the afternoon of Friday, June 5th.

The newer MS Windows 3.1, too, is compatible, of course. The first report of success using this came from Dr. Liu on July 9th as she prepared for the Seattle short course using her own 386-SX notebook computer. It is she who supplied the cook-book recipe for Salford EMTP use under Microsoft Windows 3.0 or 3.1. This is disk file ATPSETUP.LIS of the GIVE2 disk of Salford EMTP distribution that began on July 16th. Yet, that first version had several simple but important errors that were corrected during explanation to the class during the afternoon of July 17th.

DBOS is not to be run in AUTOEXEC.BAT as has been the case without MS Windows. This is a major change. If no Salford application is being executed at any particular time, the user is not aware of any Salford influence. Then, to execute Salford EMTP, the user of MS Windows clicks on an icon labeled ATP, a window opens, and a file ATP.BAT is executed automatically **just for this window** . The user creates ATP.BAT himself, so this is where DBOS and COMSPACE executions are placed. An icon is connected using the PIF

Editor as detailed in the *Microsoft Windows User's Guide; for the Windows Graphical Environment* (a Microsoft publication). WDBOS.386 is the new file of DBOS / 486 that provides the interface to memory management and other services of MS windows. This enters the SYSTEM.INI file as a device= declaration. During the installation of DBOS Rev. 2.66, the user will be asked whether he wants the declaration to be added automatically. The user group's recommendation is *yes*. This was Mr. Lee's initial choice, and operation seemed to be correct even though different directories were involved. When Salford DBOS execution begins within an MS Window, immediately following the line about no Weitek should be seen the confirmation: *"Running under WINDOWS 3 in enhanced mode."*

Screen graphics under MS Windows first were seen early in the morning of July 21st after your Editor made a minor change to initialization. Previously, Mr. Lee had demonstrated that TPPLOT executed, but screen graphics somehow were missing (the screen was blank). Yet, Mr. Lee showed that mouse buttons performed as they should. That is, button 1 marked the screen and resulted in an X-Y readout in the upper-left corner whereas button 2 resulted in the associated straight-line segment. This proved to be the key observation. It only remained for your Editor to adjust initialization: the addition of an extra CALL HAIRON (to add the graphic cursor) prior to plotting. Why this is needed, or why it makes a difference, is not known.

Microsoft windowing for TPPLOT differs from windowing that is used for ATP in one important way. Point C-7 of the ATPSETUP.LIS file indicates how: Repeat steps 4-6 to prepare for comparable execution of **TPPLOT.EXE** except select **Full screen** rather than **Windowed** for **Display Usage:** This refers to one minor remaining problem: a plot still does not look correct within an MS window; the user must take over the whole screen. Yet, this is what the interactive user normally would want, anyway, so restriction to it is not much of a hardship.

Icons for EMTP and TPPLOT are readily created using the icon editor of MS Windows --- provided one has artistic talent. Gerald Lee has a couple that were hastily constructed. Unfortunately, neither Co-Chairman has particular talent of this sort. At the short course in Seattle, some student asked whether standard icons were available to others. Dr. Liu laughed and said "*not yet.*" The idea is good, though. It makes sense to standardize the EMTP and TPPLOT icons in order that they are easily recognized on any computer just as standard MS Windows icons now are. If any readers have carefully-constructed, distinctive candidates that they would be willing to share with others, they are encouraged to send them to Portland for consideration. Maybe we should have a contest? We could show candidates in a some future issue, and allow readers to vote for their favorites!

A remote server for Windows 3.0 has been used successfully with Salford EMTP according to the first report that reached your Editor on Friday, June 19th. The computer in question is used by Jim Hall, who works on relaying at BPA (see story about Trondheim). Networking makes access to MS Windows slow, from what your Editor has seen. Why anyone would do this just to avoid paying $50 or $60 is a little hard to understand. But it did work with Salford EMTP !

Bruce Mork's Doctoral Dissertation

"Ferroresonance and Chaos" is the title of the dissertation that doctoral candidate Bruce Mork successfully defended in Fargo on May 18th. So, the title now is Doctor rather than Mister. Those who are intrigued by the title may find the first two paragraphs of Dr. Mork's 3-paragraph Abstract to be of interest. These following 2 paragraphs should convince anyone that ferroresonance is complicated! Incidentally, beginning Sept. 1st, Dr. Mork should be available in the Electrical Engineering Department of Michigan Technological University in Houghton where he will join a Salford user, Prof. Leonard Bohmann, on the faculty. The mailing address is: 1400 Townsend Drive; Houghton, Michigan 49931-1295. Dr. Mork's telephone number is scheduled to be (906) 487-2947 (or -2949 for FAX). Better yet, use E-mail: bamork@mtu.edu

Ferroresonance is a nonlinear LC resonance that can cause overvoltages, power quality problems, and damage in electrical distribution systems. Ferro-resonance has been researched for over 80 years, but its complex behaviors are still not fully understood. Observation and categorization methods must be extended to increase existing knowledge of ferro-resonance. Simulation methods must also be improved, mainly with respect to developing correct equivalent circuit models for transformers of various core designs. New theoretical developments in the area of nonlinear dynamics and chaos are identified as being applicable to the problem of ferroresonance.

Laboratory and simulation work is based on an actual five-legged core grounded-wye to grounded-wye distribution transformer, found in 80% of American distribution systems. Many ferroresonance problems are attributed to such transformers. Two new equivalent circuit models are derived -- one based on Ampere's circuital law and the other on duality transformations. Graphical observation methods from nonlinear dynamic systems are used to observe and categorize ferroresonant behavior. Parameter values for the duality-derived equivalent circuit are obtained from laboratory measurements. The Alternative Transients Program (ATP) is used to simulate excitation, ferroresonance, Poincaré sections and bifurcation. Several new means of

comparing periodic and chaotic waveforms are proposed, investigated and then used to compare ATP simulation results to laboratory measurements.

More Space for Monte Carlo Use

Beginning May 19th, much more working space became available to those who produce Monte Carlo simulations or tabulations --- but only for some program versions (including the most popular Salford EMTP for DOS computers, and DEC VAX / VMS).

Statistical tabulation of Monte Carlo simulations sometimes have failed because of inadequate working space. Prior to May 19th, only one floating point vector of size LSIZ23 (List Size 23) was used --- not only for statistical tabulation, but also to store the results of each energization (2 cells plus 2 switch vectors and one output vector for each). As the number of shots approaches infinity, any storage will overflow, of course, so it is not a question of handling all cases as long a RAM is used. It is possible that some day major reprogramming will be required in order to handle all practical cases; but not yet. A factor of nearly four has just been gained by very minor changes that allow the use of additional COMMON blocks.

Today, three REAL blocks and one INTEGER block of size LSIZ23 are available, as well as half a dozen or so much smaller blocks. The reform can be exploited for any program version that maintains the natural (input) order of COMMON blocks. Apollo and Sun-3 were prominent exceptions the last time your Editor checked. If there is any question whether the FORTRAN for any particular machine has been so enhanced, one need only look in installation-dependent SUBROUTINE SYSDEP for new variable L23TOT. If this does not appear, the new storage is not being exploited. The improved logic first was given to Doug Selin of Arizona Public Service in Phoenix (it was his overflow of Salford EMTP that prompted the delayed reform).

Salford Supports H - P LaserJet II

Those using Salford EMTP on Intel 80386- or 80486-based computers finally can produce free, high-resolution hard copy directly on Hewlett-Packard (H-P) LaserJet series II printers. Since all common laser printers seem to be advertised to be compatible with the standard-setting H-P product, this important progress of FTN77 / 486 Rev. 2.66 should extend direct, free, hard copy to the masses.

The LJ2 command of Salford TPPLOT is the laser equivalent of EPSON for dot-matrix printers. It was activated and demonstrated on June 13th when a genuine H-P printer at BPA first was driven at 100 and 150 dots/inch densities. Using default settings, a disk file PLOTXX.LJ2 is created, and this then can be copied to the LaserJet series II at any later time. This differs from EPSON use only in the file type and size (the higher resolution of laser printers requires larger disk space to store the bitmap).

Resolution of 75, 100, 150, or 300 dots/inch is possible. The choice among these is handled by the data of SET DATA 51. As distributed by the user group, the 100 dots/inch subset is in TPPARAM.DAT as reserved subset number 51. Alternate data can be found in TPPARAM.EXT which initially contains 3 subsets: a) SET DATA 4 for 768 x 1024-pixel screen graphics; b) 150 dot/inch LaserJet; c) 300 dot/inch LaserJet. The 150-dot density represents a reasonable compromise. It offers reasonable accuracy and speed while still being usable with printers that have only the minimum half megabyte of RAM . At 150 dots/inch, disk file size is 244 Kbytes --- about four times the size of an EPSON file, but still easily manageable. Doubling the density to 300 dots/inch quadruples the amount of information: disk file size is 953 Kbytes! So, use of the highest density makes no sense unless a real need for the higher resolution exists. Remember, 150 pixels/inch already is very accurate. Unless the user widens the curves with BOLD (a mouse user could use the edit window of CURVE), or possibly uses disks to mark data points, the width of a curve (and hence its visibility) decreases. At 300 dots/inch, all lines are fainter than most users would desire.

Salford TPPLOT can print a graphic bitmap on a time-shared basis without reliance upon any other time-sharing software such as Quarterdeck's DESQview. This extension for EPSON and LJ2 plots first became available July 8th following an inspiration by computer expert David Szymanski 2 days earlier. The Salford SPAWN@ and YIELD@ routines, which are associated with *threading* (a simplified form of multitasking within a single program) are being used to provide the time-sharing. This first was mentioned to readers one year ago (see the last full paragraph of column 2 on page 3 of the July, 1991, issue). Yes, Salford compiler developers did make changes following their discussions with us at BPA. For example, GET_KEY_OR_YIELD@ seems to be a new, implicit way to switch control to another process. Yet, your Editor did not see how to make the new Salford library routines work for our application, so naturally he was expressing his disappointment to any who would listen. Fortunately, Szymanski did not accept the presumed need for new capability. He had several ideas for alternatives, and within an hour, the third of these ("Plan C") worked, proving feasibility. Ironically, the solution now being used has nothing to do with new features of the Salford compiler.

JSHARE is the number of bytes that will be printed between opportunities for time-sharing with the keyboard or mouse. For weaker computers (e.g., a 16-MHz 386), it

probably is best to leave JSHARE at its default value of 256, or even reduce it to 128. For a 33-MHz 80486, a larger value certainly could be used without noticeable degradation of the interactive responsiveness. For BPA's 486, a value of 1024 is easily tolerable whereas 4096 resulted in noticeably jerky scrolling of the dialogue window (done using up and down arrow keys) during printing. Unless one is in a great hurry to produce hard copy, leaving JSHARE at 256 probably is recommended. Scrolling then seemed to be perfectly smooth for BPA's 486 (the burden of printing could not be detected). To make a change to JSHARE, use integer index 244 of disk file TPPARAM . DAT .

Printers without input buffers require special care, Szymanski has observed. Of course, any laser printer should not pose a problem (these require lots of memory to store the image being printed, and the input buffer would be negligible in comparison). But a minimal dot-matrix printer might not have storage for more than a single line. If any reader observes that time-sharing is only possible with each pass of his dot-matrix printer, this is the signal to decrease JSHARE to the size of the line buffer (presumably 80 minimum; maybe 132 or more).

QUEUE is a new command to control the printing of disk files by Salford TPPLOT. Not surprisingly, it, too, first was suggested by Szymanski. For the initial implementation, printing was all or nothing, and only when bit maps were created. Clearly, it was desirable for the user to be able to print his graphic disk files at any later time much as one has done for years with line printers that are connected to time-shared computers. Also, a user should be able to print non-graphic files. Well, as first made available during the weekend of July 25th and 26th, QUEUE provides the gateway to many choices about printing. As initially implemented, the queue is limited to 18 disk file names that are to be printed. These are displayed in the dialogue window by the SHOW subcommand. The printer queue can be started or stopped (subcommands START and STOP, respectively), and disk file names can be added to, or deleted from it (the PRINT and KILL sub-commands, respectively), at any later time. Finally, a disk file can be deleted after printing (the DELETE subcommand), if this is what the user desires. With the new QUEUE command comes a new location or sequence for printing. Previously, the printing of a single bitmap began immediately upon completion of the associated disk file. Now, the print queue is checked each time the basic, outer-most plot prompt is issued. If one or more file then is waiting, the time-shared printing is begun. Printing will continue until all disk files of the queue have been exhausted, at which time the spawned process will end. Initially, only line-oriented dialogue supports the QUEUE command although the extension to window editing (as used for CURVE, etc.) would have obvious benefit for mouse users. This is a promising subject for future development.

LPRINT is a new variable that either disables the printing of disk files by QUEUE (if non-positive), or indicates to QUEUE where the printer is connected. As distributed by the user group, the value is unity, which means that a printer is assumed to be connected to LPT1. This can be changed using SET DATA : it is integer index 243 that is connected to this variable. An entry for LPRINT will be found in the VGA subset (number 2 within disk file TPPARAM.DAT) as a way to remember the appropriate index. This has no effect because the value is unity.

80486-based Computers Are Cheaper

The prices of 80486-based computers continue to decline. This present story is a continuation of the one that began on page 6 of the January issue. The same computer store in suburban Portland is involved. However, because it already has moved about half a block to new, larger quarters, the complete address will be given: Ms. Mae Wu, President; FEI America; 15688 S.W. 72nd Avenue; Portland, Oregon 97224; USA. The voice telephone number is (503) 620-8640, and the FAX phone number is 620-8520.

For desktop computers to support EMTP, forget about 386s. At this late date, 386s appear a little anemic even at high speeds, and there is not enough saving in cost to justify the loss of speed (a factor of two or more). So, begin by considering a complete, DX (full-width and/or power) computer built around a 33-MHz 80486. With 4 Mbytes of RAM, a 120-Mbyte Western Digital hard disk (17-msec), both 1.2- and 1.44-Mbyte floppy disks, a 768 by 1024 color monitor and output card (with a full Mbyte of RAM!), 4 ports (2 serial, 1 parallel, and 1 game), a mini-tower case, Keytronics 101 keyboard, MS-DOS 5.0, a mouse, and Microsoft Windows 3.1. The cash price on July 27th for any BPA employee is an even $1800. If one prefers an American-made Cache motherboard, add $150. A 200-Mbyte rather than 120-Mbyte hard disk would add $210, but would gain 3 msec. Alternatively, a 174-Mybte Conner hard disk would add only $106.

True 50-MHz, 486-based computers are affordable ... today! This probably is the most important change from six months ago. The previous 33-MHz system could be upgraded to 50 MHz using an American-made Vega motherboard for just $316. Just as soon as a reader agrees to purchase this latest offering subject to correct EMTP execution, your Editor has promised to head for the Mae Wu's store with Salford EMTP disks in hand. For power-hungry EMTP users, this latest quantum increase in speed appears highly attractive.

End to FOIA for Computer

Programs?

FOIA, the federal Freedom of Information Act, has kept BPA's work on EMTP in the public domain since early 1985 when it was used successfully to challenge the claim of DCG and EPRI politicians that BPA work was to be sold commercially by EPRI as a sole source. Those readers who might be too new to the EMTP scene to remember these dangerous and exciting times are referred to your Editor's article on the subject in the March, 1988, issue of LEC's journal named *EMTP News* (see pages 31-40). Question: might the FOIA protection of BPA work on EMTP end some day?

Federal Employees News Digest is a weekly, 4-page newsletter concerned with employment of the U.S. government. The June 1st issue (Vol. 41, No. 42) contains the following miscellaneous item at the end: *"Software Bonanza -- Under pending legislation (HR-191 and S-1581), federal employees who invent new computer software could collect up to $100,000 for their efforts. The government would be allowed to copyright software for the first time and to grant the inventors at least 15 percent of the royalties up to the $100,000 administrative cap."*

Your Editor finds it hard to believe that any change this simple is likely to materialize as law. For one thing, the potential for abuse would be enormous. If partisan politics are prohibited by the Hatch Act because management can not be trusted to avoid coercing workers in a partisan manner, how could the same management be trusted to hand out $100K awards in an objective manner? Could Congress be this stupid (don't answer that question!) ?

News about Laurent Dubé's MODELS

Laurent Dubé has moved from Portland to the Oregon coast some 2 hours away. Do not use his old address; his former condominium has been sold, and the move is complete. The new address and telephone number are:

Laurent Dubé (503) 965-6337
35885 Nestucca Manor
P. O. Box 249
Pacific City, Oregon 97135

The variable-dimensioning of MODELS was briefly mentioned in the previous issue at the last minute when there was neither space nor time for any more details. It is worth documenting the reduced storage for MODELS in TP3. Dimensioning for TP20 has been left unchanged. The VARDIM data concerning MODELS is Lists 15 and 28. Before modification of the code, these were given the same values for TP3 as for TP20. Following the variable dimensioning, these two list sizes were blanked for use with TP3. This decreased the total table size LTLABL from 445K to 227K words. List 15 decreased from 64800 to 10800. Since the ratio here is 6 to 1, which is close to the ratio of 20 to 3, the proportions are typical --- finally.

Around mid-March, the outlook for using user-supplied FORTRAN of MODELS to represent General Electric logic for the TCSC (Thyristor Controlled Series Capacitor) project at BPA looked favorable. At least those at BPA liked the idea. But logic is a secret of G.E., and to date, those who control it in Schenectady have provided no details. No matter how a connection of the new logic to EMTP might be made, it is understood that only object code would be made available to BPA by G.E. Well, if and when any EMTP-related news about this important demonstration project that involves EPRI funding might be learned by your Editor, he will pass it along to readers. As this paragraph is finalized on August 9th, your Editor knows no more than he did back in March.

JMARTI SETUP : Shunt G , Etc.

Shunt conductance of JMARTI SETUP is keyed in columns 33-40 as variable GMODE if the default value of 3.2E-9 mhos/mile is not acceptable. For ac systems, this probably is important only in cases where the line is disconnected, thereby allowing trapped charge. As has been known for many years, the stability of voltage on the isolated circuit depends on the shunt conductance GMODE .

An added complication was just learned for the first time on July 13th from expert production user Daniel Goldsworthy of BPA. Mr. Goldsworthy revealed his discouraging finding that the value of GMODE to insure stability of trapped charge depends on the type of usage. There are two distinct cases: 1) simulation of the disconnection (watching ac become dc on the line after isolation); 2) simulation starting with trapped charge at time zero. The latter of these two is the case of common interest for which the default value of GMODE was selected. Unfortunately, recent usage at BPA has convinced Mr. Goldsworthy that a larger value of GMODE is required for the first case. It is hoped that details can be provided in a future article.

JMARTI SETUP is illustrated by standard test cases DCNEW-3, DCNEW-5, and DCNEW-6. It is important to note that the solutions to these data sets have not changed along with the change in default shunt conductance GMODE. This is because shunt conductance of columns 33-40 of the miscellaneous data card of the fitter has been changed from blank to 0.48D-7 (the former default value).

Removing the Last EMTP Error

"The last bug will never be removed from the EMTP"

is what your Editor flatly and unequivocally assured the audience of the sixth annual LEC meeting in Leuven, Belgium, during mid-October of 1990. *"Anyone who does not understand this fact simply does not understand the real world."* This was part of your Editor's negative response to a written recommendation (in a paper that was being presented at the meeting) by one LEC member that EMTP development be halted until **all** program errors had been eliminated. Your Editor went on to assert that all big digital computer programs have errors -- including well-publicized programs of American space exploration (NASA) and long-distance telephone communication (AT&T). Well, the error of the next paragraph illustrates well the problem of EMTP debugging: one can not find what one does not have the imagination or inspiration or insight to look for because the number of different combinations of data is unlimited. As your Editor observed to LEC Chairman Van Dommelen while walking back to the engineering campus of K.U. Leuven from the meeting in the center of town, the LEC member had a problem with degree. A recommendation that more emphasis be placed on quality control would have been reasonable; but phrasing the issue in absolute terms made the proposition absurd. In passing, it only remains to be noted that the LEC member in question went on to be accepted as a member of the Task Force led by CESI, and to propose that famous $19K initiation fee (see column 2 on page 2 of the April, 1991, issue). In retrospect, it would seem to be yet another case of the blind leading the blind!

A LINE CONSTANTS error was recognized by Dr. Gary Thomann of Power Technologies, Inc. (PTI) on May 13th. In its simplest form, this was the problem of the coupling between a single power conductor and a communication circuit some distance away. With the communication circuit open circuited at both ends, and with negligible current flowing in the power conductor, only electrostatic (capacitive) coupling is important. Yet, the simulation of this was wrong using untransposed, constant-parameter, distributed modeling as originated by K. C. Lee.

The cause of Dr. Thomann's bad EMTP answers was diagnosed on June 8th by Dr. Liu who provided the following summary explanation (remainder of this paragraph). It first was observed that the modal velocities stored on the punched branch cards were in error. For constant-parameter, distributed, line modeling of EMTP, whether transposed or not, the total series resistance **R** of each mode of the line is lumped in three places: half in the middle, and a quarter at each end of the line. Therefore, when the modal velocity is calculated using modal impedance, only the imaginary part of this impedance should be used. Instead, the EMTP erroneously had used the full (both real and imaginary parts), complex, modal impedance for the calculation of the modal velocity. For conventional geometry of an overhead line, the error apparently was not noticeable. But for coupling to the distant, lossy fence, resistance was much higher, and the effect was readily noticeable when not masked by additional inductive coupling. Well, after correcting the error, Dr. Thomann's data gave results that agreed closely with that of a Pi-circuit. This, in turn, agreed closely with the known result. As Dr. Thomann was the first to observe (as he communicated the problem to us), for engineering purposes, the same answer can be obtained using the simple ratio of capacitances (in effect, one has a capacitive voltage divider). Once again, ATP users are indebted to Dr. Thomann for an important contribution. Without the help of PTI, who knows how many more dozen years might have passed before this error would have been recognized and reported by some other ATP user ! ?

Miscellaneous Small Items

Lower-case comment cards are allowed for any ATP version translated after April 23rd. It is surprising that there have not been many earlier complaints. It was only during a telephone conversation with Donald Johnson of Pacific Power in downtown Portland that the illegality of a lower-case "c" in column one was appreciated. Well, no longer. BENCHMARK DC-3 has been modified to include a couple of these to illustrate the improved tolerance.

"Most of Apple's $5.5 billion suit struck" is a headline on page B6 of the April 15th issue of Portland's daily newspaper, *The Oregonian.* The AP story from San Francisco begins as follows: *"A federal judge on Tuesday dismissed most of Apple Computer Inc.'s $5.5 billion suit accusing Microsoft Corp. and Hewlett-Packard Co. of illegally copying Apple's Macintosh display technology."* Recall that this is the question of *"look and feel"* : can copyright law be applied this way to windows. Apparently U.S. District Judge Vaughn Walker was not sympathetic, finding that *"most of Apple's computer screen display symbols that were the focus of the suit were not protected by copyright law."* An obviously happy H-P attorney Marshall said that what remained was *"only a dispute over two different screen wastebasket symbols."*

"Computer Law" was the title of a 4-hour short course offered by the Oregon State Bar at the Oregon Convention Center on April 2nd. Co-Chairmen Meyer and Liu returned from this with a thick looseleaf book of the same name having Library of Congress Card Catalog No. 92-060327. This is a sign of the times: computers already provide a lot of business for the legal profession! *"While it's true that computer law is really a conglomeration of other legal areas, such as contracts, patents, business law ... today's technology has imposed many new twists and turns on these traditional areas"* according to advertising for the course. The only major disappointment was the lack of any reference to peculiarities of U.S. government agencies such as BPA. The authors clearly have targeted private-

sector business rather than government business. Nonetheless, the printed book provides excellent general background material.

Zero T_{close} of a SYSTEMATIC switch resulted in output that was structurally wrong prior to May 7th. This was the discovery of the head of BPA's production EMTP users, Robert Hasibar, who observed that the variable switching times for each energization were missing below the labeling for them. Also missing was the paragraph about statistical tabulations that precedes the energizations. It was found that existing logic treated a zero closing time differently than any small time in the range of zero to DELTAT whereas in theory all should close on the first time step. Rather than tamper with established logic, it seemed easiest to the Co-Chairmen simply to protect the user by increasing slightly (to 1.E-18) any zero closing time shortly after the number is read from the input data card.

A negative KTRPL4 of STARTUP means that output files will have default locations that are parallel to the input data file. This has worked properly, but has been subject to a limit of 32 bytes for the file names. As long as one was operating locally (without the specification of disk and/or directory information), there was no problem for most computers. The same was true as long as disk and directory names were short (your Editor's preference). But BPA ran into trouble with usage on VAX / VMS computers because of the need of ATP to detect whether or not the data file was connected externally. Unfortunately, this involves the complete path (including disk and directory) even though the user might not have used such information explicitly. Those who use VAX / VMS computers to support EMTP at BPA have adopted the use of long naming trees (e.g., with sub-subdirectories), and the resulting full names have exceeded 32 bytes. So, in response to a request from Dan Goldsworthy, the universal interface for the input file name was increased to 80 bytes on June 19th. The old 35-byte SPYCD2 was replaced by TEXT80(15) --- a new cell to an old 80-byte array. It is important to note that the installation-dependent part of the modification in SUBROUTINE SYSDEP might or might not be modified correspondingly. For VAX / VMS, this work was done June 20th. But for Salford EMTP, nothing has been done yet because developers are concentrating on what seems to be more important to more users: graphics and windows.

50-MHz upgrades of existing 25-MHz, Intel 80486-based computers are available today from national vendors such as Radio Shack and Gateway. The 66-MHz upgrade of existing 33-MHz computers has been promised by Gateway in its spring newsletter. This is to occur *"later this year when the 66 Mhz DX2 comes out."* Dr. Matt Donnelly of Control Technologies in Bozeman, Montana, provided this useful information in a telephone conversation and confirmatory letter dated June 16th. Control Technologies already has upgraded to 50 MHz, and Dr. Donnelly attached to his letter documentation of the effect on simulation speed for DC-1. Using the /DISK_CACHE qualifier of DBOS, time spent in the time-step loop is 75.438 seconds, which is typical of a 33-MHz computer as first reported by Prof. Dennis Carroll. The Gateway newsletter predicts *"a 35% performance increase over a 486DX/33."* But for EMTP simulation, Dr. Donnelly's test would seem to indicate comparability.

Gateway may have begun as a mail order company (remember all of those beautiful color pictures of scenery in PC Magazine), but it has become more. Existing owners now can have their hardware upgraded by a local representative: *"Our new On-Site Upgrade Program ... allows you to buy components at great prices and have them installed by a professional computer technician at your office or home for a $135 installation fee.*

BPA production EMTP user Dan Goldsworthy was the first to report a minor (but fatal!) error in the punched card output for the idealized double-circuit line that results from the request SPECIAL DOUBLE CIRCUIT TRANSPOSED. This is illustrated by the 4th subcase of DCNEW-3. The number of phases, six, was not being punched in column 54 of each branch card (only the final 3 phases were correct). Once the problem had been pointed out, its correction was simple enough for Dr. Liu on June 16.

Punched output of LINE CONSTANTS was missing for single-phase configurations prior to correction by Co-Chairman Liu on June 26th. To ensure that this exceptionally simple case is verified regularly, a new sixth data subcase has been added to BENCHMARK DC-59. This has two conductors that are bundled together to form a single phase.

Apple Macintosh EMTP and TPPLOT versions look more promising as this note is being keyed on June 24th. Stu Cook of Just Services in Montreal, Canada, just telephoned the Co-Chairmen with ideas about how simple and free screen graphics might be managed. Of course, hard copy could rely on existing PostScript capability (many if not most Macintosh users probably have access to some PostScript printer). Of course, graphics would be only the second step of work, after basic EMTP execution in character mode had been shown to be reliable. Dr. Matt Donnelly of Control Technologies in Bozeman, Montana, might be able to test new Macintosh EMTP FORTRAN. He has the experience from successfully working with DECStation at the University of Montana.

Protection and Control is the name of a new task force that was established in Seattle at the July 14th meeting of the IEEE PES group that is concerned with electromagnetic transient simulation. For the record, the official title is: *Working Group on Modeling and Analysis*

of System Transients Using Digital Programs. With a general name such as that, your Editor must wonder about purpose. Would users of programs to study either transient stability or long-term dynamics be welcome? If not, why not (nothing in the title would suggest otherwise)? How does someone who reads only the title know that electrical transients are of primary interest? Are they? It would have been so easy to include "EMTP-like" or "electromagnetic transient" in the title. Concerning the newest task force, both Bob Wilson and Prof. Juan Martinez have volunteered their services.

FTN77 / ix is the Salford FORTRAN compiler for use on Unix computers such as the 33-MHz, 486-based machine that was acquired by BPA one year ago in order to support EMTP development. Even though FTN77/ix is no longer being used to support EMTP at BPA, the yearly update agreement should be renewed for a second year at a cost of $150. A major preoccupation this year for Dr. Liu has been supervision of the development of a graphical user interface (GUI) for BPA's power-flow program. Some
in the western power pool, WSCC, want to use Intel PCs, and Szymanski has chosen FTN77 / ix for this.