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EMPFIT: A COMPUTER CODE FOR FITTING EMP WAVEFORMS THAT FACILITA--ETC(U)
SEP 78 J M CLODFELTER MIPR-6-531
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This report is a supplement to the original report (HDL-TR-1801) on the computer code EMPFIT and reflects the changeover from a CDC 6600 computer to an IBM 370/168 computer. Also, some additional modifications have been added to increase the usefulness and versatility of the code. EMPFIT is a code that is useful in fitting an electromagnetic pulse, as well as other data, with a simple function that is easily differentiated and Fourier → next page

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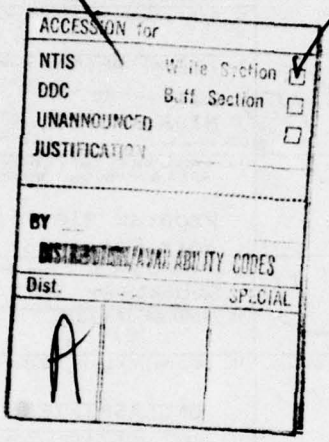
transformed. This report deals only with the aspects necessary to the conversion to the IBM system and also with the new modifications. Material not mentioned in this supplement remains unaffected.



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APPENDICES

FIGURES

1. INTRODUCTION

The computer code EMPFIT provides a method for fitting an electromagnetic pulse (EMP), as well as other traces, with a simple function that is easily differentiated and Fourier transformed. This report is a supplement to the original report on EMPFIT and reflects the changeover from a Control Data Corp. (CDC) 6600 computer at the Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, to the IBM 370/168 computer at the Harry Diamond Laboratories (HDL), Adelphi, MD. Along with this conversion effort, several modifications have been added, making EMPFIT more useful and versatile.

In the following sections, a description of the time derivative calculations and options detailing read and write selections on a disk file of EMPFIT will be given. Next, a section on increasing the accuracy of the code using the AUTODBL option of the IBM 370/168 is explained. Also, a time cutoff modification will be detailed and a full listing of all of the output options is included. A brief description of the new subroutines added to EMPFIT is discussed and an up-to-date section on preparing input cards to run the code is also presented. Finally, a section on the job control language (JCL) necessary to run EMPFIT at the Woodbridge Research Facility (WRF) is given. In appendices A and B, a listing and sample run of EMPFIT along with examples of input data appear.

2. DERIVATIVE OF FITTING FUNCTION

Following the theory of EMPFIT,[1] we fit the data points (t_i, f_i) for $1 \le i \le N$ using the function

$$f(t) = \begin{cases} A_1 e^{\alpha t} + A_3 e^{2\alpha t}, & \text{for } t \le t_1, \quad (1) \\ \dfrac{f_{i+1}(t - t_i) + f_i(t_{i+1} - t)}{t_{i+1} - t_i} + \dfrac{1}{2}(B_i + B_{i+1})(t - t_i)(t - t_{i+1}) & \\ \quad + C_i(t - t_i)(t_{i+1} - t)^3 + D_{i+1}(t_{i+1} - t)(t - t_i)^3, & \quad (2) \\ & \text{for } t_i \le t \le t_{i+1}, \\ A_2 e^{-\beta t} + A_4 e^{-2\beta t}, & \text{for } t \ge t_N. \quad (3) \end{cases}$$

[1] *Thomas V. Noon, User's Manual for the Modular Analysis-Package Libraries ANAPAC and TRANL, Harry Diamond Laboratories TR-1782-S (September 1977).*

The derivative is then easily calculated as

$$f(t) = \begin{cases} \alpha\left[f(t) + A_3 e^{2\alpha t}\right], & \text{for } t \le t_1, \quad (4) \\ \dfrac{f_{i+1} - f_i}{t_{i+1} - t_i} + \dfrac{1}{2}\left(B_i + B_{i+1}\right)\left[\left(t - t_{i+1}\right) + \left(t - t_i\right)\right] \\ \quad + C_i\left[\left(t_{i+1} - t\right)^3 - 3\left(t - t_i\right)\left(t_{i+1} - t\right)^2\right] \quad (5) \\ \quad + D_{i+1}\left[-\left(t - t_i\right)^3 + 3\left(t_{i+1} - t\right)\left(t - t_i\right)^2\right], \\ \qquad\qquad \text{for } t_i \le t \le t_{i+1}, \\ -\beta\left[f(t) + A_4 e^{-2\beta t}\right], & \text{for } t \ge t_N. \quad (6) \end{cases}$$

Examples of plots of f(t) and its derivative can be seen in figures 1 and 2.

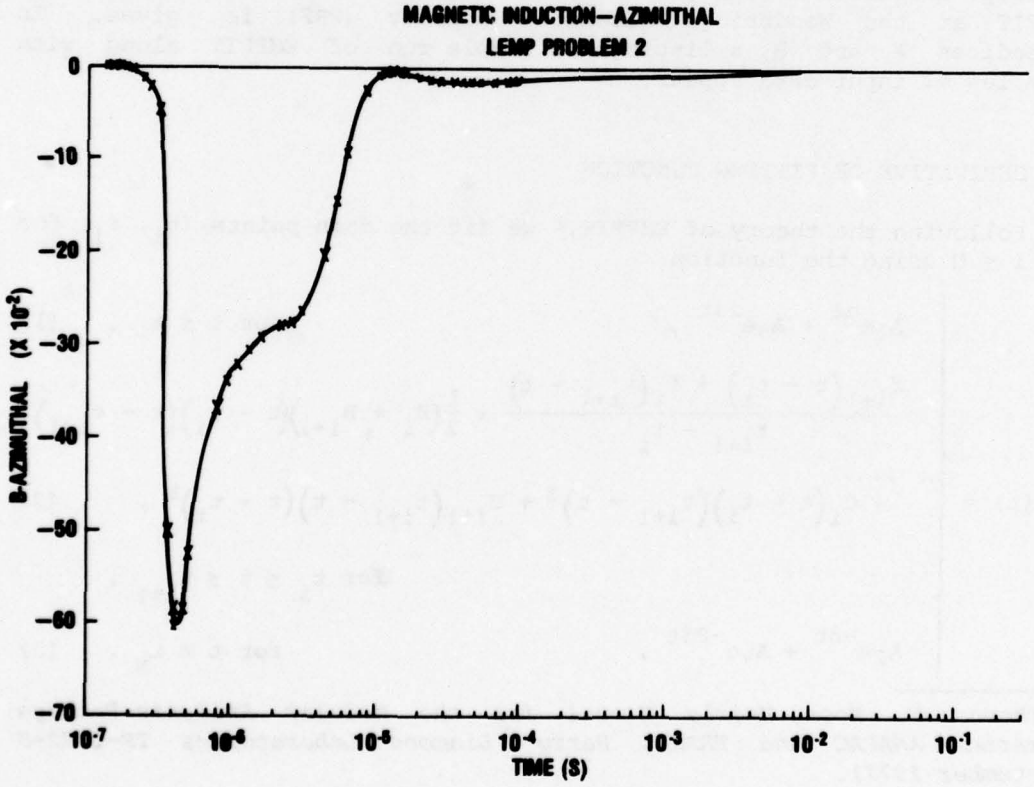

Figure 1. Curve fit, f(t).

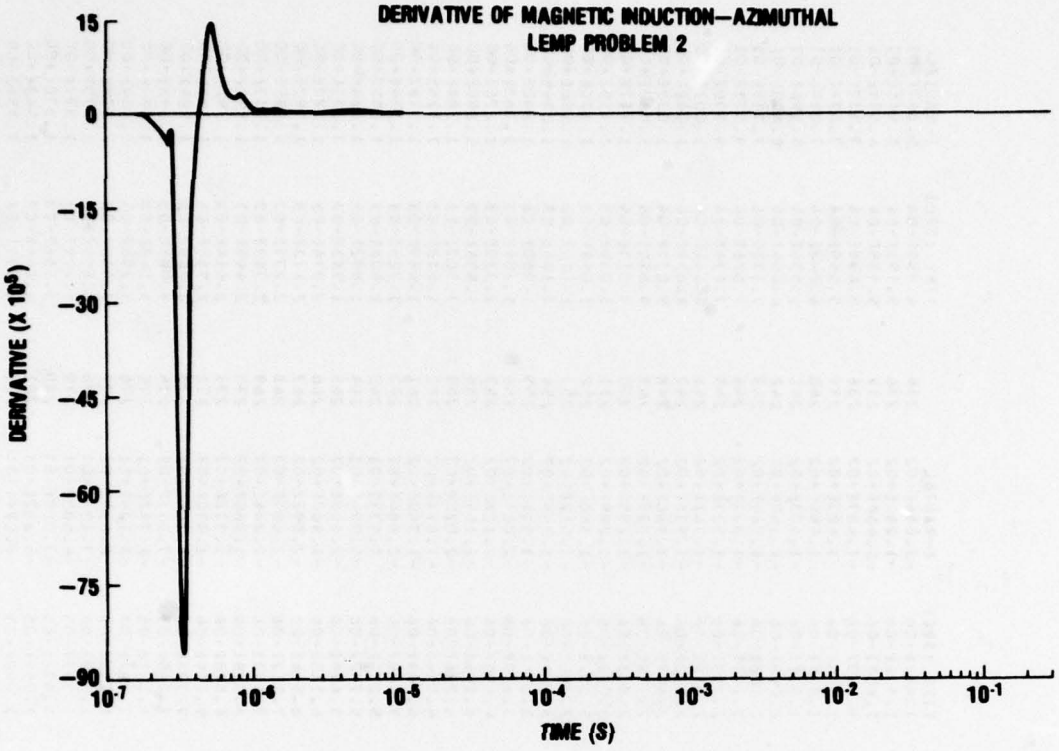

Figure 2. Derivative of curve fit, f'(t).

3. READ AND WRITE DISK FILE OPTIONS

Since there was an apparent need to be able to use data not in card format, the necessary modifications were made to utilize data that exist on a permanent disk file. With these new changes, input data to EMPFIT can now be entered through a disk file and it is also possible to add or delete specified data pairs from this disk file data. When the "read from a disk file" option is chosen, a numbered printout of the data from the disk file is produced (see fig. 3) and any deletions or additions are made in reference to this listing. Deletions are accomplished by selecting the integer number of the time-amplitude point to be scratched and entering this value as described in section 8. An example of the input cards necessary to delete data points appears in appendix B. Additions to the disk file data are entered by the time-amplitude value and are automatically placed in the proper location. The use of this option is also detailed in section 8, while an example of the input cards required to add data points can be found in appendix B.

Figure 3. Example of disk file printout.

ELECTRIC FIELD STRENGTH-RADIAL
NEMP PROBLEM A OBSERVER 1

	TIME (SEC)	E-RADIAL		TIME (SEC)	E-RADIAL		TIME (SEC)	E-RADIAL
1	1.000E-08	0.0	118	1.461E-06	-1.096E+02	235	4.959E-04	5.887E-01
2	1.000E-08	2.154E-12	119	1.526E-06	-1.292E+02	236	5.193E-04	5.945E-01
3	1.038E-08	1.055E+00	120	1.608E-06	-1.438E+02	237	5.435E-04	6.559E-01
4	1.269E-08	9.021E+00	121	1.673E-06	-1.487E+02	238	5.698E-04	7.137E-01
5	1.481E-08	2.977E+01	122	1.756E-06	-1.485E+02	239	5.959E-04	7.679E-01
6	1.705E-08	6.791E+01	123	1.838E-06	-1.450E+02	240	6.242E-04	7.689E-01
7	1.948E-08	1.255E+02	124	1.921E-06	-1.403E+02	241	6.536E-04	8.196E-01
8	2.191E-08	1.911E+02	125	2.020E-06	-1.348E+02	242	6.855E-04	8.680E-01
9	2.406E-08	2.479E+02	126	2.102E-06	-1.324E+02	243	7.172E-04	9.139E-01
10	2.656E-08	3.032E+02	127	2.201E-06	-1.322E+02	244	7.516E-04	9.571E-01
11	2.843E-08	3.393E+02	128	2.317E-06	-1.337E+02	245	7.874E-04	9.592E-01
12	3.043E-08	3.796E+02	129	2.416E-06	-1.361E+02	246	8.246E-04	1.001E+00
13	3.133E-08	4.011E+02	130	2.531E-06	-1.378E+02	247	8.634E-04	1.041E+00
14	3.214E-08	4.239E+02	131	2.647E-06	-1.366E+02	248	9.037E-04	1.077E+00
15	3.287E-08	4.476E+02	132	2.779E-06	-1.331E+02	249	9.475E-04	1.082E+00
16	3.353E-08	4.723E+02	133	2.911E-06	-1.295E+02	250	9.913E-04	1.117E+00
17	3.412E-08	4.976E+02	134	3.043E-06	-1.289E+02	251	1.039E-03	1.150E+00
18	3.465E-08	5.238E+02	135	3.192E-06	-1.360E+02	252	1.088E-03	1.180E+00
19	3.513E-08	5.499E+02	136	3.340E-06	-1.512E+02	253	1.140E-03	1.186E+00
20	3.556E-08	5.755E+02	137	3.489E-06	-1.706E+02	254	1.194E-03	1.214E+00
21	3.595E-08	6.004E+02	138	3.654E-06	-1.916E+02	255	1.250E-03	1.240E+00
22	3.630E-08	6.242E+02	139	3.819E-06	-2.059E+02	256	1.309E-03	1.263E+00
23	3.661E-08	6.465E+02	140	4.000E-06	-2.116E+02	257	1.370E-03	1.270E+00
24	3.689E-08	6.673E+02	141	4.198E-06	-2.104E+02	258	1.436E-03	1.290E+00
25	3.715E-08	6.863E+02	142	4.396E-06	-2.025E+02	259	1.502E-03	1.308E+00
26	3.737E-08	7.037E+02	143	4.594E-06	-1.811E+02	260	1.573E-03	1.324E+00
27	3.758E-08	7.196E+02	144	4.809E-06	-1.340E+02	261	1.649E-03	1.338E+00
28	3.778E-08	7.350E+02	145	5.040E-06	-5.880E+01	262	1.725E-03	1.344E+00
29	3.818E-08	7.656E+02	146	5.271E-06	1.477E+01	263	1.808E-03	1.355E+00
30	3.858E-08	7.957E+02	147	5.272E-06	-5.934E+01	264	1.892E-03	1.364E+00
31	3.898E-08	8.249E+02	148	5.698E-06	-2.008E+02	265	1.983E-03	1.371E+00
32	3.938E-08	8.533E+02	149	6.115E-06	-1.968E+02	266	2.074E-03	1.377E+00
33	3.998E-08	8.946E+02	150	6.566E-06	-2.892E+02	267	2.173E-03	1.382E+00
34	4.039E-08	9.216E+02	151	7.052E-06	-2.407E+02	268	2.277E-03	1.385E+00
35	4.189E-08	1.010E+03	152	7.537E-06	-2.294E+02	269	2.383E-03	1.387E+00
36	4.316E-08	1.067E+03	153	8.058E-06	-1.866E+02	270	2.495E-03	1.392E+00
37	4.515E-08	1.134E+03	154	8.578E-06	-1.372E+02	271	2.614E-03	1.392E+00
38	4.659E-08	1.176E+03	155	9.134E-06	-1.070E+02	272	2.735E-03	1.391E+00
39	4.827E-08	1.219E+03	156	9.723E-06	-8.248E+01	273	2.864E-03	1.388E+00
40	5.020E-08	1.261E+03	157	1.035E-05	-7.351E+01	274	3.001E-03	1.393E+00
41	5.245E-08	1.301E+03	158	1.101E-05	-8.732E+01	275	3.143E-03	1.389E+00
42	5.413E-08	1.329E+03	159	1.167E-05	-8.124E+01	276	3.290E-03	1.384E+00
43	5.599E-08	1.374E+03	160	1.240E-05	-6.684E+01	277	3.445E-03	1.379E+00
44	5.804E-08	1.413E+03	161	1.312E-05	-7.133E+01	278	3.609E-03	1.373E+00
45	6.031E-08	1.561E+03	162	1.392E-05	-6.603E+01	279	3.779E-03	1.377E+00
46	6.280E-08	1.474E+03	163	1.472E-05	-7.080E+01	280	3.956E-03	1.370E+00
47	6.555E-08	1.689E+03	164	1.559E-05	-6.802E+01	281	4.144E-03	1.363E+00
48	6.858E-08	1.839E+03	165	1.646E-05	-6.029E+01	282	4.339E-03	1.356E+00
49	7.192E-08	1.927E+03	166	1.739E-05	-5.069E+01	283	4.544E-03	1.359E+00
50	7.372E-08	2.008E+03	167	1.840E-05	-4.333E+01	284	4.757E-03	1.352E+00

Figure 3. Example of disk file printout (cont'd).

51	7.759E-08	2.153E+03	168	1.940E-05	-4.064E+01	285	4.982E-03	1.344E+00
52	7.967E-08	2.205E+03	169	2.048E-05	-3.962E+01	286	5.215E-03	1.337E+00
53	8.414E-08	2.359E+03	170	2.159E-05	-3.966E+01	287	5.461E-03	1.340E+00
54	8.644E-08	2.400E+03	171	2.277E-05	-3.859E+01	288	5.720E-03	1.332E+00
55	9.104E-08	2.395E+03	172	2.402E-05	-3.551E+01	289	5.989E-03	1.325E+00
56	9.334E-08	2.458E+03	173	2.530E-05	-3.206E+01	290	6.273E-03	1.317E+00
57	9.794E-08	2.623E+03	174	2.666E-05	-2.865E+01	291	6.568E-03	1.319E+00
58	1.025E-07	2.604E+03	175	2.808E-05	-2.700E+01	292	6.876E-03	1.312E+00
59	1.071E-07	2.653E+03	176	2.954E-05	-2.417E+01	293	7.202E-03	1.304E+00
60	1.117E-07	2.704E+03	177	3.110E-05	-2.067E+01	294	7.541E-03	1.297E+00
61	1.163E-07	2.702E+03	178	3.273E-05	-2.067E+01	295	7.895E-03	1.298E+00
62	1.212E-07	2.732E+03	179	3.443E-05	-2.281E+01	296	8.270E-03	1.291E+00
63	1.263E-07	2.775E+03	180	3.620E-05	-2.101E+01	297	8.658E-03	1.284E+00
64	1.315E-07	2.785E+03	181	3.807E-05	-1.727E+01	298	9.065E-03	1.278E+00
65	1.372E-07	2.751E+03	182	4.002E-05	-1.507E+01	299	9.495E-03	1.272E+00
66	1.430E-07	2.749E+03	183	4.206E-05	-1.427E+01	300	9.941E-03	1.273E+00
67	1.491E-07	2.759E+03	184	4.422E-05	-1.333E+01	301	1.041E-02	1.267E+00
68	1.555E-07	2.748E+03	185	4.647E-05	-1.414E+01	302	1.090E-02	1.262E+00
69	1.622E-07	2.724E+03	186	4.880E-05	-1.196E+01	303	1.141E-02	1.257E+00
70	1.692E-07	2.690E+03	187	5.126E-05	-9.675E+00	304	1.196E-02	1.257E+00
71	1.766E-07	2.655E+03	188	5.383E-05	-1.071E+01	305	1.252E-02	1.252E+00
72	1.843E-07	2.620E+03	189	5.653E-05	-1.012E+01	306	1.310E-02	1.248E+00
73	1.924E-07	2.583E+03	190	5.938E-05	-9.779E+00	307	1.373E-02	1.244E+00
74	2.050E-07	2.518E+03	191	6.233E-05	-7.894E+00	308	1.437E-02	1.244E+00
75	2.138E-07	2.468E+03	192	6.542E-05	-8.788E+00	309	1.505E-02	1.240E+00
76	2.231E-07	2.416E+03	193	6.865E-05	-7.764E+00	310	1.576E-02	1.237E+00
77	2.330E-07	2.360E+03	194	7.205E-05	-7.100E+00	311	1.650E-02	1.233E+00
78	2.431E-07	2.303E+03	195	7.562E-05	-6.539E+00	312	1.728E-02	1.233E+00
79	2.538E-07	2.245E+03	196	7.933E-05	-6.533E+00	313	1.809E-02	1.230E+00
80	2.651E-07	2.186E+03	197	8.322E-05	-5.613E+00	314	1.894E-02	1.227E+00
81	2.769E-07	2.126E+03	198	8.731E-05	-5.519E+00	315	1.984E-02	1.225E+00
82	2.891E-07	2.067E+03	199	9.158E-05	-5.141E+00	316	2.078E-02	1.222E+00
83	3.022E-07	2.006E+03	200	9.606E-05	-4.949E+00	317	2.175E-02	1.222E+00
84	3.156E-07	1.947E+03	201	1.007E-04	-4.508E+00	318	2.278E-02	1.220E+00
85	3.298E-07	1.888E+03	202	1.057E-04	-4.094E+00	319	2.385E-02	1.218E+00
86	3.442E-07	1.831E+03	203	1.108E-04	-4.479E+00	320	2.497E-02	1.216E+00
87	3.594E-07	1.774E+03	204	1.162E-04	-9.442E+01	321	2.616E-02	1.216E+00
88	3.745E-07	1.720E+03	205	1.218E-04	-3.623E+00	322	2.739E-02	1.214E+00
89	3.987E-07	1.640E+03	206	1.277E-04	-3.594E+00	323	2.867E-02	1.212E+00
90	4.150E-07	1.590E+03	207	1.339E-04	-3.071E+00	324	3.003E-02	1.211E+00
91	4.316E-07	1.541E+03	208	1.403E-04	-2.922E+00	325	3.144E-02	1.211E+00
92	4.491E-07	1.491E+03	209	1.472E-04	-2.587E+00	326	3.293E-02	1.209E+00
93	4.752E-07	1.420E+03	210	1.542E-04	-2.265E+00	327	3.448E-02	1.208E+00
94	4.926E-07	1.375E+03	211	1.616E-04	-2.116E+00	328	3.610E-02	1.207E+00
95	5.205E-07	1.304E+03	212	1.695E-04	-1.884E+00	329	3.781E-02	1.207E+00
96	5.392E-07	1.258E+03	213	1.776E-04	-1.672E+00	330	3.959E-02	1.205E+00
97	5.677E-07	1.190E+03	214	1.861E-04	-1.452E+00	331	4.145E-02	1.204E+00
98	5.877E-07	1.143E+03	215	1.950E-04	-1.357E+00	332	4.341E-02	1.203E+00
99	6.178E-07	1.074E+03	216	2.044E-04	-1.182E+00	333	4.545E-02	1.203E+00
100	6.484E-07	1.005E+03	217	2.141E-04	-1.018E+00	334	4.759E-02	1.203E+00
101	6.807E-07	9.343E+02	218	2.244E-04	-8.523E-01	335	4.985E-02	1.202E+00
102	7.129E-07	8.653E+02	219	2.351E-04	-7.839E-01	336	5.219E-02	1.201E+00
103	7.457E-07	7.970E+02	220	2.464E-04	-6.434E-01	337	5.466E-02	1.200E+00
104	7.803E-07	7.268E+02	221	2.581E-04	-5.092E-01	338	5.723E-02	1.200E+00
105	8.149E-07	6.586E+02	222	2.705E-04	-3.832E-01	339	5.992E-02	1.200E+00
106	8.503E-07	5.917E+02	223	2.834E-04	-2.671E-01	340	6.276E-02	1.199E+00
107	8.872E-07	5.233E+02	224	2.969E-04	-2.313E-01	341	6.571E-02	1.199E+00
108	9.244E-07	4.576E+02	225	3.111E-04	-1.254E-01	342	6.879E-02	1.199E+00
109	9.745E-07	3.738E+02	226	3.259E-04	-2.603E-02	343	7.205E-02	1.198E+00
110	1.014E-06	3.111E+02	227	3.414E-04	6.736E-02	344	7.544E-02	1.198E+00

Figure 3. Example of disk file printout (cont'd).

111	1.067E-06	2.333E+02	228	3.577E-04	8.558E-02	345	7.898E-02	1.197E+00
112	1.121E-06	1.621E+02	229	3.746E-04	1.715E-01	346	8.273E-02	1.197E+00
113	1.164E-06	1.110E+02	230	3.925E-04	2.533E-01	347	8.661E-02	1.197E+00
114	1.221E-06	5.035E+01	231	4.116E-04	3.450E-01	348	9.068E-02	1.197E+00
115	1.278E-06	-1.371E+00	232	4.308E-04	3.680E-01	349	9.498E-02	1.196E+00
116	1.339E-06	-4.635E+01	233	4.517E-04	4.485E-01	350	9.944E-02	1.196E+00
117	1.400E-06	-8.244E+01	234	4.734E-04	5.214E-01	351	1.000E-01	1.196E+00

In addition to being able to read input data from a permanent file, it is now possible to write specific output to a permanent disk file so that other computer codes may use EMPFIT's calculations. Thus, EMPFIT is now set up to write the calculations of the derivative, f'(t), on a disk file at either the input data points or the curve fit data pairs. Also, the calculations for the curve fit, f(t), may be written on a permanent file. The utilization of these permanent file disk writes, which are performed on separate devices, is fully described in section 8.

It should be noted that it is possible in EMPFIT to read and write data from or to a disk file in any particular format. The subroutines READPF and WRITPF are used by EMPFIT to perform the disk file read and write operations, respectively, and may be changed to fit the user's need. Figures 4 and 5 show the listings of READPF and WRITPF and the starred (*) cards reflect cards that may be changed according to a particular user's requirements. To employ these user modifications requires the user's version of READPF and WRITPF to be placed behind the //FORT.SYSIN DD * card seen in section 9.

```
      SUBROUTINE READPF(NT,NSETS,X,Y,JPTS)
      DIMENSION X(JPTS),Y(JPTS)
      DO 10 J=1,NSETS
      READ (NT) N1,N2,JPTS,(X(I),A,I=1,JPTS),(Y(I),B,I=1,JPTS)     *
10    CONTINUE
      RETURN
      END
```

Figure 4. Listing of subroutine READPF.

```
      SUBROUTINE WRITPF(NT,X,Y,NPTS,ATITLE)
      DIMENSION X(NPTS),Y(NPTS),ATITLE(10)
      WRITE(NT) ATITLE                *
      WRITE(NT) NPTS                  *
      WRITE(NT) X,Y                   *
      RETURN
      END
```

Figure 5. Listing of subroutine WRITPF.

4. DOUBLE PRECISION AND EXPONENTIAL CALCULATIONS

The IBM version of EMPFIT has been written in such a manner that the AUTODBL option of the HDL IBM 370/168 can be used and not affect the plotting software. This variation is seen in the subroutine ANOTAT which has been constructed differently from the CDC version to accommodate the AUTODBL option, which automatically converts all single and double precision variables to double and extended precision quantities, respectively. This conversion allows greater accuracy in the computations and is easy to employ. Only minor changes are required in EMPFIT, specifically dealing with the plotting software of ANAPAC.[1] In particular, the only modifications occur in calling the double precision versions of subroutine DRAW4, which appear in EMPFIT's plotting routine PLOTT. If the AUTODBL option is chosen, EMPFIT should be compiled with the following changes in subroutine PLOTT:

(1) The DRAW4 calls

```
CALL DRAW4(1,3,3,3,8,20, XTITLE, YTITLE, ATITLE, TITLE)
CALL DRAW4(2,3,ILNLOG, IPTS,-2,10,T,F,0.,0.)
CALL DRAW4(2,3,ILNLOG, MAXPTS, 0,10,TT,FF,0.,0.)
CALL DRAW4(3,3,0,0,0, MAXPTS, TT,FF,2.,0.)
```

should be changed to

```
CALL DRAW41(3,3,3,8,20, XTITLE, YTITLE, ATITLE, TITLE)
CALL DRAW42(3,ILNLOG, IPTS, -2,10,T,F,0.,0.)
CALL DRAW42(3, ILNLOG, MAXPTS, 0,10,TT,FF,0.,0.)
CALL DRAW43(3,0,0,0, MAXPTS, TT,FF,2.,0.)
```

(2) The DRAW4 calls

```
CALL DRAW4(1,3,3,3,8,20, XTITLE, YTITLE, ATITLE, TITLE)
CALL DRAW4(2,3, ILNLOG, MAXPTS, 0,10,TT,FF,0.,0.)
CALL DRAW4(3,3,0,0,0, MAXPTS, TT,FF,2.,0.)
```

should be changed to

```
CALL DRAW41(3,3,3,8,20, XTITLE, YTITLE, ATITLE, TITLE)
CALL DRAW42(3, ILNLOG, MAXPTS, 0,10,TT,FF,0.,0.)
CALL DRAW43(3,0,0,0, MAXPTS, TT,FF,2.,0.)
```

---

[1] *Thomas V. Noon, User's Manual for the Modular Analysis-Package Libraries ANAPAC and TRANL, Harry Diamond Laboratories TR-1782-S (September 1977).*

(3) The DRAW4 calls

```
CALL DRAW4(1,3,4,5,14,20, XTITLE, YTITLE, FTITLE, TITLE)
CALL DRAW4(2,3,2,OPTS, 0,10,OMEGA, ZABS, 0.,0.)
CALL DRAW4(3,3,0,0,0,OPTS,OMEGA,ZABS,2.,0.)
```

should be changed to

```
CALL DRAW41(3,4,5,14,20,XTITLE,YTITLE,FTITLE,TITLE)
CALL DRAW42(3,2,OPTS,0,10,OMEGA,ZABS,0.,0.)
CALL DRAW43(3,0,0,0,OPTS,OMEGA,ZABS,2.,0.)
```

(4) The DRAW4 calls

```
CALL DRAW4(1,3,3,3,12,20,XTITLE,YTITLE,FTITLE,TITLE)
CALL DRAW4(2,3,ILNLOG,MAXPTS,0,10,TT,DFF,0.,0.)
CALL DRAW4(3,3,0,0,0,MAXPTS,TT,DFF,2.,0.)
```

should be changed to

```
CALL DRAW41(3,3,3,12,20,XTITLE,YTITLE,FTITLE,TITLE)
CALL DRAW42(3,ILNLOG,MAXPTS,0,10,TT,DFF,0.,0.)
CALL DRAW43(3,0,0,0,MAXPTS,TT,DFF,2.,0.)
```

It should also be noted that a convention involving the exponential function calculations has been employed. This is due to the word size difference between the CDC 6600 computer, which has 60 bits per word, and the IBM 370/168 computer, which has only 32 bits per word. Since the CDC version of EMPFIT allows exponential arguments to be taken up to approximately 720, while the IBM exponential argument size is limited to approximately 174, a simple change was added. This change was mainly influenced by the fact that EMPFIT fits data primarily in the time frame of 1 to 5000 shakes (1 shake $\approx 10^{-8}$ s) and exponential values sometimes need to be calculated which exceed the IBM limit of 174. Thus, it was decided that the easiest solution was to limit the size of exponential values to 174 rather than to make extensive software changes to EMPFIT. This limitation is only used when fitting the exponential functions (eq 1 and 3) to the front and rear of the fitting function where the values for α and β in equations 1 and 3 are minimized so that the argument size does not exceed 174. When this convention is automatically employed, EMPFIT prints out the largest values that can be used for α and β and the message that this variation has been utilized.

5. TIME CUTOFF OPTION

Since it is sometimes necessary to deal with data with amplitudes very nearly zero (with respect to the peak amplitude) at the tail of a

waveform, an addition has been employed which allows the user to chop off the trace after a prescribed time value. This option allows one to ignore meaningless information at the end of a waveform which exists on a permanent disk file and cannot be deleted easily. An example of this option can be seen in figures 6 and 7. The use of this modification is detailed in section 8.

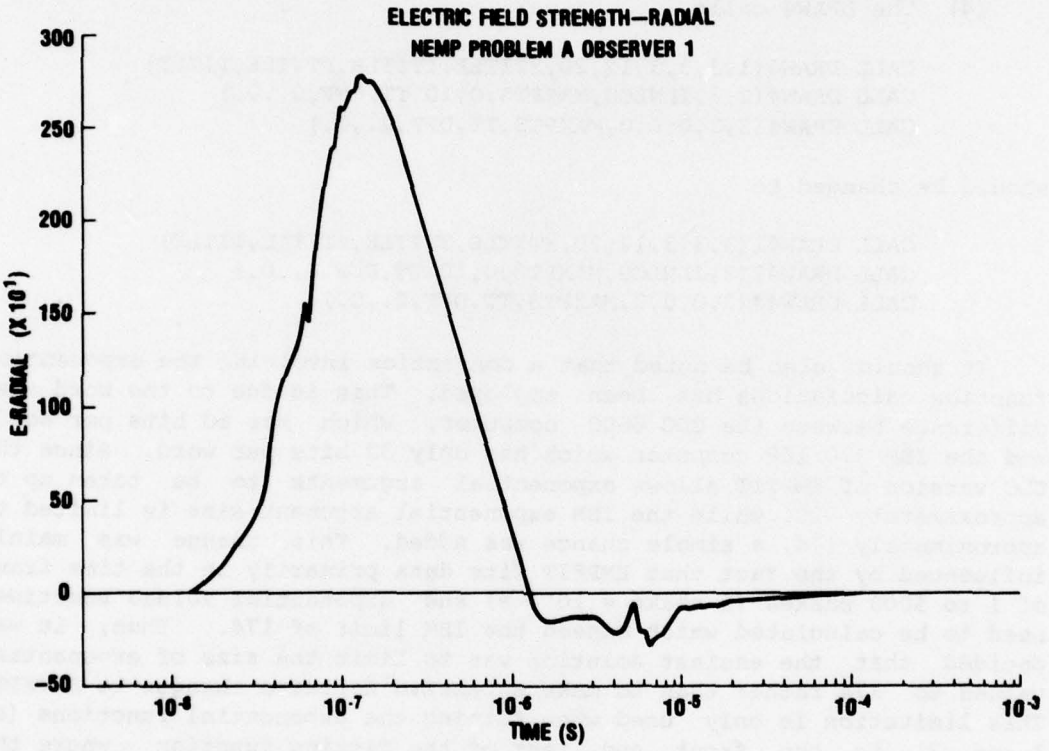

Figure 6. Example of curve with long, nearly zero tail.

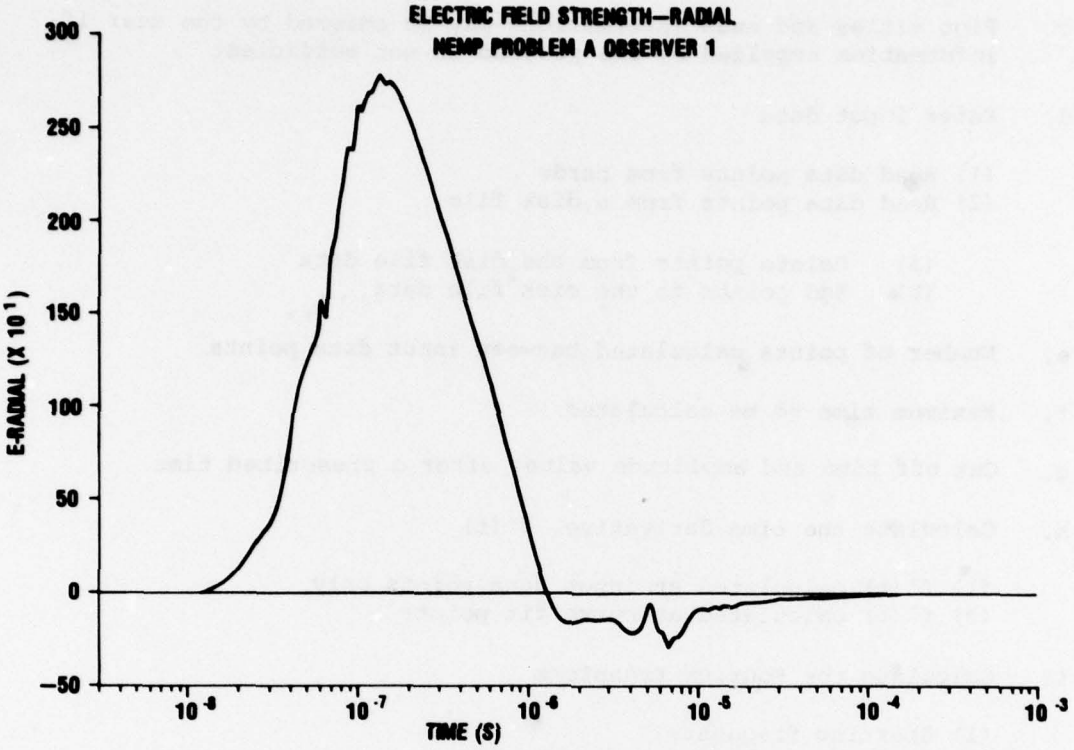

Figure 7. Example of time cutoff option applied to waveform with long, nearly zero tail.

6. OUTPUT OPTIONS

With the aforementioned modifications EMPFIT now consists of numerous output options. Thus a total compilation of these selections will now be listed. The use of these options is fully detailed in section 8.

a. Multiple runs

b. Plot titles and axes information supplied in program

(1) T vs E_R--time versus electric field strength--radial
(2) T vs E_V--time versus electric field strength--vertical
(3) T vs B_ϕ--time versus magnetic induction--azimuthal
(4) T vs J_R--time versus current density--radial
(5) T vs J_V--time versus current density--vertical
(6) T vs σ--time versus air conductivity

c. Plot titles and axes information--may be entered by the user if information supplied by the program is not sufficient

d. Enter input data

(1) Read data points from cards
(2) Read data points from a disk file

(a) Delete points from the disk file data
(b) Add points to the disk file data

e. Number of points calculated between input data points

f. Maximum time to be calculated

g. Cut off time and amplitude values after a prescribed time

h. Calculate the time derivative, f'(t)

(1) f'(t) calculated at input data points only
(2) f'(t) calculated at curve fit points

i. Calculate the Fourier transform

(1) Starting frequency
(2) Maximum frequency to be calculated

j. Plots

(1) Linear
(2) Log-log
(3) Semilog

(a) Abscissa (log)
(b) Ordinate (linear)

} Available on curve fit and derivative plots only; Fourier transform plots are always log-log

(4) Minimum value of ordinate to be plotted (does not plot data points below this value)--useful when plotting linear or semilog and the range of values is very large

(5) Curve fit plots--three plots may be obtained:

(a) Data points (plotted with X's) and curve through data points
(b) Curve only
(c) Both (a) and (b)

(6) Derivative plot

(7) Fourier transform plot

k. Write data on a disk file

(1) Write the curve fit, f(t), on a disk file
(2) Write the time derivative, f'(t), on a disk file

7. DESCRIPTION OF NEW SUBROUTINES OF EMPFIT

The modified version of EMPFIT contains the following new subroutines.

PERFIL Subroutine: reads the data from the disk file and writes the data points on output; deletes or adds any specified data points to the disk file data.

CUTOFF Subroutine: cuts off the time and amplitude values after a prescribed time value.

DERIV Subroutine: calculates the time derivative at either the input points or the curve fit points.

RITDAT Subroutine: writes either or both the time derivative data and the curve fit data on a disk file.

READPF Subroutine: reads input data from a disk file.

WRITPF Subroutine: performs the actual writing of the data onto the disk file as specified by RITDAT.

8. DATA INPUT PREPARATION FOR EMPFIT (REVISION)

Input data cards for EMPFIT are prepared in the following manner. Examples of input card decks appear in appendix B.

Column	Variable	Format	Explanation
Card 1: Multiple Run Card			
8-10	NRUN	I3	Number of runs

Column	Variable	Format	Explanation
Card 2: Plot Parameter Card			
10	IDENT	I1	Identifies data to be read in IDENT = 1 T vs E_R = 2 T vs E_V = 3 T vs B_ϕ = 4 T vs J_R = 5 T vs J_V = 6 T vs σ
20	IFFT	I1	Fourier transform? IFFT = 0 Yes = 1 No
30	IPLOT	I1	Plots? IPLOT = 0 Yes = 1 No
40	ILNLOG	I1	Plots in linear, log-log, or semilog? ILNLOG = 1 Linear = 2 Log-log = 3 Semilog Abscissa (log) Ordinate (linear) Note: Fourier transform plots are always log-log.
41-50	ORDMIN	E10.3	Minimum value of ordinate to be plotted (all points below this value are not plotted on linear or semilog plots)
60	ICURV	I1	Curve fit plots ICURV = 0 One plot of data points and curve fit = 1 One plot of curve fit only = 2 Two plots--one plot of data points and curve fit, one plot of curve fit only

Column	Variable	Format	Explanation
70	IOT	I1	Enter own plot and axes labels? IOT = 0 Use plot and axes labels supplied in program = 1 Enter own labels on cards 6, 7, 8
80	IREAD	I1	Read data points from permanent file? IREAD = 0 No = 1 Yes Calculate time derivative? IREAD = 0 No = 2 Yes Do both of above? IREAD = 0 No = 3 Yes

Card 3: Title Card

1-80	TITLE	8A10	Title or subtitle

Card 4: Fitting Parameter Card

8-10	IPTS	I3	Number of data points read in
18-20	MPTS	I3	Number of points calculated between input data points
21-30	TMAX	E10.3	Maximum time to be calculated in curve fit calculations
31-40	ALPHA	E10.3	Used to fit $f(t) = A_1 e^{\alpha t} + A_3 e^{2\alpha t}$ to front of waveform (good starting value: $\alpha = 1.2E+8$)

Column	Variable	Format	Explanation
41-50	BETA	E10.3	Used to fit $f(t) = A_2 e^{-\beta t} + A_4 e^{-2\beta t}$ to end of waveform (good starting value: β = 5.0E+4)
51-60	OSTART	E10.3	Frequency to start Fourier transform calculations
61-70	OMAX	E10.3	Maximum frequency to be calculated
80	ICUT	I1	Time cutoff?

ICUT = 0 No time cutoff
= 1 Cutoff time points at prescribed time shown on card 5

Note: If IREAD = 0 Skip to card 13
= 1 Skip to card 10
= 2 Go to card 9
= 3 Go to card 9

If IOT = 1 Go to cards 6,7 8; then go to IREAD prescribed cards

If ICUT = 1 Go to card 5; then go to IREAD and IOT prescribed cards

Card 5: Time Cutoff Card

1-10	TCUT	E10.3	Prescribed cutoff time value

Card 6: Abscissa Label Card

1-10	XTITLE	A10	X label; start in column 1

Column	Variable	Format	Explanation
Card 7: Ordinate Label Card			
1-20	YTITLE	2A10	Y label; start in column 1; on output, ordinate label is only in A10, A2 format instead of 2A10
Card 8: Plot Label Card			
1-40	ATITLE	4A10	Plot label; start in column 1
Card 9: Time Derivative Card			
10	IFPRIM	I1	IFPRIM = 1 f'(t) calculated at input data points only = 2 f'(t) calculated at input and calculated points
20	IPERM	I1	Write f'(t) on permanent file? IPERM = 0 No = 1 Yes (as specified by IFPRIM) Write f(t) on permanent file? IPERM = 0 No = 2 Yes Do both of above? IPERM = 0 No = 3 Yes
30	IFPPLT	I1	Plot of f'(t)? IFPPLT = 0 No = 1 Yes Note: If IREAD = 2 Skip to card 13 = 3 Go to card 10

Column	Variable	Format	Explanation
Card 10: Permanent File Card			
8-10	NSETS	I3	Number of particular data set to be read from disk file
8-20	IDELET	I3	Delete points from disk file data? IDELET = 0 No = 1 Yes
28-30	IADD	I3	Add points to disk file data? IADD = 0 No = 1 Yes
			Note: If IDELET = 1 Go to card 11 If IADD = 1 Go to card 12 If IDELET & IADD = 1 Go to card 11, then 12 If IDELET & IADD = 0 Input for this data run is complete
Card 11: Deletion Card			
8-10	NUM	I3	Number of data point on disk file that is to be deleted from disk file data
18-20	NUM	I3	
28-30	NUM	I3	
38-40	NUM	I3	
48-50	NUM	I3	
58-60	NUM	I3	
68-70	NUM	I3	
78-80	NUM	I3	
			Note: At present only eight data pairs can be deleted.

Column	Variable	Format	Explanation
Card 12: Addition Card			
8-10	NIADD	I3	Number of data pairs to be added to disk file data
11-20	TX	E10.3	Time value of point 1 to be added
21-30	FY	E10.3	Amplitude value of point 1 to be added
31-40	TX	E10.3	Time value of point 2 to be added
41-50	FY	E10.3	Amplitude value of point 2 to be added
51-60	TX	E10.3	Time value of point 3 to be added
61-70	FY	E10.3	Amplitude value of point 3 to be added
			Note: Additional cards may be entered starting in column 11. Data input is complete.
Card 13: Data Card			
1-10	T	E10.3	Time value of first point
11-20	F	E10.3	Amplitude of first point
Card 14: Data Card			
1-10	T	E10.3	Time value of second point
11-20	F	E10.3	Amplitude of second point
			Note: Card 13, card 14, . . . are repeated with respect to the number of input points indicated on card 4, IPTS.
			Note: Card 2 to card 13, card 14, . . . are repeated according to the number of times identified on card 1, NRUN.

9. JOB CONTROL LANGUAGE FOR EMPFIT

The following JCL is necessary to execute EMPFIT on the HDL IBM 370/168 computer. The procedure ANAFORT is used to supply the plotting software while the object version of EMPFIT exists on permanent file.

```
//Job Card
/*JOBPARM CARDS=20000
//ST EXEC ANAFORT,PPELIB='HK3002.EMPFIT',OUT=X,F3=
//FORT.SYSIN DD *
//LKED.SYSIN DD *
  INCLUDE SYSLIB(EMPFIT)
  ENTRY MAIN
{ //GO.FT10F001  DD  DISP=(NEW,CATLG),VOL=SER=USER02,
{ //  UNIT=SYSDA,SPACE=(TRK,(2,2)),DSN=permanent file
     name for curve fit output data,DCB=(RECFM=VS)
{ //GO.FT11F001  DD  DISP=(NEW,CATLG),VOL=SER=USER02,
{ //  UNIT=SYSDA,SPACE=(TRK,(2,2)),DSN=permanent file
     name for derivative output data,DCB=(RECFM=VS)
{ //GO.FT12F001  DD  DSN=permanent file name of disk
     file input data,DISP=SHR
//GO.SYSIN DD *

              Input Data

//
```

The control cards in braces should only be used if the respective read or write option of EMPFIT is employed.

APPENDIX A.--SAMPLE RUN AND LISTING OF EMPFIT

APPENDIX A

This appendix shows a sample run of EMPFIT and lists its main program and subroutines. Figures A-1 to A-3 show sample plots from EMPFIT.

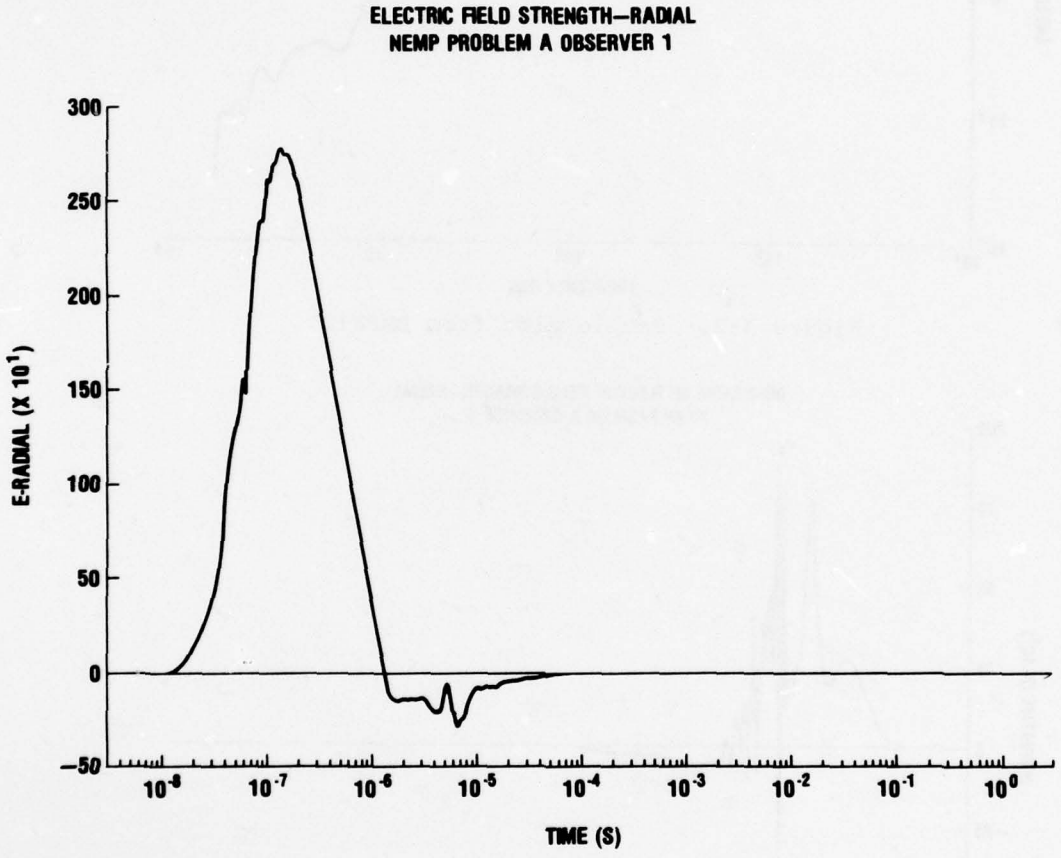

Figure A-1. Sample plot from EMPFIT.

APPENDIX A

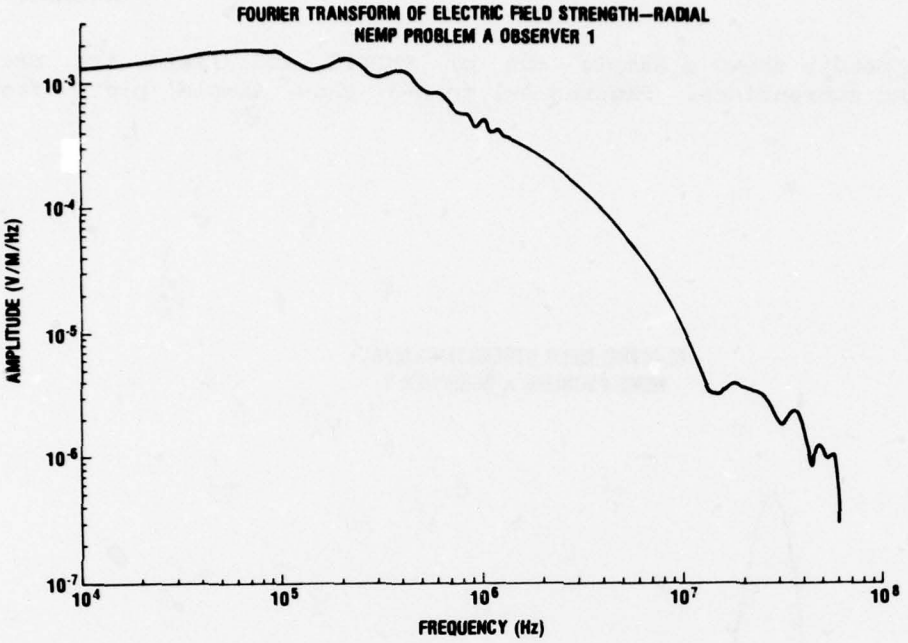

Figure A-2. Sample plot from EMPFIT.

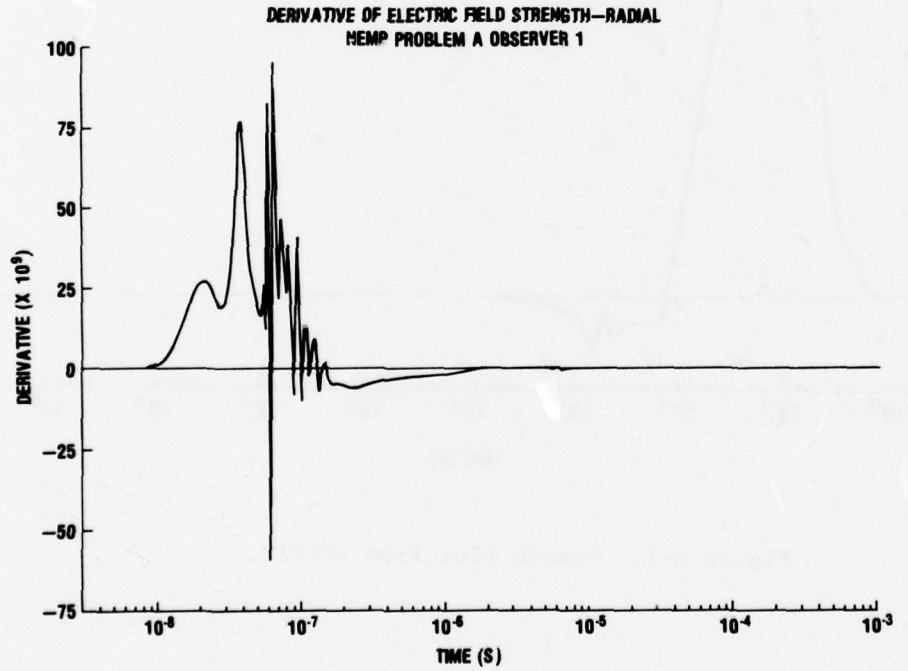

Figure A-3. Sample plot from EMPFIT.

```
 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.07       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


                C     PROGRAM EMPFIT(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE3,
                C                    TAPE10,TAPE11,TAPE12)
   ISN 0002           INTEGER TITLE
   ISN 0003           COMMON/A/ DRDMIN,IDENT,IFFT,TITLE(20),IPLOT,ILNLOG
   ISN 0004           COMMON/H/ IOT,IFPRIM,IPERM,IFPPLT
   ISN 0005           READ(5,10) NRUN
   ISN 0006        10 FORMAT(7X,I3)
   ISN 0007           DO 50 L=1,NRUN
                C
                C  READ IN INPUT DATA
                C
   ISN 0008           CALL INPUTT
                C
                C  CALCULATE CURVE FIT
                C
   ISN 0009           CALL CURFIT
                C
                C  CALCULATE FOURIER TRANSFORM
                C
   ISN 0010           IF(IFFT.EQ.1)  GO TO 20
   ISN 0012           CALL FORT
                C
                C  WRITE OUTPUT
                C
   ISN 0013        20 CALL OTPUT
                C
                C  PLOT DATA
                C
   ISN 0014           IF(IPLOT.EQ.1)  GO TO 30
   ISN 0016           CALL PLOTT
   ISN 0017        30 CONTINUE
                C
                C  WRITE DATA ON PERMANENT FILE
                C
   ISN 0018           IF(IPERM.EQ.0)  GO TO 40
   ISN 0020           CALL RITDAT
   ISN 0021        40 CONTINUE
   ISN 0022        50 CONTINUE
   ISN 0023           STOP
   ISN 0024           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      23, PROGRAM SIZE =      424, SUBPROGRAM NAME =  MAIN
```

```
LEVEL 2.2  (SEPT 76)                 OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.09       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE INPUTT
   ISN 0003            COMPLEX FT
   ISN 0004            INTEGER XTITLE,YTITLE,ATITLE,TITLE
   ISN 0005            COMMON/A/ ORDMIN,IDENT,IFFT,TITLE(20),IPLOT,ILNLOG
   ISN 0006            COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     *           DF(500),DFF(5000)
   ISN 0007            COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0008            COMMON/D/ DELF,OSTART,OMAX,OMEGA(5000),FT(5000)
   ISN 0009            COMMON/G/ ICURV
   ISN 0010            COMMON/H/ IDT,IFPRIM,IPERM,IFPPLT
   ISN 0011            COMMON/K/ TX(100),FY(100),IREAD,IDELET,IADD,NIADD,NSETS,NUM(8)
   ISN 0012            DIMENSION XTITLE(10),YTITLE(10),ATITLE(10)
   ISN 0013            READ(5,10) IDENT,IFFT,IPLOT,ILNLOG,ORDMIN,ICURV,ICT,IREAD
   ISN 0014         10 FORMAT(4(9X,I1),E10.3,3(9X,I1))
   ISN 0015            READ(5,20) (TITLE(I),I=1,20)
   ISN 0016         20 FORMAT(20A4)
   ISN 0017            READ(5,30) IPTS,MPTS,TMAX,ALPHA,BETA,OSTART,OMAX,ICUT
   ISN 0018         30 FORMAT(7X,I3,7X,I3,5E10.3,9X,I1)
   ISN 0019            IF(ICUT.EQ.1)  READ(5,33) TCUT
   ISN 0021         33 FORMAT(E10.3)
   ISN 0022            NPTS=IPTS+1
   ISN 0023            IF(IDT.EQ.0)  GO TO 35
   ISN 0025            CALL ENTITL(1,XTITLE,YTITLE,ATITLE)
   ISN 0026         35 CONTINUE
                    C
                    C   READ TIME DERIVATIVE INFORMATION
                    C
   ISN 0027            IF(IREAD.EQ.2.OR.IREAD.EQ.3)  READ(5,36) IFPRIM,IPERM,IFPPLT
                    C
                    C   READ PERMANENT FILE DATA
                    C
   ISN 0029            IF(IREAD.EQ.1.OR.IREAD.EQ.3)  READ(5,36) NSETS,IDELET,IADD
   ISN 0031         36 FORMAT(3(9X,I1))
   ISN 0032            IF(IDELET.EQ.1)  READ(5,37) (NUM(I),I=1,8)
   ISN 0034         37 FORMAT(8(7X,I3))
   ISN 0035            IF(IADD.EQ.1)  READ(5,38) NIADD,(TX(I),FY(I),I=1,NIADD)
   ISN 0037         38 FORMAT(7X,I3,6E10.3)
   ISN 0038            IF(IREAD.EQ.1.OR.IREAD.EQ.3)  CALL PERFIL
   ISN 0040            IF(IREAD.EQ.1.OR.IREAD.EQ.3)  GO TO 60
                    C
                    C   READ DATA POINTS
                    C
   ISN 0042            DO 50 I=2,NPTS
   ISN 0043            READ(5,40) T(I),F(I)
   ISN 0044         40 FORMAT(2E10.3)
   ISN 0045         50 CONTINUE
   ISN 0046         60 IF(ICUT.EQ.1)  CALL CUTOFF
   ISN 0048            RETURN
   ISN 0049            END
```

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EVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.10       PAGE   1

QUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

TIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                 SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                    FUNCTIONS INLINE ARE:   NONE


 ISN 0002            SUBROUTINE CURFIT
 ISN 0003            INTEGER CPTS
 ISN 0004            COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                    *       DF(500),DFF(5000)
 ISN 0005            COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
 ISN 0006            COMMON/E/ A1,A2,A3,A4,C1,CNM1,D2,DNN
 ISN 0007            COMMON/H/ IOT,IFPRIM,IPERM,IFPPLT
 ISN 0008            COMMON/K/ TX(100),FY(100),IREAD,IDELET,IADD,NIADD,NSETS,NUM(8)
 ISN 0009            I=2
 ISN 0010            J=2
 ISN 0011            T(1)=.8*T(2)
 ISN 0012            F(1)=0.
 ISN 0013            TT(1)=T(1)
 ISN 0014            FF(1)=0.
 ISN 0015            T(NPTS+1)=TMAX
 ISN 0016            CALL A1A3(A1,A3,C1)
 ISN 0017            CALL A2A4(A2,A4,DNN)
 ISN 0018         10 H=T(J)-T(J-1)
 ISN 0019            DEL=H/(MPTS+1)
 ISN 0020         20 TT(I)=TT(I-1)+DEL
 ISN 0021            IF(TT(I).LT.(T(J)-DEL/100.)) GO TO 30
 ISN 0023            IF(TT(I).GT.T(NPTS)) GO TO 50
 ISN 0025            TT(I)=T(J)
 ISN 0026            FF(I)=F(J)
 ISN 0027            I=I+1
 ISN 0028         40 J=J+1
 ISN 0029            GO TO 10
 ISN 0030         30 CONTINUE
 ISN 0031            IF(TT(I).GT.T(2)) GO TO 50
 ISN 0033            ARG1=ALPHA*TT(I)
 ISN 0034            ARG2=2.*ARG1
 ISN 0035            FF(I)=A1*EXP(ARG1)+A3*EXP(ARG2)
 ISN 0036            I=I+1
 ISN 0037            GO TO 20
 ISN 0038         50 IF(TT(I).LT.T(NPTS)) GO TO 60
 ISN 0040            ARG3=-BETA*TT(I)
 ISN 0041            ARG4=2.*ARG3
 ISN 0042            FF(I)=A2*EXP(ARG3)+A4*EXP(ARG4)
 ISN 0043            IF(TT(I).GE.TMAX) GO TO 90
 ISN 0045            I=I+1
 ISN 0046            GO TO 20
 ISN 0047         60 CONTINUE
 ISN 0048            DT=TT(I)-T(J-1)
 ISN 0049            DTN=T(J)-TT(I)
 ISN 0050            DTNN=T(J)-T(J-1)
 ISN 0051            DTP1=TT(I)-T(J)
 ISN 0052            IF(J.NE.NPTS) GO TO 70
 ISN 0054            CALL A2A4(U,V,D)
 ISN 0055            GO TO 80
 ISN 0056         70 D=DN(J)
```

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LEVEL 2.2  (SEPT 76)          CURFIT          OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.39.10       PAGE   2

   ISN 0057        80  P1=(F(J)*DT+F(J-1)*DTN1/DTNN
   ISN 0058            P2=.5*(BN(J-1)+BN(J))*DT*DTP1
   ISN 0059            P3=CN(J-1)*DT*(DTN**3)
   ISN 0060            P4=D*DTN*(DT**3)
   ISN 0061            FF(I)=P1+P2+P3+P4
   ISN 0062            I=I+1
   ISN 0063            GO TO 20
   ISN 0064        90  CONTINUE
   ISN 0065            MAXPTS=I
   ISN 0066            OPTS=MAXPTS
                C
                C   CALCULATE TIME DERIVATIVE
                C
   ISN 0067            IF(IREAD.EQ.2.OR.IREAD.EQ.3)  CALL DERIV
   ISN 0069            L=0
   ISN 0070            DO 100 I=2,NPTS
   ISN 0071            L=L+1
   ISN 0072            T(L)=T(I)
   ISN 0073            F(L)=F(I)
   ISN 0074       100  CONTINUE
   ISN 0075            RETURN
   ISN 0076            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      75, PROGRAM SIZE =     1994, SUBPROGRAM NAME =CURFIT

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                  200K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.12       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           SUBROUTINE FORT
   ISN 0003           REAL IPFT
   ISN 0004           INTEGER OPTS
   ISN 0005           COMPLEX FT
   ISN 0006           COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     *          DF(500),DFF(5000)
   ISN 0007           COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0008           COMMON/D/ DELF,OSTART,OMAX,OMEGA(5000),FT(5000)
   ISN 0009           COMMON/E/ A1,A2,A3,A4,C1,CNM1,D2,DNN
   ISN 0010           COMMON/F/ RPFT(1000),IPFT(1000),ZABS(1000)
   ISN 0011           DATA TOPI/6.2831853/
   ISN 0012           OMEGA(1)=OSTART
   ISN 0013           DELF=(OMAX/OSTART)**(1./(OPTS-1))
   ISN 0014           DO 10 J=1,OPTS
   ISN 0015           CALL FLINE(FT(J),OMEGA(J)*TOPI,TT,FF,OPTS)
   ISN 0016           OMEGA(J+1)=OMEGA(J)*DELF
   ISN 0017        10 CONTINUE
   ISN 0018           DO 20 J=1,OPTS
   ISN 0019           RPFT(J)=REAL(FT(J))
   ISN 0020           IPFT(J)=AIMAG(FT(J))
   ISN 0021           ARG=RPFT(J)**2+IPFT(J)**2
   ISN 0022           ZABS(J)=SQRT(ARG)
   ISN 0023        20 CONTINUE
   ISN 0024           RETURN
   ISN 0025           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      24, PROGRAM SIZE =      786, SUBPROGRAM NAME =  FORT

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                        208K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    05/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.14       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOCALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE OTPUT
   ISN 0003            COMPLEX FT
   ISN 0004            INTEGER OPTS,FTITLE,TITLE,XTITLE,YTITLE,ATITLE
   ISN 0005            COMMON/A/ ORDMIN,IDENT,IFFT,TITLE(20),IPLOT,ILNLOG
   ISN 0006            COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                      '          DF(500),DFF(5000)
   ISN 0007            COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0008            COMMON/D/ DELF,OSTART,OMAX,OMEGA(5000),FT(5000)
   ISN 0009            COMMON/H/ IOT,IFPRIM,IPERM,IFPPLT
   ISN 0010            COMMON/J/ALFA,BET,AL,BE,LA1,LA2
   ISN 0011            COMMON/K/ TX(100),FY(100),IREAD,IDELET,IADD,NIADD,NSETS,NUM(8)
   ISN 0012            DIMENSION ATITLE(10),XTITLE(10),YTITLE(10)
   ISN 0013            DATA ATITLE/10*4H    /,XTITLE/10*4H    /,YTITLE/10*4H
   ISN 0014            IF(IOT.EQ.1)  GO TO 5
   ISN 0016            CALL ANOTAT(XTITLE,YTITLE,ATITLE,0)
   ISN 0017            GO TO 7
   ISN 0018         5  CALL ENTITL(0,XTITLE,YTITLE,ATITLE)
   ISN 0019         7  WRITE(6,10)
   ISN 0020        10  FORMAT(1H1)
   ISN 0021            WRITE(6,20) (TITLE(I),I=1,20)
   ISN 0022        20  FORMAT(1X,20A4)
   ISN 0023            WRITE(6,30) (ATITLE(I),I=1,10)
   ISN 0024        30  FORMAT(/,/,6X,13HINPUT DATA - ,10A4)
   ISN 0025            WRITE(6,40) AL,BE,TMAX,IPTS,MPTS
   ISN 0026        40  FORMAT(/,/,9X,7HALPHA= ,1PE11.3,5X,6HBETA= ,1PE11.3,5X,
                      131HMAXIMUM TIME TO BE CALCULATED= ,1PE11.3,/,9X,
                      229HNUMBER OF INPUT DATA POINTS= ,I3,5X,
                      355HNUMBER OF POINTS CALCULATED BETWEEN INPUT DATA POINTS= ,I3)
   ISN 0027            IF(ICUT.EQ.1)  WRITE(6,41) TCUT
   ISN 0029        41  FORMAT(9X,22HCUTOFF TIME EMPLOYED= ,1PE11.3)
   ISN 0030            IF(LA1.EQ.1)  WRITE(6,43) ALFA
   ISN 0032        43  FORMAT(9X,30HMAXIMUM VALUE FOR ALPHA USED= ,1PE11.3)
   ISN 0033            IF(LA2.EQ.1)  WRITE(6,45) BET
   ISN 0035        45  FORMAT(9X,29HMAXIMUM VALUE FOR BETA USED= ,1PE11.3)
   ISN 0036            WRITE(6,50) (XTITLE(I),I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),
                      'I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),I=1,3),(YTITLE(I),I=1,3)
   ISN 0037        50  FORMAT(/,/,13X,2A4,A2,4X,3A4,2(10X,2A4,A2,4X,3A4))
   ISN 0038            WRITE(6,60)
   ISN 0039        60  FORMAT(3(11X,25(1H-)))
   ISN 0040            CALL COLMNS(3,IPTS,T,F)
   ISN 0041            WRITE(6,80) IPTS
   ISN 0042        80  FORMAT(/,15X,19HNUMBER OF POINTS = ,I3)
   ISN 0043            WRITE(6,10)
   ISN 0044            WRITE(6,90)
   ISN 0045        90  FORMAT(/,/,6X,22HCURVE FIT CALCULATIONS)
   ISN 0046            WRITE(6,95) ORDMIN
   ISN 0047        95  FORMAT(/,/,9X,41HMINIMUM VALUE OF ORDINATE TO BE PLOTTED= ,
                      11PE11.3)
   ISN 0048            WRITE(6,50) (XTITLE(I),I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),
                      'I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),I=1,3),(YTITLE(I),I=1,3)
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LEVEL 2.2  (SEPT 76)          OTPUT          OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.14       PAGE   2

   ISN 0049            WRITE(6,60)
   ISN 0050            CALL COLMNS(3,MAXPTS,TT,FF)
   ISN 0051            WRITE(6,80) MAXPTS
   ISN 0052            IF(IFFT.EQ.1)  GO TO 140
   ISN 0054            CALL ANOTAT(XTITLE,YTITLE,ATITLE,1)
   ISN 0055            WRITE(6,10)
   ISN 0056            WRITE(6,100)
   ISN 0057       100  FORMAT(/,/,6X,30HFOURIER TRANSFORM CALCULATIONS)
   ISN 0058            WRITE(6,110) OSTART,DELF,OMAX
   ISN 0059       110  FORMAT(/,/,9X,27HSTARTING FREQUENCY(HERTZ)= ,1PE11.3,5X,
                      117HDELTA FREQUENCY= ,1PE11.3,/,9X,
                      236HMAXIMUM FREQUENCY TO BE CALCULATED= ,1PE11.3)
   ISN 0060            WRITE(6,120) (XTITLE(I),I=1,4),(YTITLE(I),I=1,5),(XTITLE(I),
                      'I=1,4),(YTITLE(I),I=1,5)
   ISN 0061       120  FORMAT(/,/,12X,4A4,7X,5A4,6X,4A4,7X,5A4,/,2(28X,4HREAL,7X,
                      '9HIMAGINARY,1X))
   ISN 0062            WRITE(6,130)
   ISN 0063       130  FORMAT(2(11X,38(1H-)))
   ISN 0064            CALL COLMNS(1,OPTS,OMEGA,FT)
   ISN 0065            WRITE(6,80) OPTS
   ISN 0066       140  CONTINUE
   ISN 0067            IF(IREAD.EQ.0.OR.IREAD.EQ.1)  GO TO 200
   ISN 0069            IF(IDT.EQ.1)  GO TO 150
   ISN 0071            CALL ANOTAT(XTITLE,YTITLE,ATITLE,0)
   ISN 0072            GO TO 160
   ISN 0073       150  CALL ENTITL(0,XTITLE,YTITLE,ATITLE)
   ISN 0074       160  WRITE(6,10)
   ISN 0075            WRITE(6,170)
   ISN 0076       170  FORMAT(/,/,6X,28HTIME DERIVATIVE CALCULATIONS)
   ISN 0077            WRITE(6,180)
   ISN 0078       180  FORMAT(/,/,27X,13HDERIVATIVE OF,2(23X,13HDERIVATIVE OF))
   ISN 0079            WRITE(6,190) (XTITLE(I),I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),
                      'I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),I=1,3),(YTITLE(I),I=1,3)
   ISN 0080       190  FORMAT(13X,2A4,A2,4X,3A4,2(10X,2A4,A2,4X,3A4))
   ISN 0081            WRITE(6,60)
   ISN 0082            CALL COLMNS(3,MAXPTS,TT,DFF)
   ISN 0083            WRITE(6,80) MAXPTS
   ISN 0084       200  RETURN
   ISN 0085            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      84, PROGRAM SIZE =     2852, SUBPROGRAM NAME = OTPUT

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                    192K BYTES OF CORE NOT USED
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LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

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LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.15       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE COLMNS(L,KPTS,X,Y)
   ISN 0003            COMPLEX FT
   ISN 0004            DIMENSION X(1),Y(1)
   ISN 0005            COMMON/D/ DELF,OSTART,OMAX,OMEGA(5000),FT(5000)
   ISN 0006            IF(L.EQ.2)  GO TO 40
   ISN 0008            IF(L.EQ.3)  GO TO 40
   ISN 0010            INC=KPTS/2
   ISN 0011            IK=MOD(KPTS,2)
   ISN 0012            ICOL=INC+1
   ISN 0013            IF(IK.EQ.0)  GO TO 10
   ISN 0015            IF(IK.EQ.1)  GO TO 30
   ISN 0017         10 WRITE(6,20) (OMEGA(I),FT(I),OMEGA(I+INC),FT(I+INC),I=1,INC)
   ISN 0018         20 FORMAT(2(11X,1PE11.3,3X,1PE11.3,2X,1PE11.3))
   ISN 0019            RETURN
   ISN 0020         30 WRITE(6,20) (OMEGA(I),FT(I),OMEGA(I+ICOL),FT(I+ICOL),I=1,INC)
   ISN 0021            WRITE(6,20) OMEGA(ICOL),FT(ICOL)
   ISN 0022            RETURN
   ISN 0023         40 INC=KPTS/3
   ISN 0024            IK=MOD(KPTS,3)
   ISN 0025            ICOL=INC+1
   ISN 0026            IF(L.EQ.2)  GO TO 90
   ISN 0028            IF(IK.EQ.0)  GO TO 50
   ISN 0030            IF(IK.EQ.1)  GO TO 70
   ISN 0032            IF(IK.EQ.2)  GO TO 80
   ISN 0034         50 WRITE(6,60) (X(I),Y(I),X(I+INC),Y(I+INC),X(I+2*INC),Y(I+2*INC),
                      1I=1,INC)
   ISN 0035         60 FORMAT(3(11X,1PE11.3,3X,1PE11.3))
   ISN 0036            RETURN
   ISN 0037         70 WRITE(6,60) (X(I),Y(I),X(I+ICOL),Y(I+ICOL),X(I+2*ICOL-1),
                      1Y(I+2*ICOL-1),I=1,INC)
   ISN 0038            WRITE(6,60) X(ICOL),Y(ICOL)
   ISN 0039            RETURN
   ISN 0040         80 WRITE(6,60) (X(I),Y(I),X(I+ICOL),Y(I+ICOL),X(I+2*ICOL),
                      1Y(I+2*ICOL),I=1,INC)
   ISN 0041            WRITE(6,60) X(ICOL),Y(ICOL),X(2*ICOL),Y(2*ICOL)
   ISN 0042            RETURN
   ISN 0043         90 CONTINUE
   ISN 0044            IF(IK.EQ.0)  GO TO 100
   ISN 0046            IF(IK.EQ.1)  GO TO 130
   ISN 0048            IF(IK.EQ.2)  GO TO 150
   ISN 0050        100 DO 110 I=1,INC
   ISN 0051            IINC=I+INC
   ISN 0052            I2INC=I+2*INC
   ISN 0053            WRITE(6,120) I,X(I),Y(I),IINC,X(IINC),Y(IINC),I2INC,X(I2INC),
                     *              Y(I2INC)
   ISN 0054        110 CONTINUE
   ISN 0055        120 FORMAT(3(4X,I3,4X,1PE11.3,3X,1PE11.3))
   ISN 0056            RETURN
   ISN 0057        130 DO 140 I=1,INC
   ISN 0058            IICOL=I+ICOL
```

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LEVEL 2.2  (SEPT 76)          COLMNS          OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.15       PAGE   2

   ISN 0059            I2ICOL=1+2*ICOL-1
   ISN 0060            WRITE(6,120) I,X(I),Y(I),I1CCL,X(I1COL),Y(I1COL),I2ICOL,X(I2ICOL),
                      *                 Y(I2ICOL)
   ISN 0061         140 CONTINUE
   ISN 0062            WRITE(6,120) ICOL,X(ICOL),Y(ICOL)
   ISN 0063            RETURN
   ISN 0064         150 DO 160 I=1,INC
   ISN 0065            I1COL=I+ICOL
   ISN 0066            I2ICOL=1+2*ICOL
   ISN 0067            WRITE(6,120) I,X(I),Y(I),I1CCL,X(I1COL),Y(I1COL),I2ICOL,X(I2ICCL),
                      *                 Y(I2ICOL)
   ISN 0068         160 CONTINUE
   ISN 0069            I2COL=2*ICOL
   ISN 0070            WRITE(6,120) ICOL,X(ICCL),Y(ICOL),I2COL,X(I2COL),Y(I2CCL)
   ISN 0071            RETURN
   ISN 0072            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =       71, PROGRAM SIZE =     2894, SUBPROGRAM NAME =COLMNS

*STATISTICS*  NO  DIAGNOSTICS GENERATED

******* END OF COMPILATION ******                                    196K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.17       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE PLOTT
   ISN 0003            REAL IPFT
   ISN 0004            COMPLEX FT
   ISN 0005            INTEGER OPTS,FTITLE
   ISN 0006            INTEGER XTITLE,YTITLE,ATITLE,TITLE
   ISN 0007            COMMON/A/ ORDMIN,IDENT,IFFT,TITLE(20),IPLOT,ILNLOG
   ISN 0008            COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     *          DF(500),DFF(5000)
   ISN 0009            COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0010            COMMON/D/ DELF,OSTART,OMAX,OMEGA(5000),FT(5000)
   ISN 0011            COMMON/E/ A1,A2,A3,A4,C1,CNM1,D2,DNN
   ISN 0012            COMMON/F/ RPFT(1000),IPFT(1000),ZABS(1000)
   ISN 0013            COMMON/G/ ICURV
   ISN 0014            COMMON/H/ IOT,IFPRIM,IPERM,IFPPLT
   ISN 0015            DIMENSION FTITLE(14),ATITLE(10),XTITLE(10),YTITLE(10)
   ISN 0016            DATA FTITLE/14*4H     /,ATITLE/10*4H     /,XTITLE/10*4H     /,
                     *      YTITLE/10*4H     /
   ISN 0017            IF(ILNLOG.EQ.2)  GO TO 2
   ISN 0019            L=0
   ISN 0020            DO 1 I=1,MAXPTS
   ISN 0021            IF(FF(I).LT.ORDMIN)  GO TO 1
   ISN 0023            L=L+1
   ISN 0024            TT(L)=TT(I)
   ISN 0025            FF(L)=FF(I)
   ISN 0026         1  CONTINUE
   ISN 0027            MAXPTS=L
   ISN 0028            GO TO 4
   ISN 0029         2  CONTINUE
   ISN 0030            DO 3 I=1,MAXPTS
   ISN 0031            IF(FF(I).LT.ORDMIN)  TT(I)=0.
   ISN 0033         3  CONTINUE
   ISN 0034         4  CONTINUE
   ISN 0035            IF(IOT.EQ.1)  GO TO 5
   ISN 0037            CALL ANOTAT(XTITLE,YTITLE,ATITLE,0)
   ISN 0038            GO TO 7
   ISN 0039         5  CALL ENTITL(0,XTITLE,YTITLE,ATITLE)
   ISN 0040         7  IF(ICURV.EQ.1)  GO TO 8
   ISN 0042            CALL DRAW4(1,3,3,3,8,20,XTITLE,YTITLE,ATITLE,TITLE)
   ISN 0043            CALL DRAW4(2,3,ILNLOG,IPTS,-2,10,T,F,0.,0.)
   ISN 0044            CALL DRAW4(2,3,ILNLOG,MAXPTS,0,10,TT,FF,0.,0.)
   ISN 0045            CALL DRAW4(3,3,0,0,0,MAXPTS,TT,FF,2.,0.)
   ISN 0046            IF(ICURV.EQ.0)  GO TO 9
   ISN 0048         8  CONTINUE
   ISN 0049            CALL DRAW4(1,3,3,3,8,20,XTITLE,YTITLE,ATITLE,TITLE)
   ISN 0050            CALL DRAW4(2,3,ILNLOG,MAXPTS,0,10,TT,FF,0.,0.)
   ISN 0051            CALL DRAW4(3,3,0,0,0,MAXPTS,TT,FF,2.,0.)
   ISN 0052         9  CONTINUE
   ISN 0053            IF(IFFT.EQ.1)  GO TO 20
   ISN 0055            CALL ANOTAT(XTITLE,YTITLE,FTITLE,1)
   ISN 0056            DO 10 J=7,14
```

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LEVEL 2.2  (SEPT 76)          PLOTT          OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.17       PAGE   2

   ISN 0057            K=J-6
   ISN 0058            FTITLE(J)=ATITLE(K)
   ISN 0059         10 CONTINUE
   ISN 0060            CALL DRAW4(1,3,4,5,14,20,XTITLE,YTITLE,FTITLE,TITLE)
   ISN 0061            CALL DRAW4(2,3,2,OPTS,0,10,OMEGA,ZABS,0.,0.)
   ISN 0062            CALL DRAW4(3,3,0,0,0,OPTS,OMEGA,ZABS,2.,0.)
   ISN 0063         20 CONTINUE
   ISN 0064            IF(IFPPLT.EQ.0)  GO TO 60
   ISN 0066            IF(IDT.EG.1)  GO TL 30
   ISN 0068            CALL ANOTAT(XTITLE,YTITLE,ATITLE,0)
   ISN 0069            GO TO 40
   ISN 0070         30 CALL ENTITL(C,XTITLE,YTITLE,ATITLE)
   ISN 0071         40 CONTINUE
   ISN 0072            CALL ANOTAT(XTITLE,YTITLE,FTITLE,2)
   ISN 0073            DO 50 J=5,12
   ISN 0074            K=J-4
   ISN 0075            FTITLE(J)=ATITLE(K)
   ISN 0076         50 CONTINUE
   ISN 0077            CALL DRAW4(1,3,3,3,12,20,XTITLE,YTITLE,FTITLE,TITLE)
   ISN 0078            CALL DRAW4(2,3,ILNLOG,MAXPTS,0,10,TT,DFF,0.,0.)
   ISN 0079            CALL DRAW4(3,3,0,0,0,MAXPTS,TT,DFF,2.,0.)
   ISN 0080         60 RETURN
   ISN 0081            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(OSCOK) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =       80, PROGRAM SIZE =      1804, SUBPROGRAM NAME = PLOTT

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                    196K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS        DATE 77.325/14.19.20        PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE ANOTAT(XTITLE,YTITLE,ATITLE,IZ)
   ISN 0003            INTEGER TIME,ERAD,YERAD,EVER,YEVER,BAZ,YBAZ,YJRAD,YJVER,SIG
   ISN 0004            INTEGER YSIG,FOUR,XFOUR,YFOUR,YDER,DRIV,YFOR
   ISN 0005            INTEGER XTITLE,YTITLE,ATITLE,TITLE
   ISN 0006            COMMON/A/ ORDMIN,IDENT,IFFT,TITLE(20),IPLOT,ILNLOG
   ISN 0007            COMMON/H/ IOT,IFPRIM,IPERM,IFPPLT
   ISN 0008            DIMENSION ATITLE(8),XTITLE(4),YTITLE(5)
   ISN 0009            DIMENSION TIME(4),ERAD(8),YERAD(5),EVER(8),YEVER(5),BAZ(8),
                      *          YBAZ(5),JRAD(8),YJRAD(5),JVER(8),YJVER(5),SIG(8),
                      *          YSIG(5),FOUR(8),XFOUR(4),YFOUR(5),YDER(5),DRIV(8),
                      *          YFOR(5)
   ISN 0010            DATA TIME/4HTIME,4H (SE,4HC)  ,4H    /
                      *,    ERAD/4HELEC,4HTRIC,4H FIE,4HLD S,4HTREN,4HGTH-,4HRADI,4HAL  /
                      *,    YERAD/4HE-RA,4HDIAL,3*4H    /
                      *,    EVER/4HELEC,4HTRIC,4H FIE,4HLD S,4HTREN,4HGTH-,4HVERT,4HICAL/
                      *,    YEVER/4HE-VE,4HTRIC,4HAL  ,2*4H    /
                      *,    BAZ/4HMAGN,4HETIC,4H IND,4HUCTI,4HON-A,4HZIMU,4HTHAL,4H    /
                      *,    YBAZ/4HB-AZ,4HIMUT,4HHAL ,2*4H    /
                      *,    JRAD/4HCURR,4HENT ,4HDENS,4HITY-,4HRADI,4HAL  ,2*4H    /
                      *,    YJRAD/4HJ-RA,4HDIAL,3*4H    /
                      *,    JVER/4HCURR,4HENT ,4HDENS,4HITY-,4HVERT,4HICAL,2*4H    /
                      *,    YJVER/4HJ-VE,4HRTIC,4HAL  ,2*4H    /
                      *,    SIG/4HAIR ,4HCOND,4HUCTI,4HVITY,4*4H    /
                      *,    YSIG/4HSIGM,4HA   ,3*4H    /
                      *,    FOUR/4H   F,4HOURI,4HER T,4HRANS,4HFORM,4H OF ,2*4H    /
                      *,    XFOUR/4HFREQ,4HUENC,4HY(HZ,4H)  /
                      *,    YFOUR/4HAMPL,4HITUD,4HE(V/,4HM/HZ,4H)   /
                      *,    YFOR/4HAMPL,4HITUD,4HE   ,2*4H    /
                      *,    YDER/4HDERI,4HVATI,4HVE  ,2*4H    /
                      *,    DRIV/4H  DE,4HRIVA,4HTIVE,4H OF ,4*4H    /
   ISN 0011            IF(IZ.EQ.1)  GO TO 200
   ISN 0013            DO 10 I=1,4
   ISN 0014            XTITLE(I)=TIME(I)
   ISN 0015         10 CONTINUE
   ISN 0016            IF(IZ.EQ.2)  GO TO 240
   ISN 0018            GO TO (20,50,80,110,140,170),IDENT
   ISN 0019         20 DO 30 I=1,8
   ISN 0020            ATITLE(I)=ERAD(I)
   ISN 0021         30 CONTINUE
   ISN 0022            DO 40 I=1,5
   ISN 0023            YTITLE(I)=YERAD(I)
   ISN 0024         40 CONTINUE
   ISN 0025            RETURN
   ISN 0026         50 DO 60 I=1,8
   ISN 0027            ATITLE(I)=EVER(I)
   ISN 0028         60 CONTINUE
   ISN 0029            DO 70 I=1,5
   ISN 0030            YTITLE(I)=YEVER(I)
   ISN 0031         70 CONTINUE
   ISN 0032            RETURN
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LEVEL 2.2  (SEPT 76)          ANGTAT          OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.20       PAGE   2

   ISN 0033        80  DO 90 I=1,8
   ISN 0034            ATITLE(I)=BAZ(I)
   ISN 0035        90  CONTINUE
   ISN 0036            DO 100 I=1,5
   ISN 0037            YTITLE(I)=YBAZ(I)
   ISN 0038        100 CONTINUE
   ISN 0039            RETURN
   ISN 0040        110 DO 120 I=1,8
   ISN 0041            ATITLE(I)=JRAD(I)
   ISN 0042        120 CONTINUE
   ISN 0043            DO 130 I=1,5
   ISN 0044            YTITLE(I)=YJRAD(I)
   ISN 0045        130 CONTINUE
   ISN 0046            RETURN
   ISN 0047        140 DO 150 I=1,8
   ISN 0048            ATITLE(I)=JVER(I)
   ISN 0049        150 CONTINUE
   ISN 0050            DO 160 I=1,5
   ISN 0051            YTITLE(I)=YJVER(I)
   ISN 0052        160 CONTINUE
   ISN 0053            RETURN
   ISN 0054        170 DO 180 I=1,8
   ISN 0055            ATITLE(I)=SIG(I)
   ISN 0056        180 CONTINUE
   ISN 0057            DO 190 I=1,5
   ISN 0058            YTITLE(I)=YSIG(I)
   ISN 0059        190 CONTINUE
   ISN 0060            RETURN
   ISN 0061        200 CONTINUE
   ISN 0062            DO 210 I=1,8
   ISN 0063            ATITLE(I)=FOUR(I)
   ISN 0064        210 CONTINUE
   ISN 0065            DO 220 I=1,4
   ISN 0066            XTITLE(I)=XFOUR(I)
   ISN 0067        220 CONTINUE
   ISN 0068            IF(IDENT.EQ.1.OR.IDENT.EQ.2)  GO TO 235
   ISN 0070            DO 237 I=1,5
   ISN 0071            YTITLE(I)=YFOR(I)
   ISN 0072        237 CONTINUE
   ISN 0073            RETURN
   ISN 0074        235 CONTINUE
   ISN 0075            DO 230 I=1,5
   ISN 0076            YTITLE(I)=YFOUR(I)
   ISN 0077        230 CONTINUE
   ISN 0078            RETURN
   ISN 0079        240 CONTINUE
   ISN 0080            DO 250 I=1,5
   ISN 0081            YTITLE(I)=YDER(I)
   ISN 0082        250 CONTINUE
   ISN 0083            DO 260 I=1,8
   ISN 0084            ATITLE(I)=DRIV(I)
   ISN 0085        260 CONTINUE
   ISN 0086            RETURN
   ISN 0087            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)
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LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.22       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE FLINE(SUM,W,T,Y,NT)
   ISN 0003            DIMENSION T(1),Y(1)
   ISN 0004            COMPLEX AA,AB,AC,F3,F4,SUM
   ISN 0005            SUM=(0.0,0.0)
   ISN 0006            IF(W.EQ.0.0) GO TO 101
   ISN 0008            AA=1.0
   ISN 0009            IF(ABS(W*T(1)).GE.8.231E+5)  GO TO 10
   ISN 0011            AA=CMPLX(COS(W*T(1)),-SIN(W*T(1)))
   ISN 0012         10 CONTINUE
   ISN 0013            DO 100 I=2,NT
   ISN 0014            DT=T(I)-T(I-1)
   ISN 0015            AB=1.0
   ISN 0016            IF(ABS(W*T(I)).GE.8.231E+5)  GO TO 20
   ISN 0018            AB=CMPLX(COS(W*T(I)),-SIN(W*T(I)))
   ISN 0019         20 CONTINUE
   ISN 0020            WDT=W*DT
                     C  THE BREAKPOINT BETWEEN LARGE- AND SMALL-ARGUMENTS SHOULE BE 1.0E-N,
                     C  WHERE N=(D-4)/8, WHERE D = NUMBER OF DIGITS CARRIED BY THE COMPUTER.
                     C  THE AMPLITUDE ACCURACY OF THE LARGE ARGUMENT PROCEDURE IS D-2N DIGITS
                     C  AND OF THE SMALL-ARGUMENT PROCECURE IS 6N+4 DIGITS.
   ISN 0021            IF(ABS(WDT).GT.5.0E-2) GO TO 50
   ISN 0023            G=WDT**2
   ISN 0024            AC= G    *(CMPLX(0.5,-(1.0/3.0)*WDT)+G*(CMPLX(-0.125,(1.0/30.0)*WDT
                      "))+G*CMPLX((1.0/144.0),-(1.0/840.0)*WDT)))
   ISN 0025            F3=CONJG(AC)*AB
   ISN 0026            F4=AC*AA
   ISN 0027            GO TO 60
   ISN 0028         50 AC=CMPLX(1.0,WDT)
   ISN 0029            F4=AC*AB-AA
   ISN 0030            F3=CONJG(AC)*AA-AB
   ISN 0031         60 SUM=SUM+(F3*Y(I-1)+F4*Y(I))/(WDT*W)
   ISN 0032        100 AA=AB
   ISN 0033            RETURN
   ISN 0034        101 DO 102 J=2,NT
   ISN 0035        102 SUM=SUM+0.5*(Y(J-1)+Y(J))*(T(J)-T(J-1))
   ISN 0036            RETURN
   ISN 0037            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =       36, PROGRAM SIZE =      1876, SUBPROGRAM NAME = FLINE

*STATISTICS*  NO  DIAGNOSTICS GENERATED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.24       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           SUBROUTINE A1A3(A1,A3,C1)
   ISN 0003           REAL K1,K2
   ISN 0004           COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                    *           DF(500),DFF(5000)
   ISN 0005           COMMON/J/ALFA,BET,AL,BE,LA1,LA2
   ISN 0006           DF2=F(3)-F(2)
   ISN 0007           DT2=T(3)-T(2)
   ISN 0008           DT1=T(2)-T(3)
   ISN 0009           K1=DF2/DT2+.5*(BN(2)+BN(3))*DT1-ALPHA*F(2)
   ISN 0010           K2=BN(2)+BN(3)-(ALPHA**2)*F(2)
   ISN 0011           ARG1=2.*ALPHA*T(2)
   ISN 0012           AL=ALPHA
   ISN 0013           IF(ABS(ARG1).LT.174.)  GO TO 10
   ISN 0015           ALFA=174./(2.*T(2))
   ISN 0016           LA1=1
   ISN 0017           ALPHA=ALFA
   ISN 0018        10 ARG1=2.*ALPHA*T(2)
   ISN 0019           ARG2=-ALPHA*T(2)
   ISN 0020           EXA2=EXP(ARG1)
   ISN 0021           EXA=EXP(ARG2)
   ISN 0022           A3=(K1+K2*DT2/6.)/(((ALPHA**2)*DT2/2.+ALPHA)*EXA2)
   ISN 0023           A1=(F(2)-A3*EXA2)*EXA
   ISN 0024           RNUM=K1+K2*DT2/6.
   ISN 0025           RDENOM=((ALPHA**2)*DT2/2.)+ALPHA
   ISN 0026           C1=(K2-3.*(ALPHA**2)*(RNUM/RDENOM))/(6.*(DT2**2))
   ISN 0027           RETURN
   ISN 0028           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      27, PROGRAM SIZE =      992, SUBPROGRAM NAME =  A1A3

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                        212K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.26       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           SUBROUTINE A2A4(A2,A4,DNN)
   ISN 0003           REAL K3,K4
   ISN 0004           COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                               DF(500),DFF(5000)
   ISN 0005           COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0006           COMMON/J/ALFA,BET,AL,BE,LA1,LA2
   ISN 0007           DFN=F(NPTS)-F(NPTS-1)
   ISN 0008           DTN=T(NPTS)-T(NPTS-1)
   ISN 0009           K3=-DFN/DTN-.5*(BN(NPTS)+BN(NPTS-1))*DTN-BETA*F(NPTS)
   ISN 0010           K4=(BETA**2)*F(NPTS)-(BN(NPTS)+BA(NPTS-1))
   ISN 0011           BE=BETA
   ISN 0012           ARG1=-2.*BETA*T(NPTS)
   ISN 0013           IF(ABS(ARG1).LT.174.)  GO TO 10
   ISN 0015           LA2=1
   ISN 0016           BET=174./(-2.*T(NPTS))
   ISN 0017           BETA=BET
   ISN 0018        10 ARG1=-2.*BETA*T(NPTS)
   ISN 0019           ARG2=BETA*T(NPTS)
   ISN 0020           EXB2=EXP(ARG1)
   ISN 0021           EXB=EXP(ARG2)
   ISN 0022           A4=(K3-K4*DTN/6.)/((BETA+(BETA**2)*DTN/2.)*EXB2)
   ISN 0023           A2=(F(NPTS)-A4*EXB2)*EXB
   ISN 0024           RNUM=K3-K4*DTN/6.
   ISN 0025           RDENOM=BETA+(BETA**2)*DTN/2.
   ISN 0026           DNN=(K4+3.*(BETA**2)*(RNUM/RDENOM))/(6.*(DTN**2))
   ISN 0027           RETURN
   ISN 0028           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      27, PROGRAM SIZE =     1182, SUBPROGRAM NAME =  A2A4

*STATISTICS*  NO  DIAGNOSTICS GENERATED

*****  END OF COMPILATION  *****                                    212K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.28       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           FUNCTION BN(I)
   ISN 0003           COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                    *           DF(500),DFF(5000)
   ISN 0004           COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0005           IF(I.NE.2)  GO TO 10
   ISN 0007           DF2=F(3)-F(2)
   ISN 0008           DT2=T(3)-T(2)
   ISN 0009           D1=DF2/DT2
   ISN 0010           BN=(D1-ALPHA*F(2))*(1./DT2)
   ISN 0011           RETURN
   ISN 0012        10 IF(I.NE.NPTS)  GO TO 20
   ISN 0014           DFN=F(NPTS)-F(NPTS-1)
   ISN 0015           DTN=T(NPTS)-T(NPTS-1)
   ISN 0016           D2=DFN/DTN
   ISN 0017           BN=(-BETA*F(NPTS)-D2)*(1./DTN)
   ISN 0018           RETURN
   ISN 0019        20 DFP=F(I+1)-F(I)
   ISN 0020           FD=F(I)-F(I-1)
   ISN 0021           DTP=T(I+1)-T(I)
   ISN 0022           DT=T(I)-T(I-1)
   ISN 0023           BN=(DFP/DTP-FD/DT)*(1./(T(I+1)-T(I-1)))
   ISN 0024           RETURN
   ISN 0025           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*    FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =      24, PROGRAM SIZE =      834, SUBPROGRAM NAME =     BN

*STATISTICS*  NO  DIAGNOSTICS GENERATED

******* END OF COMPILATION *****                                    212K BYTES OF CORE NOT USED
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LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.30       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            FUNCTION CN(J)
   ISN 0003            COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     *           DF(500),DFF(5000)
   ISN 0004            COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0005            COMMON/E/ A1,A2,A3,A4,C1,CNM1,D2,DNN
   ISN 0006            IF(J.EQ.2)  GO TO 10
   ISN 0008            DTN=T(J)-T(J-1)
   ISN 0009            DTP1=T(J+1)-T(J)
   ISN 0010            DTP2=T(J+1)-T(J-1)
   ISN 0011            CN=(-DELF1(J)+DELF2(J)*DTN/6.)/((DTP1**2)*DTP2)
   ISN 0012            IF(J.NE.NPTS-1)  RETURN
   ISN 0014            CNM1=CN
   ISN 0015            RETURN
   ISN 0016         10 CN=C1
   ISN 0017            RETURN
   ISN 0018            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      17, PROGRAM SIZE =      562, SUBPROGRAM NAME =    CN

*STATISTICS*  NO  DIAGNOSTICS GENERATED

*****  END OF COMPILATION  *****                                   212K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.31       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           FUNCTION DN(J)
   ISN 0003           COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     '           DF(500),DFF(5000)
   ISN 0004           COMMON/E/ A1,A2,A3,A4,C1,CNM1,D2,DNN
   ISN 0005           DTN=T(J)-T(J-1)
   ISN 0006           DTP2=T(J+1)-T(J-1)
   ISN 0007           DN=(-DELF1(J)-DELF2(J)*DTN/6.)/((DTN**2)*DTP2)
   ISN 0008           IF(J.NE.3)  RETURN
   ISN 0010           D2=DN
   ISN 0011           RETURN
   ISN 0012           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*    FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =       11, PROGRAM SIZE =       466, SUBPROGRAM NAME =     DN

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                    212K BYTES OF CORE NOT USED
```

```
 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.33       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(OSCOK) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           FUNCTION DELF1(J)
   ISN 0003           COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     *          DF(500),DFF(5000)
   ISN 0004           DFP1=F(J+1)-F(J)
   ISN 0005           DFN=F(J)-F(J-1)
   ISN 0006           DTP1=T(J+1)-T(J)
   ISN 0007           DTN=T(J)-T(J-1)
   ISN 0008           R1=.5*(BN(J)+BN(J+1))*DTP1
   ISN 0009           R2=.5*(BN(J)+BN(J-1))*DTN
   ISN 0010           DELF1=DFP1/DTP1-DFN/DTN-R1-R2
   ISN 0011           RETURN
   ISN 0012           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(OSCOK) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      11, PROGRAM SIZE =      584, SUBPROGRAM NAME = DELF1

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                        212K BYTES OF CORE NOT USED
```

```
LEVEL 2.2  (SEPT 76)                    CS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.35       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           FUNCTION DELF2(J)
   ISN 0003           DELF2=BN(J+1)-BN(J-1)
   ISN 0004           RETURN
   ISN 0005           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =       4, PROGRAM SIZE =      306, SUBPROGRAM NAME = DELF2

*STATISTICS*  NO  DIAGNOSTICS GENERATED

*****  END OF COMPILATION  *****                                    212K BYTES OF CORE NOT USED
```

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

```
 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.36       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE ENTITL(IZ,XLAB,YLAB,PLAB)
   ISN 0003            INTEGER XTITLE,YTITLE,ATITLE
   ISN 0004            INTEGER XLAB,YLAB,PLAB
   ISN 0005            COMMON/I/ XTITLE(10),YTITLE(10),ATITLE(10)
   ISN 0006            DIMENSION XLAB(10),YLAB(10),PLAB(10)
   ISN 0007            IF(IZ.EQ.0)  GO TO 40
   ISN 0009            READ(5,10) (XTITLE(I),I=1,3)
   ISN 0010         10 FORMAT(3A4)
   ISN 0011            READ(5,20) (YTITLE(I),I=1,5)
   ISN 0012         20 FORMAT(5A4)
   ISN 0013            READ(5,30) (ATITLE(I),I=1,10)
   ISN 0014         30 FORMAT(10A4)
   ISN 0015            RETURN
   ISN 0016         40 CONTINUE
   ISN 0017            DO 50 I=1,3
   ISN 0018         50 XLAB(I)=XTITLE(I)
   ISN 0019            DO 60 I=1,5
   ISN 0020         60 YLAB(I)=YTITLE(I)
   ISN 0021            DO 70 I=1,10
   ISN 0022         70 PLAB(I)=ATITLE(I)
   ISN 0023            RETURN
   ISN 0024            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =      23, PROGRAM SIZE =      724, SUBPROGRAM NAME =ENTITL

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                    212K BYTES OF CORE NOT USED
```

```
 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.38       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE PERFIL
   ISN 0003            INTEGER TITLE
   ISN 0004            COMMON/A/ ORDMIN,IDENT,IFFT,TITLE(20),IPLOT,ILNLOG
   ISN 0005            COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                      *          DF(500),DFF(5000)
   ISN 0006            COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0007            COMMON/H/ IOT
   ISN 0008            COMMON/K/ TX(100),FY(100),IREAD,IDELET,IADD,NIADD,NSETS,NUM(8)
   ISN 0009            DIMENSION ATITLE(10),XTITLE(10),YTITLE(10)
   ISN 0010            DATA BLANK/4H    /
   ISN 0011            IF(IOT.EQ.1)  GO TO 5
   ISN 0013            CALL ANOTAT(XTITLE,YTITLE,ATITLE,0)
   ISN 0014            GO TO 7
   ISN 0015          5 CALL ENTITL(0,XTITLE,YTITLE,ATITLE)
   ISN 0016          7 IF(NSETS.EQ.0)  NSETS=1
   ISN 0018            CALL READPF(12,NSETS,T,F,JPTS)
                     C
                     C   WRITE DATA POINTS THAT WERE ON PERMANENT FILE
                     C
   ISN 0019            WRITE(6,10)
   ISN 0020         10 FORMAT(1H1)
   ISN 0021            WRITE(6,20) (ATITLE(I),I=1,10)
   ISN 0022         20 FORMAT(/,/,1X,10A4)
   ISN 0023            WRITE(6,30) (TITLE(I),I=1,20)
   ISN 0024         30 FORMAT(5X,20A4,/,/)
   ISN 0025            WRITE(6,40) (XTITLE(I),I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),
                      'I=1,3),(YTITLE(I),I=1,3),(XTITLE(I),I=1,3),(YTITLE(I),I=1,3)
   ISN 0026         40 FORMAT(/,/,13X,2A4,A2,4X,3A4,2(10X,2A4,A2,4X,3A4))
   ISN 0027            CALL COLMNS(2,JPTS,T,F)
                     C
                     C   DELETE SPECIFIED POINTS
                     C
   ISN 0028            IF(IDELET.EQ.0)  GO TO 60
   ISN 0030            J=1
                     C
                     C   IDENTIFY POINTS TO BE SCRATCHED
                     C
   ISN 0031            DO 50 I=1,JPTS
   ISN 0032            IF(I.EQ.NUM(J))  T(I)=BLANK
   ISN 0034            IF(I.EQ.NUM(J))  J=J+1
   ISN 0036         50 CONTINUE
                     C
                     C   DELETE POINTS
                     C
   ISN 0037            K=1
   ISN 0038            DO 70 I=1,JPTS
   ISN 0039            IF(T(I).EQ.BLANK)  GO TO 60
   ISN 0041            T(K)=T(I)
   ISN 0042            F(K)=F(I)
   ISN 0043            K=K+1
```

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LEVEL 2.2  (SEPT 76)          PERFIL           OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.38       PAGE   2

   ISN 0044        60  IF(I.EQ.JPTS.AND.T(I).EQ.BLANK)  K=K+1
   ISN 0046        70  CONTINUE
   ISN 0047            JPTS=K-1
                C
                C   ADD SPECIFIED POINTS
                C
   ISN 0048          80  IF(NIADD.EQ.0)  GO TO 130
   ISN 0050              DO 120 I=1,NIADD
   ISN 0051              K=1
   ISN 0052              DO 110 J=1,JPTS
   ISN 0053              T(K)=T(J)
   ISN 0054              F(K)=F(J)
   ISN 0055              IF(TX(I).GE.T(J).AND.TX(I).LE.T(J+1))  GO TO 90
   ISN 0057              IF(J.EQ.JPTS.AND.TX(I).GE.T(JPTS))  GO TO 90
   ISN 0059              GO TO 100
   ISN 0060          90  K=K+1
   ISN 0061              T(K)=TX(I)
   ISN 0062              F(K)=FY(I)
   ISN 0063         100  K=K+1
   ISN 0064         110  CONTINUE
   ISN 0065              JPTS=K-1
   ISN 0066         120  CONTINUE
                C
                C   DELETE FIRST POINT IF TIME OR AMPLITUDE EQUAL TO ZERO
                C
   ISN 0067         130  IF(T(1).NE.0..AND.F(1).NE.0.)  GO TO 150
   ISN 0069              DO 140 I=2,JPTS
   ISN 0070              T(I-1)=T(I)
   ISN 0071              F(I-1)=F(I)
   ISN 0072         140  CONTINUE
   ISN 0073              JPTS=JPTS-1
   ISN 0074         150  CONTINUE
   ISN 0075              DO 200 I=1,JPTS
   ISN 0076              K=JPTS+2-I
   ISN 0077              T(K)=T(K-1)
   ISN 0078              F(K)=F(K-1)
   ISN 0079         200  CONTINUE
   ISN 0080              IPTS=JPTS
   ISN 0081              NPTS=JPTS+1
   ISN 0082              RETURN
   ISN 0083              END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      82, PROGRAM SIZE =     2070, SUBPROGRAM NAME =PERFIL

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                    196K BYTES OF CORE NOT USED
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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS        DATE 77.325/14.19.41        PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002             SUBROUTINE DERIV
   ISN 0003             COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                       *          DF(500),DFF(5000)
   ISN 0004             COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0005             COMMON/E/ A1,A2,A3,A4,C1,CNM1,D2,DNN
   ISN 0006             COMMON/H/ IOT,IFPRIM,IPERM,IFPPLT
   ISN 0007             COMMON/K/ TX(100),FY(100),IREAD,IDELET,IADD,NIADD,NSETS,NUM(8)
   ISN 0008             DF(1)=0.
   ISN 0009             DFF(1)=0.
   ISN 0010             IF(IFPRIM.EQ.2)  GO TO 40
   ISN 0012             DO 30 I=2,NPTS
   ISN 0013             IF(T(I).NE.T(2))  GO TO 10
   ISN 0015             DF(I)=ALPHA*(F(I)+A3*EXP(2.*ALPHA*T(I)))
   ISN 0016             GO TO 30
   ISN 0017          10 IF(T(I).NE.T(NPTS))  GO TO 20
   ISN 0019             DF(I)=-BETA*(F(I)+A4*EXP(-2.*BETA*T(I)))
   ISN 0020             GO TO 30
   ISN 0021          20 FT=(F(I)-F(I-1))/(T(I)-T(I-1))
   ISN 0022             BT=T(I)-T(I-1)
   ISN 0023             DT=-(T(I)-T(I-1))**3
   ISN 0024             DF(I)=FT+.5*(BN(I-1)+BN(I))*BT+DN(I)*DT
   ISN 0025          30 CONTINUE
   ISN 0026             RETURN
   ISN 0027          40 CONTINUE
   ISN 0028             I=2
   ISN 0029             J=2
   ISN 0030          50 CONTINUE
   ISN 0031             IF(TT(I).GT.T(J))  J=J+1
   ISN 0033             IF(TT(I).GT.T(2))  GO TO 60
   ISN 0035             DFF(I)=ALPHA*(FF(I)+A3*EXP(2.*ALPHA*TT(I)))
   ISN 0036             I=I+1
   ISN 0037             GO TO 50
   ISN 0038          60 IF(TT(I).LT.T(NPTS))  GO TO 70
   ISN 0040             DFF(I)=-BETA*(FF(I)+A4*EXP(-2.*BETA*TT(I)))
   ISN 0041             IF(TT(I).GE.TMAX)  GO TO 100
   ISN 0043             I=I+1
   ISN 0044             GO TO 50
   ISN 0045          70 FT=(F(J)-F(J-1))/(T(J)-T(J-1))
   ISN 0046             BT=TT(I)-T(J)+TT(I)-T(J-1)
   ISN 0047             CT=(T(J)-TT(I))**3-3.*(TT(I)-T(J-1))*(T(J)-TT(I))**2
   ISN 0048             DT=-(TT(I)-T(J-1))**3+3.*(T(J)-TT(I))*(TT(I)-T(J-1))**2
   ISN 0049             IF(J.NE.NPTS)  GO TO 80
   ISN 0051             CALL A2A4(U,V,D)
   ISN 0052             GO TO 90
   ISN 0053          80 D=DN(J)
   ISN 0054          90 DFF(I)=FT+.5*(BN(J-1)+BN(J))*BT+CN(J-1)*CT+D*DT
   ISN 0055             I=I+1
   ISN 0056             GO TO 50
   ISN 0057         100 RETURN
   ISN 0058             END
```

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 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.43       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           SUBROUTINE RITDAT
   ISN 0003           INTEGER TITLE
   ISN 0004           COMMON/A/ ORDMIN,IDENT,IFFT,TITLE(20),IPLOT,ILNLOG
   ISN 0005           COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     *          DF(500),DFF(5000)
   ISN 0006           COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,OPTS,ICUT
   ISN 0007           COMMON/H/ IOT,IFPRIM,IPERM,IFPPLT
   ISN 0008           DIMENSION XTITLE(10),YTITLE(10),ATITLE(10)
   ISN 0009           DATA XTITLE/10*4H    /,YTITLE/10*4H    /,ATITLE/10*4H    /
   ISN 0010           GO TO (10,60,10),IPERM
   ISN 0011        10 CONTINUE
   ISN 0012           IF(IOT.EQ.1)  GO TO 20
   ISN 0014           CALL ANOTAT(XTITLE,YTITLE,ATITLE,2)
   ISN 0015           GO TO 30
   ISN 0016        20 CALL ENTITL(0,XTITLE,YTITLE,ATITLE)
   ISN 0017        30 IF(IFPRIM.EQ.2)  GO TO 40
   ISN 0019           CALL WRITPF(11,T,DF,IPTS,ATITLE)
   ISN 0020           GO TO 50
   ISN 0021        40 CALL WRITPF(11,TT,DFF,MAXPTS,ATITLE)
   ISN 0022        50 IF(IPERM.NE.3)  RETURN
   ISN 0024        60 CONTINUE
   ISN 0025           IF(IOT.EQ.1)  GO TO 70
   ISN 0027           CALL ANOTAT(XTITLE,YTITLE,ATITLE,0)
   ISN 0028           GO TO 80
   ISN 0029        70 CALL ENTITL(0,XTITLE,YTITLE,ATITLE)
   ISN 0030        80 CALL WRITPF(10,TT,FF,MAXPTS,ATITLE)
   ISN 0031           RETURN
   ISN 0032           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =       31, PROGRAM SIZE =       710, SUBPROGRAM NAME =RITDAT

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                        208K BYTES OF CORE NOT USED
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LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

```
 LEVEL 2.2  (SEPT 78)                    OS/360  FORTRAN H EXTENDED PLUS        DATE 77.325/14.19.44        PAGE    1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(OSCOK) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002            SUBROUTINE READPF(NT,NSETS,X,Y,JPTS)
   ISN 0003            DIMENSION X(JPTS),Y(JPTS)
   ISN 0004            DO 10 J=1,NSETS
   ISN 0005            READ (NT) N1,N2,JPTS,(X(I),A,I=1,JPTS),(Y(I),B,I=1,JPTS)
   ISN 0006       10   CONTINUE
   ISN 0007            RETURN
   ISN 0008            END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(OSCOK) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =        7, PROGRAM SIZE =       540, SUBPROGRAM NAME =READPF

*STATISTICS*  NO  DIAGNOSTICS GENERATED

*****  END OF COMPILATION  *****                                    212K BYTES OF CORE NOT USED
```

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

```
 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.47       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           SUBROUTINE WRITPF(NT,X,Y,NPTS,ATITLE)
   ISN 0003           DIMENSION X(NPTS),Y(NPTS),ATITLE(10)
   ISN 0004           WRITE(NT) ATITLE
   ISN 0005           WRITE(NT) NPTS
   ISN 0006           WRITE(NT) X,Y
   ISN 0007           RETURN
   ISN 0008           END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =        7, PROGRAM SIZE =       446, SUBPROGRAM NAME =WRITPF

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                  212K BYTES OF CORE NOT USED
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```
 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.49       PAGE    1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002             SUBROUTINE CUTOFF
   ISN 0003             COMMON/B/ T(500),F(500),ALPHA,BETA,TT(5000),FF(5000),
                     *           DF(500),DFF(5000)
   ISN 0004             COMMON/C/ TMAX,TCUT,NPTS,MPTS,IPTS,MAXPTS,DPTS,ICUT
   ISN 0005             DO 10 I=2,NPTS
   ISN 0006             IF(T(I).GE.TCUT)  GO TO 20
   ISN 0008          10 CONTINUE
   ISN 0009          20 NPTS=I
   ISN 0010             IPTS=NPTS-1
   ISN 0011             RETURN
   ISN 0012             END

*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*     SOURCE STATEMENTS =      11, PROGRAM SIZE =      284, SUBPROGRAM NAME =CUTOFF

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                        212K BYTES OF CORE NOT USED
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```
 LEVEL 2.2  (SEPT 76)                    OS/360  FORTRAN H EXTENDED PLUS       DATE 77.325/14.19.51       PAGE   1

REQUESTED OPTIONS: SOURCE,NOMAP,NOXREF,OPT(0)

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

                      FUNCTIONS INLINE ARE:   NONE


   ISN 0002           BLOCK DATA
   ISN 0003           INTEGER TITLE
   ISN 0004           COMMON/A/IDENT,IFFT,TITLE(20),IPLOT,ILNLOG,ORDMIN
   ISN 0005           COMMON/J/ALFA,BET,AL,BE,LA1,LA2
   ISN 0006           DATA TITLE/20*1H /,LA1/0/,LA2/0/
   ISN 0007           END


*OPTIONS IN EFFECT*NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(0500K) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF NOTERM FLAG(I)

*OPTIONS IN EFFECT*   FUNCTIONS INLINE ARE:   NONE

*OPTIONS IN EFFECT*

*STATISTICS*      SOURCE STATEMENTS =        6, PROGRAM SIZE =         0, SUBPROGRAM NAME =      A

*STATISTICS*  NO  DIAGNOSTICS GENERATED

****** END OF COMPILATION ******                                        212K BYTES OF CORE NOT USED

*STATISTICS*  NO  DIAGNOSTICS THIS STEP
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NEMP PROBLEM A OBSERVER 1

INPUT DATA - ELECTRIC FIELD STRENGTH-RADIAL

ALPHA= 1.200E+08 BETA= 5.000E+04 MAXIMUM TIME TO BE CALCULATED= 5.000E-04
NUMBER OF INPUT DATA POINTS= 221 NUMBER OF POINTS CALCULATED BETWEEN INPUT DATA POINTS= 1
CUTOFF TIME EMPLOYED= 3.000E-04

TIME (SEC)	E-RADIAL	TIME (SEC)	E-RADIAL	TIME (SEC)	E-RADIAL
1.038E-08	1.055E+00	2.330E-07	2.360E+03	7.537E-06	-2.294E+02
1.269E-08	9.021E+00	2.431E-07	2.303E+03	8.058E-06	-1.866E+02
1.481E-08	2.977E+01	2.538E-07	2.245E+03	8.578E-06	-1.372E+02
1.705E-08	6.791E+01	2.651E-07	2.186E+03	9.134E-06	-1.070E+02
1.948E-08	1.255E+02	2.769E-07	2.126E+03	9.723E-06	-8.248E+01
2.191E-08	1.911E+02	2.891E-07	2.067E+03	1.035E-05	-7.351E+01
2.406E-08	2.479E+02	3.022E-07	2.006E+03	1.101E-05	-8.732E+01
2.656E-08	3.032E+02	3.156E-07	1.947E+03	1.167E-05	-8.124E+01
2.843E-08	3.393E+02	3.298E-07	1.888E+03	1.240E-05	-6.684E+01
3.043E-08	3.796E+02	3.442E-07	1.831E+03	1.312E-05	-7.133E+01
3.133E-08	4.011E+02	3.594E-07	1.774E+03	1.392E-05	-6.603E+01
3.214E-08	4.239E+02	3.745E-07	1.720E+03	1.472E-05	-7.080E+01
3.287E-08	4.476E+02	3.987E-07	1.640E+03	1.559E-05	-6.802E+01
3.353E-08	4.723E+02	4.150E-07	1.590E+03	1.646E-05	-6.029E+01
3.412E-08	4.978E+02	4.316E-07	1.541E+03	1.739E-05	-5.069E+01
3.465E-08	5.238E+02	4.491E-07	1.491E+03	1.840E-05	-4.333E+01
3.513E-08	5.499E+02	4.752E-07	1.420E+03	1.940E-05	-4.064E+01
3.556E-08	5.755E+02	4.926E-07	1.375E+03	2.048E-05	-3.962E+01
3.595E-08	6.004E+02	5.205E-07	1.304E+03	2.159E-05	-3.966E+01
3.630E-08	6.242E+02	5.392E-07	1.258E+03	2.277E-05	-3.859E+01
3.661E-08	6.465E+02	5.677E-07	1.190E+03	2.402E-05	-3.551E+01
3.689E-08	6.673E+02	5.877E-07	1.143E+03	2.530E-05	-3.206E+01
3.715E-08	6.863E+02	6.178E-07	1.074E+03	2.666E-05	-2.865E+01
3.737E-08	7.037E+02	6.484E-07	1.005E+03	2.808E-05	-2.700E+01
3.758E-08	7.196E+02	6.807E-07	9.343E+02	2.954E-05	-2.417E+01
3.778E-08	7.350E+02	7.129E-07	8.653E+02	3.110E-05	-2.087E+01
3.818E-08	7.656E+02	7.457E-07	7.970E+02	3.273E-05	-2.067E+01
3.858E-08	7.957E+02	7.803E-07	7.268E+02	3.443E-05	-2.281E+01
3.898E-08	8.249E+02	8.149E-07	6.586E+02	3.620E-05	-2.101E+01
3.938E-08	8.533E+02	8.501E-07	5.917E+02	3.807E-05	-1.727E+01
3.998E-08	8.946E+02	8.872E-07	5.233E+02	4.002E-05	-1.507E+01
4.039E-08	9.216E+02	9.244E-07	4.576E+02	4.206E-05	-1.427E+01
4.189E-08	1.010E+03	9.745E-07	3.738E+02	4.422E-05	-1.333E+01
4.316E-08	1.067E+03	1.014E-06	3.111E+02	4.647E-05	-1.414E+01
4.515E-08	1.134E+03	1.067E-06	2.333E+02	4.880E-05	-1.196E+01
4.659E-08	1.176E+03	1.121E-06	1.621E+02	5.126E-05	-9.675E+00
4.827E-08	1.219E+03	1.164E-06	1.110E+02	5.383E-05	-1.071E+01
5.020E-08	1.261E+03	1.221E-06	5.035E+01	5.653E-05	-1.012E+01
5.245E-08	1.301E+03	1.278E-06	-1.371E+00	5.938E-05	-9.779E+00
5.413E-08	1.329E+03	1.339E-06	-4.635E+01	6.233E-05	-7.894E+00
5.599E-08	1.374E+03	1.400E-06	-8.244E+01	6.542E-05	-8.788E+00
5.804E-08	1.413E+03	1.461E-06	-1.096E+02	6.865E-05	-7.764E+00
6.031E-08	1.561E+03	1.526E-06	-1.292E+02	7.205E-05	-7.100E+00
6.280E-08	1.474E+03	1.608E-06	-1.438E+02	7.562E-05	-6.539E+00
6.555E-08	1.689E+03	1.673E-06	-1.487E+02	7.933E-05	-6.533E+00
6.858E-08	1.839E+03	1.756E-06	-1.485E+02	8.322E-05	-5.613E+00

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

7.192E-08	1.927E+03	1.838E-06	-1.450E+02	8.731E-05	-5.519E+00
7.372E-08	2.008E+03	1.921E-06	-1.403E+02	9.158E-05	-5.141E+00
7.759E-08	2.153E+03	2.020E-06	-1.348E+02	9.606E-05	-4.949E+00
7.967E-08	2.205E+03	2.102E-06	-1.324E+02	1.007E-04	-4.508E+00
8.414E-08	2.359E+03	2.201E-06	-1.322E+02	1.057E-04	-4.094E+00
8.644E-08	2.400E+03	2.317E-06	-1.337E+02	1.108E-04	-4.479E+00
9.104E-08	2.395E+03	2.416E-06	-1.361E+02	1.218E-04	-3.623E+00
9.334E-08	2.458E+03	2.531E-06	-1.378E+02	1.277E-04	-3.594E+00
9.794E-08	2.623E+03	2.647E-06	-1.366E+02	1.339E-04	-3.071E+00
1.025E-07	2.604E+03	2.779E-06	-1.331E+02	1.403E-04	-2.922E+00
1.071E-07	2.653E+03	2.911E-06	-1.295E+02	1.472E-04	-2.587E+00
1.117E-07	2.704E+03	3.043E-06	-1.289E+02	1.542E-04	-2.265E+00
1.163E-07	2.702E+03	3.192E-06	-1.360E+02	1.616E-04	-2.116E+00
1.212E-07	2.732E+03	3.340E-06	-1.512E+02	1.695E-04	-1.884E+00
1.263E-07	2.775E+03	3.489E-06	-1.706E+02	1.776E-04	-1.672E+00
1.315E-07	2.785E+03	3.654E-06	-1.916E+02	1.861E-04	-1.452E+00
1.372E-07	2.751E+03	3.819E-06	-2.059E+02	1.950E-04	-1.357E+00
1.430E-07	2.749E+03	4.000E-06	-2.116E+02	2.044E-04	-1.182E+00
1.491E-07	2.759E+03	4.198E-06	-2.104E+02	2.141E-04	-1.018E+00
1.555E-07	2.748E+03	4.396E-06	-2.025E+02	2.244E-04	-8.523E-01
1.622E-07	2.724E+03	4.594E-06	-1.811E+02	2.351E-04	-7.839E-01
1.692E-07	2.690E+03	4.809E-06	-1.340E+02	2.464E-04	-6.434E-01
1.766E-07	2.655E+03	5.040E-06	-5.880E+01	2.581E-04	-5.092E-01
1.843E-07	2.620E+03	5.272E-06	-5.934E+01	2.705E-04	-3.832E-01
1.924E-07	2.583E+03	5.698E-06	-2.008E+02	2.834E-04	-2.671E-01
2.050E-07	2.518E+03	6.115E-06	-1.968E+02	2.969E-04	-2.313E-01
2.138E-07	2.468E+03	6.566E-06	-2.892E+02	3.111E-04	-1.254E-01
2.231E-07	2.416E+03	7.052E-06	-2.407E+02		

NUMBER OF POINTS = 221

CURVE FIT CALCULATIONS

MINIMUM VALUE OF ORDINATE TO BE PLOTTED= -5.000E+05

TIME (SEC)	E-RADIAL	TIME (SEC)	E-RADIAL	TIME (SEC)	E-RADIAL
8.304E-09	0.0	2.280E-07	2.388E+03	7.294E-06	-2.336E+02
9.342E-09	8.872E-02	2.330E-07	2.360E+03	7.537E-06	-2.294E+02
1.038E-08	1.055E+00	2.380E-07	2.331E+03	7.798E-06	-2.109E+02
1.153E-08	3.282E+00	2.431E-07	2.303E+03	8.058E-06	-1.866E+02
1.269E-08	9.021E+00	2.485E-07	2.274E+03	8.318E-06	-1.608E+02
1.375E-08	1.763E+01	2.538E-07	2.245E+03	8.578E-06	-1.372E+02
1.481E-08	2.977E+01	2.595E-07	2.215E+03	8.856E-06	-1.201E+02
1.593E-08	4.686E+01	2.651E-07	2.186E+03	9.134E-06	-1.070E+02
1.705E-08	6.791E+01	2.710E-07	2.156E+03	9.429E-06	-9.338E+01
1.827E-08	9.509E+01	2.769E-07	2.126E+03	9.723E-06	-8.248E+01
1.948E-08	1.255E+02	2.830E-07	2.096E+03	1.004E-05	-7.530E+01
2.070E-08	1.579E+02	2.891E-07	2.067E+03	1.035E-05	-7.351E+01
2.191E-08	1.911E+02	2.956E-07	2.036E+03	1.068E-05	-8.020E+01
2.298E-08	2.201E+02	3.022E-07	2.006E+03	1.101E-05	-8.732E+01
2.406E-08	2.479E+02	3.089E-07	1.976E+03	1.134E-05	-8.630E+01
2.531E-08	2.768E+02	3.156E-07	1.947E+03	1.167E-05	-8.124E+01
2.656E-08	3.032E+02	3.227E-07	1.917E+03	1.203E-05	-7.315E+01
2.750E-08	3.215E+02	3.298E-07	1.888E+03	1.240E-05	-6.684E+01
2.843E-08	3.393E+02	3.370E-07	1.859E+03	1.276E-05	-6.841E+01
2.943E-08	3.586E+02	3.442E-07	1.831E+03	1.312E-05	-7.133E+01
3.043E-08	3.796E+02	3.518E-07	1.802E+03	1.352E-05	-6.880E+01
3.088E-08	3.899E+02	3.594E-07	1.774E+03	1.392E-05	-6.603E+01
3.133E-08	4.011E+02	3.670E-07	1.747E+03	1.432E-05	-6.812E+01
3.174E-08	4.120E+02	3.745E-07	1.720E+03	1.472E-05	-7.080E+01
3.214E-08	4.239E+02	3.866E-07	1.680E+03	1.515E-05	-7.036E+01
3.251E-08	4.353E+02	3.987E-07	1.640E+03	1.559E-05	-6.802E+01
3.287E-08	4.476E+02	4.069E-07	1.615E+03	1.602E-05	-6.454E+01
3.320E-08	4.595E+02	4.150E-07	1.590E+03	1.646E-05	-6.029E+01
3.353E-08	4.723E+02	4.233E-07	1.565E+03	1.692E-05	-5.539E+01
3.382E-08	4.846E+02	4.316E-07	1.541E+03	1.739E-05	-5.069E+01
3.412E-08	4.978E+02	4.404E-07	1.516E+03	1.790E-05	-4.649E+01
3.439E-08	5.104E+02	4.491E-07	1.491E+03	1.840E-05	-4.333E+01
3.465E-08	5.238E+02	4.621E-07	1.455E+03	1.890E-05	-4.157E+01
3.489E-08	5.365E+02	4.752E-07	1.420E+03	1.940E-05	-4.064E+01
3.513E-08	5.499E+02	4.839E-07	1.397E+03	1.994E-05	-3.995E+01
3.534E-08	5.625E+02	4.926E-07	1.375E+03	2.048E-05	-3.962E+01
3.556E-08	5.755E+02	5.066E-07	1.339E+03	2.104E-05	-3.963E+01
3.575E-08	5.878E+02	5.205E-07	1.304E+03	2.159E-05	-3.966E+01
3.595E-08	6.004E+02	5.298E-07	1.281E+03	2.218E-05	-3.933E+01
3.612E-08	6.121E+02	5.392E-07	1.258E+03	2.277E-05	-3.859E+01
3.630E-08	6.242E+02	5.534E-07	1.224E+03	2.340E-05	-3.720E+01
3.645E-08	6.353E+02	5.677E-07	1.190E+03	2.402E-05	-3.551E+01
3.661E-08	6.465E+02	5.777E-07	1.166E+03	2.466E-05	-3.379E+01
3.675E-08	6.568E+02	5.877E-07	1.143E+03	2.530E-05	-3.206E+01
3.689E-08	6.673E+02	6.028E-07	1.108E+03	2.598E-05	-3.021E+01
3.702E-08	6.768E+02	6.178E-07	1.074E+03	2.666E-05	-2.865E+01
3.715E-08	6.863E+02	6.331E-07	1.039E+03	2.737E-05	-2.777E+01
3.726E-08	6.950E+02	6.484E-07	1.005E+03	2.808E-05	-2.700E+01
3.737E-08	7.037E+02	6.645E-07	9.695E+02	2.881E-05	-2.571E+01

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

3.748E-08	7.116E+02	6.807E-07	9.343E+02	2.954E-05	-2.417E+01
3.758E-08	7.196E+02	6.968E-07	8.995E+02	3.032E-05	-2.234E+01
3.768E-08	7.273E+02	7.129E-07	8.653E+02	3.110E-05	-2.087E+01
3.778E-08	7.350E+02	7.293E-07	8.309E+02	3.191E-05	-2.037E+01
3.798E-08	7.504E+02	7.457E-07	7.970E+02	3.273E-05	-2.067E+01
3.818E-08	7.656E+02	7.630E-07	7.617E+02	3.358E-05	-2.184E+01
3.838E-08	7.807E+02	7.803E-07	7.268E+02	3.443E-05	-2.281E+01
3.858E-08	7.957E+02	7.976E-07	6.925E+02	3.532E-05	-2.233E+01
3.878E-08	8.104E+02	8.149E-07	6.586E+02	3.620E-05	-2.101E+01
3.898E-08	8.249E+02	8.325E-07	6.249E+02	3.714E-05	-1.915E+01
3.918E-08	8.392E+02	8.501E-07	5.917E+02	3.807E-05	-1.727E+01
3.938E-08	8.533E+02	8.687E-07	5.572E+02	3.905E-05	-1.595E+01
3.968E-08	8.742E+02	8.872E-07	5.233E+02	4.002E-05	-1.507E+01
3.998E-08	8.946E+02	9.058E-07	4.901E+02	4.104E-05	-1.459E+01
4.019E-08	9.082E+02	9.244E-07	4.576E+02	4.206E-05	-1.427E+01
4.039E-08	9.216E+02	9.494E-07	4.150E+02	4.314E-05	-1.369E+01
4.114E-08	9.683E+02	9.745E-07	3.738E+02	4.422E-05	-1.333E+01
4.189E-08	1.010E+03	9.944E-07	3.420E+02	4.534E-05	-1.381E+01
4.253E-08	1.041E+03	1.014E-06	3.111E+02	4.647E-05	-1.414E+01
4.316E-08	1.067E+03	1.041E-06	2.713E+02	4.763E-05	-1.328E+01
4.416E-08	1.103E+03	1.067E-06	2.333E+02	4.880E-05	-1.196E+01
4.515E-08	1.134E+03	1.094E-06	1.967E+02	5.003E-05	-1.057E+01
4.587E-08	1.155E+03	1.121E-06	1.621E+02	5.126E-05	-9.675E+00
4.659E-08	1.176E+03	1.142E-06	1.360E+02	5.254E-05	-1.006E+01
4.743E-08	1.198E+03	1.164E-06	1.110E+02	5.383E-05	-1.071E+01
4.827E-08	1.219E+03	1.192E-06	7.961E+01	5.518E-05	-1.053E+01
4.924E-08	1.241E+03	1.221E-06	5.035E+01	5.653E-05	-1.012E+01
5.020E-08	1.261E+03	1.249E-06	2.334E+01	5.796E-05	-1.003E+01
5.132E-08	1.282E+03	1.278E-06	-1.371E+00	5.938E-05	-9.779E+00
5.245E-08	1.301E+03	1.308E-06	-2.509E+01	6.085E-05	-8.754E+00
5.329E-08	1.315E+03	1.339E-06	-4.635E+01	6.233E-05	-7.894E+00
5.413E-08	1.329E+03	1.369E-06	-6.552E+01	6.387E-05	-8.259E+00
5.506E-08	1.352E+03	1.400E-06	-8.244E+01	6.542E-05	-8.788E+00
5.599E-08	1.374E+03	1.430E-06	-9.711E+01	6.703E-05	-8.403E+00
5.702E-08	1.387E+03	1.461E-06	-1.096E+02	6.865E-05	-7.764E+00
5.804E-08	1.413E+03	1.493E-06	-1.204E+02	7.035E-05	-7.386E+00
5.918E-08	1.496E+03	1.526E-06	-1.292E+02	7.205E-05	-7.100E+00
6.031E-08	1.561E+03	1.567E-06	-1.378E+02	7.383E-05	-6.771E+00
6.155E-08	1.518E+03	1.608E-06	-1.438E+02	7.562E-05	-6.539E+00
6.280E-08	1.474E+03	1.641E-06	-1.469E+02	7.748E-05	-6.558E+00
6.417E-08	1.562E+03	1.673E-06	-1.487E+02	7.933E-05	-6.533E+00
6.555E-08	1.689E+03	1.715E-06	-1.493E+02	8.128E-05	-6.084E+00
6.706E-08	1.777E+03	1.756E-06	-1.485E+02	8.322E-05	-5.613E+00
6.858E-08	1.839E+03	1.797E-06	-1.470E+02	8.527E-05	-5.519E+00
7.025E-08	1.882E+03	1.838E-06	-1.450E+02	8.731E-05	-5.519E+00
7.192E-08	1.927E+03	1.880E-06	-1.427E+02	8.945E-05	-5.341E+00
7.282E-08	1.966E+03	1.921E-06	-1.403E+02	9.158E-05	-5.141E+00
7.372E-08	2.008E+03	1.970E-06	-1.373E+02	9.382E-05	-5.045E+00
7.565E-08	2.087E+03	2.020E-06	-1.348E+02	9.606E-05	-4.949E+00
7.759E-08	2.153E+03	2.061E-06	-1.333E+02	9.840E-05	-4.748E+00
7.863E-08	2.179E+03	2.102E-06	-1.324E+02	1.007E-04	-4.508E+00
7.967E-08	2.205E+03	2.152E-06	-1.320E+02	1.032E-04	-4.242E+00
8.190E-08	2.284E+03	2.201E-06	-1.322E+02	1.057E-04	-4.094E+00
8.414E-08	2.359E+03	2.259E-06	-1.328E+02	1.082E-04	-4.263E+00
8.529E-08	2.384E+03	2.317E-06	-1.337E+02	1.108E-04	-4.479E+00
8.644E-08	2.400E+03	2.366E-06	-1.349E+02	1.163E-04	-4.139E+00
8.874E-08	2.393E+03	2.416E-06	-1.361E+02	1.218E-04	-3.623E+00
9.104E-08	2.395E+03	2.474E-06	-1.372E+02	1.247E-04	-3.617E+00
9.219E-08	2.422E+03	2.531E-06	-1.378E+02	1.277E-04	-3.594E+00
9.334E-08	2.458E+03	2.589E-06	-1.375E+02	1.308E-04	-3.347E+00

9.564E-08	2.550E+03	2.647E-06	-1.366E+02	1.339E-04	-3.071E+00
9.794E-08	2.623E+03	2.713E-06	-1.350E+02	1.371E-04	-2.977E+00
1.002E-07	2.622E+03	2.779E-06	-1.331E+02	1.403E-04	-2.922E+00
1.025E-07	2.604E+03	2.845E-06	-1.312E+02	1.437E-04	-2.768E+00
1.048E-07	2.623E+03	2.911E-06	-1.295E+02	1.472E-04	-2.587E+00
1.071E-07	2.653E+03	2.977E-06	-1.286E+02	1.507E-04	-2.411E+00
1.094E-07	2.682E+03	3.043E-06	-1.289E+02	1.542E-04	-2.265E+00
1.117E-07	2.704E+03	3.117E-06	-1.314E+02	1.579E-04	-2.182E+00
1.140E-07	2.705E+03	3.192E-06	-1.360E+02	1.616E-04	-2.116E+00
1.163E-07	2.702E+03	3.266E-06	-1.428E+02	1.655E-04	-2.004E+00
1.188E-07	2.713E+03	3.340E-06	-1.512E+02	1.695E-04	-1.884E+00
1.212E-07	2.732E+03	3.414E-06	-1.606E+02	1.735E-04	-1.776E+00
1.237E-07	2.755E+03	3.489E-06	-1.706E+02	1.776E-04	-1.672E+00
1.263E-07	2.775E+03	3.571E-06	-1.816E+02	1.818E-04	-1.554E+00
1.289E-07	2.786E+03	3.654E-06	-1.916E+02	1.861E-04	-1.452E+00
1.315E-07	2.785E+03	3.736E-06	-1.998E+02	1.906E-04	-1.400E+00
1.344E-07	2.769E+03	3.819E-06	-2.059E+02	1.950E-04	-1.357E+00
1.372E-07	2.751E+03	3.909E-06	-2.099E+02	1.997E-04	-1.274E+00
1.401E-07	2.747E+03	4.000E-06	-2.116E+02	2.044E-04	-1.182E+00
1.430E-07	2.749E+03	4.099E-06	-2.118E+02	2.093E-04	-1.098E+00
1.460E-07	2.754E+03	4.198E-06	-2.104E+02	2.141E-04	-1.018E+00
1.491E-07	2.759E+03	4.297E-06	-2.077E+02	2.193E-04	-9.277E-01
1.523E-07	2.756E+03	4.396E-06	-2.025E+02	2.244E-04	-8.523E-01
1.555E-07	2.748E+03	4.495E-06	-1.940E+02	2.298E-04	-8.154E-01
1.589E-07	2.737E+03	4.594E-06	-1.811E+02	2.351E-04	-7.839E-01
1.622E-07	2.724E+03	4.702E-06	-1.610E+02	2.408E-04	-7.183E-01
1.657E-07	2.707E+03	4.809E-06	-1.340E+02	2.464E-04	-6.434E-01
1.692E-07	2.690E+03	4.924E-06	-9.314E+01	2.523E-04	-5.742E-01
1.729E-07	2.672E+03	5.040E-06	-5.880E+01	2.581E-04	-5.092E-01
1.766E-07	2.655E+03	5.156E-06	-4.953E+01	2.643E-04	-4.446E-01
1.805E-07	2.638E+03	5.272E-06	-5.934E+01	2.705E-04	-3.832E-01
1.843E-07	2.620E+03	5.485E-06	-1.289E+02	2.770E-04	-3.184E-01
1.884E-07	2.602E+03	5.698E-06	-2.008E+02	2.834E-04	-2.671E-01
1.924E-07	2.583E+03	5.906E-06	-2.028E+02	2.902E-04	-2.478E-01
1.987E-07	2.552E+03	6.115E-06	-1.968E+02	2.969E-04	-2.313E-01
2.050E-07	2.518E+03	6.340E-06	-2.445E+02	3.040E-04	-1.836E-01
2.094E-07	2.493E+03	6.566E-06	-2.892E+02	3.111E-04	-1.254E-01
2.138E-07	2.468E+03	6.809E-06	-2.733E+02	4.055E-04	-9.985E-04
2.185E-07	2.442E+03	7.052E-06	-2.407E+02	5.000E-04	-8.864E-06
2.231E-07	2.416E+03				

NUMBER OF POINTS = 445

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

FOURIER TRANSFORM CALCULATIONS

STARTING FREQUENCY(HERTZ)= 1.000E+04 DELTA FREQUENCY= 1.020E+00
MAXIMUM FREQUENCY TO BE CALCULATED= 6.000E+07

FREQUENCY(HZ)	AMPLITUDE(V/M/HZ) REAL	IMAGINARY	FREQUENCY(HZ)	AMPLITUDE(V/M/HZ) REAL	IMAGINARY
1.000E+04	-2.061E-05	1.323E-03	7.898E+05	2.799E-05	-5.743E-04
1.020E+04	1.234E-06	1.324E-03	8.054E+05	2.480E-05	-5.786E-04
1.040E+04	2.299E-05	1.325E-03	8.213E+05	1.145E-05	-5.810E-04
1.061E+04	4.469E-05	1.326E-03	8.376E+05	-8.696E-06	-5.764E-04
1.082E+04	6.638E-05	1.327E-03	8.541E+05	-3.056E-05	-5.619E-04
1.103E+04	8.811E-05	1.327E-03	8.710E+05	-4.874E-05	-5.373E-04
1.125E+04	1.099E-04	1.327E-03	8.883E+05	-5.676E-05	-5.047E-04
1.147E+04	1.317E-04	1.327E-03	9.058E+05	-4.939E-05	-4.716E-04
1.170E+04	1.535E-04	1.327E-03	9.238E+05	-2.741E-05	-4.492E-04
1.193E+04	1.753E-04	1.326E-03	9.420E+05	-7.296E-07	-4.457E-04
1.216E+04	1.970E-04	1.325E-03	9.607E+05	1.639E-05	-4.608E-04
1.241E+04	2.185E-04	1.324E-03	9.797E+05	1.465E-05	-4.842E-04
1.265E+04	2.398E-04	1.323E-03	9.991E+05	-6.733E-06	-5.010E-04
1.290E+04	2.610E-04	1.321E-03	1.019E+06	-3.898E-05	-5.013E-04
1.316E+04	2.821E-04	1.320E-03	1.039E+06	-6.861E-05	-4.827E-04
1.342E+04	3.031E-04	1.319E-03	1.060E+06	-8.449E-05	-4.510E-04
1.368E+04	3.242E-04	1.317E-03	1.081E+06	-8.157E-05	-4.186E-04
1.395E+04	3.454E-04	1.316E-03	1.102E+06	-6.402E-05	-3.993E-04
1.423E+04	3.667E-04	1.314E-03	1.124E+06	-4.558E-05	-3.991E-04
1.451E+04	3.880E-04	1.312E-03	1.146E+06	-4.152E-05	-4.119E-04
1.480E+04	4.093E-04	1.311E-03	1.169E+06	-5.484E-05	-4.226E-04
1.509E+04	4.308E-04	1.309E-03	1.192E+06	-7.688E-05	-4.192E-04
1.539E+04	4.523E-04	1.307E-03	1.215E+06	-9.416E-05	-4.017E-04
1.569E+04	4.740E-04	1.306E-03	1.239E+06	-9.874E-05	-3.796E-04
1.600E+04	4.962E-04	1.304E-03	1.264E+06	-9.305E-05	-3.639E-04
1.632E+04	5.188E-04	1.302E-03	1.289E+06	-8.653E-05	-3.585E-04
1.664E+04	5.420E-04	1.300E-03	1.314E+06	-8.673E-05	-3.588E-04
1.697E+04	5.656E-04	1.297E-03	1.340E+06	-9.413E-05	-3.572E-04
1.731E+04	5.896E-04	1.294E-03	1.367E+06	-1.034E-04	-3.499E-04
1.765E+04	6.137E-04	1.290E-03	1.394E+06	-1.095E-04	-3.386E-04
1.800E+04	6.379E-04	1.285E-03	1.422E+06	-1.114E-04	-3.278E-04
1.836E+04	6.619E-04	1.280E-03	1.450E+06	-1.122E-04	-3.199E-04
1.872E+04	6.856E-04	1.273E-03	1.478E+06	-1.142E-04	-3.137E-04
1.909E+04	7.089E-04	1.267E-03	1.508E+06	-1.177E-04	-3.070E-04
1.947E+04	7.319E-04	1.260E-03	1.537E+06	-1.215E-04	-2.991E-04
1.985E+04	7.546E-04	1.253E-03	1.568E+06	-1.239E-04	-2.907E-04
2.025E+04	7.774E-04	1.246E-03	1.599E+06	-1.257E-04	-2.834E-04
2.065E+04	8.002E-04	1.238E-03	1.631E+06	-1.281E-04	-2.768E-04
2.105E+04	8.229E-04	1.230E-03	1.663E+06	-1.315E-04	-2.699E-04
2.147E+04	8.455E-04	1.221E-03	1.696E+06	-1.348E-04	-2.613E-04
2.190E+04	8.673E-04	1.211E-03	1.729E+06	-1.363E-04	-2.523E-04
2.233E+04	8.882E-04	1.202E-03	1.763E+06	-1.365E-04	-2.446E-04
2.277E+04	9.082E-04	1.192E-03	1.798E+06	-1.375E-04	-2.393E-04
2.322E+04	9.278E-04	1.183E-03	1.834E+06	-1.409E-04	-2.327E-04
2.368E+04	9.475E-04	1.175E-03	1.870E+06	-1.438E-04	-2.250E-04
2.415E+04	9.676E-04	1.167E-03	1.907E+06	-1.456E-04	-2.151E-04
2.463E+04	9.883E-04	1.158E-03	1.945E+06	-1.440E-04	-2.075E-04

2.511E+04	1.009E-03	1.150E-03	1.983E+06	-1.451E-04	-2.018E-04
2.561E+04	1.030E-03	1.141E-03	2.023E+06	-1.464E-04	-1.963E-04
2.612E+04	1.051E-03	1.132E-03	2.063E+06	-1.496E-04	-1.879E-04
2.663E+04	1.073E-03	1.122E-03	2.103E+06	-1.496E-04	-1.792E-04
2.716E+04	1.094E-03	1.112E-03	2.145E+06	-1.485E-04	-1.717E-04
2.770E+04	1.115E-03	1.101E-03	2.188E+06	-1.484E-04	-1.662E-04
2.825E+04	1.136E-03	1.090E-03	2.231E+06	-1.495E-04	-1.600E-04
2.881E+04	1.156E-03	1.079E-03	2.275E+06	-1.509E-04	-1.520E-04
2.938E+04	1.176E-03	1.068E-03	2.320E+06	-1.494E-04	-1.439E-04
2.996E+04	1.197E-03	1.057E-03	2.366E+06	-1.486E-04	-1.383E-04
3.055E+04	1.218E-03	1.045E-03	2.413E+06	-1.483E-04	-1.322E-04
3.115E+04	1.239E-03	1.033E-03	2.460E+06	-1.490E-04	-1.248E-04
3.177E+04	1.261E-03	1.020E-03	2.509E+06	-1.469E-04	-1.177E-04
3.240E+04	1.280E-03	1.006E-03	2.559E+06	-1.458E-04	-1.119E-04
3.304E+04	1.300E-03	9.925E-04	2.609E+06	-1.454E-04	-1.062E-04
3.369E+04	1.319E-03	9.800E-04	2.661E+06	-1.437E-04	-9.883E-05
3.436E+04	1.340E-03	9.673E-04	2.714E+06	-1.424E-04	-9.392E-05
3.504E+04	1.361E-03	9.536E-04	2.767E+06	-1.413E-04	-8.686E-05
3.573E+04	1.383E-03	9.389E-04	2.822E+06	-1.387E-04	-8.163E-05
3.644E+04	1.404E-03	9.232E-04	2.878E+06	-1.375E-04	-7.634E-05
3.716E+04	1.426E-03	9.065E-04	2.935E+06	-1.354E-04	-6.989E-05
3.790E+04	1.447E-03	8.884E-04	2.993E+06	-1.330E-04	-6.569E-05
3.865E+04	1.467E-03	8.687E-04	3.052E+06	-1.317E-04	-5.928E-05
3.941E+04	1.486E-03	8.483E-04	3.113E+06	-1.278E-04	-5.537E-05
4.019E+04	1.503E-03	8.281E-04	3.174E+06	-1.281E-04	-5.050E-05
4.099E+04	1.519E-03	8.088E-04	3.237E+06	-1.226E-04	-4.364E-05
4.180E+04	1.535E-03	7.897E-04	3.301E+06	-1.212E-04	-4.325E-05
4.262E+04	1.551E-03	7.708E-04	3.366E+06	-1.200E-04	-3.398E-05
4.347E+04	1.567E-03	7.521E-04	3.433E+06	-1.141E-04	-3.325E-05
4.433E+04	1.584E-03	7.328E-04	3.501E+06	-1.152E-04	-2.901E-05
4.521E+04	1.601E-03	7.125E-04	3.570E+06	-1.092E-04	-2.278E-05
4.610E+04	1.617E-03	6.917E-04	3.641E+06	-1.079E-04	-2.234E-05
4.701E+04	1.633E-03	6.703E-04	3.713E+06	-1.052E-04	-1.588E-05
4.794E+04	1.648E-03	6.480E-04	3.786E+06	-1.008E-04	-1.451E-05
4.889E+04	1.663E-03	6.247E-04	3.861E+06	-9.940E-05	-1.045E-05
4.986E+04	1.676E-03	6.015E-04	3.938E+06	-9.520E-05	-7.496E-06
5.084E+04	1.688E-03	5.791E-04	4.015E+06	-9.307E-05	-4.920E-06
5.185E+04	1.701E-03	5.570E-04	4.095E+06	-8.985E-05	-1.931E-06
5.288E+04	1.713E-03	5.351E-04	4.176E+06	-8.660E-05	3.074E-07
5.392E+04	1.726E-03	5.130E-04	4.259E+06	-8.409E-05	3.212E-06
5.499E+04	1.740E-03	4.904E-04	4.343E+06	-8.049E-05	4.828E-06
5.608E+04	1.755E-03	4.663E-04	4.429E+06	-7.789E-05	7.553E-06
5.719E+04	1.770E-03	4.394E-04	4.516E+06	-7.449E-05	9.003E-06
5.832E+04	1.782E-03	4.100E-04	4.606E+06	-7.189E-05	1.117E-05
5.947E+04	1.791E-03	3.803E-04	4.697E+06	-6.906E-05	1.229E-05
6.065E+04	1.798E-03	3.524E-04	4.790E+06	-6.568E-05	1.426E-05
6.185E+04	1.806E-03	3.264E-04	4.885E+06	-6.356E-05	1.588E-05
6.307E+04	1.815E-03	3.005E-04	4.981E+06	-6.009E-05	1.646E-05
6.432E+04	1.826E-03	2.720E-04	5.080E+06	-5.719E-05	1.837E-05
6.559E+04	1.836E-03	2.399E-04	5.180E+06	-5.491E-05	1.902E-05
6.689E+04	1.843E-03	2.054E-04	5.283E+06	-5.222E-05	1.974E-05
6.821E+04	1.845E-03	1.708E-04	5.387E+06	-4.893E-05	2.042E-05
6.956E+04	1.846E-03	1.380E-04	5.494E+06	-4.677E-05	2.209E-05
7.094E+04	1.845E-03	1.067E-04	5.603E+06	-4.476E-05	2.153E-05
7.234E+04	1.846E-03	7.535E-05	5.713E+06	-4.105E-05	2.226E-05
7.378E+04	1.845E-03	4.251E-05	5.826E+06	-3.949E-05	2.334E-05
7.524E+04	1.842E-03	8.186E-06	5.942E+06	-3.723E-05	2.276E-05
7.672E+04	1.836E-03	-2.565E-05	6.059E+06	-3.423E-05	2.308E-05
7.824E+04	1.828E-03	-5.770E-05	6.179E+06	-3.235E-05	2.371E-05
7.979E+04	1.818E-03	-8.820E-05	6.301E+06	-3.052E-05	2.339E-05

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

8.137E+04	1.808E-03	-1.181E-04	6.426E+06	-2.816E-05	2.309E-05
8.298E+04	1.796E-03	-1.468E-04	6.553E+06	-2.594E-05	2.338E-05
8.462E+04	1.783E-03	-1.729E-04	6.683E+06	-2.432E-05	2.311E-05
8.629E+04	1.770E-03	-1.955E-04	6.815E+06	-2.239E-05	2.255E-05
8.800E+04	1.761E-03	-2.166E-04	6.950E+06	-2.022E-05	2.250E-05
8.974E+04	1.756E-03	-2.391E-04	7.087E+06	-1.873E-05	2.226E-05
9.152E+04	1.752E-03	-2.657E-04	7.228E+06	-1.702E-05	2.158E-05
9.333E+04	1.749E-03	-2.982E-04	7.371E+06	-1.521E-05	2.120E-05
9.518E+04	1.741E-03	-3.373E-04	7.517E+06	-1.387E-05	2.093E-05
9.706E+04	1.724E-03	-3.805E-04	7.665E+06	-1.265E-05	2.022E-05
9.898E+04	1.697E-03	-4.214E-04	7.817E+06	-1.111E-05	1.942E-05
1.009E+05	1.662E-03	-4.553E-04	7.972E+06	-9.620E-06	1.900E-05
1.029E+05	1.626E-03	-4.819E-04	8.129E+06	-8.492E-06	1.866E-05
1.050E+05	1.588E-03	-5.026E-04	8.290E+06	-7.702E-06	1.797E-05
1.070E+05	1.550E-03	-5.180E-04	8.454E+06	-6.897E-06	1.704E-05
1.092E+05	1.514E-03	-5.283E-04	8.621E+06	-5.889E-06	1.605E-05
1.113E+05	1.480E-03	-5.356E-04	8.792E+06	-4.903E-06	1.518E-05
1.135E+05	1.447E-03	-5.416E-04	8.966E+06	-4.094E-06	1.440E-05
1.158E+05	1.414E-03	-5.452E-04	9.143E+06	-3.362E-06	1.374E-05
1.181E+05	1.382E-03	-5.455E-04	9.324E+06	-2.510E-06	1.306E-05
1.204E+05	1.350E-03	-5.424E-04	9.509E+06	-1.822E-06	1.214E-05
1.228E+05	1.320E-03	-5.357E-04	9.697E+06	-1.385E-06	1.137E-05
1.252E+05	1.291E-03	-5.244E-04	9.889E+06	-9.727E-07	1.081E-05
1.277E+05	1.268E-03	-5.099E-04	1.008E+07	-5.325E-07	1.018E-05
1.302E+05	1.248E-03	-4.949E-04	1.028E+07	-2.006E-07	9.392E-06
1.328E+05	1.230E-03	-4.788E-04	1.049E+07	-1.198E-07	8.582E-06
1.354E+05	1.215E-03	-4.584E-04	1.069E+07	-1.387E-07	8.043E-06
1.381E+05	1.208E-03	-4.353E-04	1.091E+07	1.356E-07	7.571E-06
1.408E+05	1.208E-03	-4.145E-04	1.112E+07	2.950E-07	6.936E-06
1.436E+05	1.212E-03	-3.971E-04	1.134E+07	4.327E-07	6.360E-06
1.465E+05	1.219E-03	-3.814E-04	1.157E+07	2.617E-07	5.957E-06
1.494E+05	1.232E-03	-3.677E-04	1.180E+07	4.186E-07	5.472E-06
1.523E+05	1.250E-03	-3.592E-04	1.203E+07	2.453E-07	5.059E-06
1.553E+05	1.271E-03	-3.600E-04	1.227E+07	3.233E-07	4.698E-06
1.584E+05	1.288E-03	-3.707E-04	1.251E+07	2.370E-07	4.485E-06
1.615E+05	1.297E-03	-3.837E-04	1.276E+07	2.804E-07	4.005E-06
1.647E+05	1.301E-03	-3.915E-04	1.301E+07	3.737E-08	3.948E-06
1.680E+05	1.308E-03	-3.945E-04	1.327E+07	5.077E-08	3.633E-06
1.713E+05	1.323E-03	-3.984E-04	1.353E+07	-1.725E-07	3.450E-06
1.747E+05	1.342E-03	-4.093E-04	1.380E+07	-1.257E-07	3.256E-06
1.782E+05	1.359E-03	-4.279E-04	1.407E+07	-2.155E-07	3.254E-06
1.817E+05	1.374E-03	-4.502E-04	1.435E+07	-3.911E-07	3.180E-06
1.853E+05	1.387E-03	-4.747E-04	1.463E+07	-4.756E-07	3.169E-06
1.889E+05	1.399E-03	-5.035E-04	1.492E+07	-5.671E-07	3.113E-06
1.927E+05	1.409E-03	-5.378E-04	1.522E+07	-5.561E-07	3.116E-06
1.965E+05	1.413E-03	-5.757E-04	1.552E+07	-4.984E-07	3.252E-06
2.004E+05	1.412E-03	-6.143E-04	1.583E+07	-5.696E-07	3.446E-06
2.043E+05	1.409E-03	-6.554E-04	1.614E+07	-4.567E-07	3.433E-06
2.084E+05	1.400E-03	-7.002E-04	1.646E+07	-2.683E-07	3.623E-06
2.125E+05	1.384E-03	-7.470E-04	1.678E+07	-1.417E-07	3.709E-06
2.167E+05	1.359E-03	-7.928E-04	1.712E+07	1.940E-07	3.745E-06
2.210E+05	1.328E-03	-8.365E-04	1.745E+07	4.995E-07	3.811E-06
2.254E+05	1.289E-03	-8.770E-04	1.780E+07	7.251E-07	3.838E-06
2.298E+05	1.241E-03	-9.109E-04	1.815E+07	1.043E-06	3.780E-06
2.344E+05	1.188E-03	-9.359E-04	1.851E+07	1.334E-06	3.586E-06
2.390E+05	1.134E-03	-9.509E-04	1.888E+07	1.629E-06	3.379E-06
2.438E+05	1.081E-03	-9.568E-04	1.925E+07	1.937E-06	3.240E-06
2.486E+05	1.029E-03	-9.557E-04	1.963E+07	2.156E-06	2.970E-06
2.535E+05	9.803E-04	-9.462E-04	2.002E+07	2.374E-06	2.771E-06
2.585E+05	9.361E-04	-9.289E-04	2.042E+07	2.594E-06	2.493E-06

2.636E+05	9.007E-04	-9.055E-04	2.082E+07	2.797E-06	2.135E-06
2.688E+05	8.741E-04	-8.808E-04	2.123E+07	2.948E-06	1.894E-06
2.742E+05	8.541E-04	-8.563E-04	2.165E+07	3.061E-06	1.539E-06
2.796E+05	8.405E-04	-8.320E-04	2.208E+07	3.160E-06	1.150E-06
2.851E+05	8.347E-04	-8.098E-04	2.252E+07	3.260E-06	8.049E-07
2.908E+05	8.343E-04	-7.926E-04	2.296E+07	3.300E-06	3.222E-07
2.965E+05	8.368E-04	-7.809E-04	2.342E+07	3.342E-06	-1.391E-07
3.024E+05	8.414E-04	-7.733E-04	2.388E+07	3.214E-06	-6.247E-07
3.084E+05	8.473E-04	-7.706E-04	2.435E+07	3.001E-06	-1.109E-06
3.145E+05	8.535E-04	-7.730E-04	2.483E+07	2.761E-06	-1.588E-06
3.207E+05	8.591E-04	-7.790E-04	2.533E+07	2.327E-06	-1.955E-06
3.270E+05	8.642E-04	-7.895E-04	2.583E+07	1.872E-06	-2.326E-06
3.335E+05	8.674E-04	-8.048E-04	2.634E+07	1.289E-06	-2.482E-06
3.401E+05	8.673E-04	-8.237E-04	2.686E+07	6.808E-07	-2.560E-06
3.468E+05	8.637E-04	-8.445E-04	2.739E+07	1.370E-07	-2.529E-06
3.537E+05	8.574E-04	-8.673E-04	2.793E+07	-2.956E-07	-2.297E-06
3.607E+05	8.487E-04	-8.927E-04	2.849E+07	-6.944E-07	-2.055E-06
3.678E+05	8.355E-04	-9.207E-04	2.905E+07	-9.575E-07	-1.780E-06
3.751E+05	8.173E-04	-9.509E-04	2.962E+07	-1.157E-06	-1.491E-06
3.825E+05	7.932E-04	-9.815E-04	3.021E+07	-1.326E-06	-1.209E-06
3.901E+05	7.622E-04	-1.012E-03	3.081E+07	-1.472E-06	-9.885E-07
3.978E+05	7.238E-04	-1.041E-03	3.142E+07	-1.650E-06	-7.550E-07
4.057E+05	6.778E-04	-1.065E-03	3.204E+07	-1.796E-06	-4.790E-07
4.137E+05	6.254E-04	-1.083E-03	3.267E+07	-1.970E-06	-1.434E-07
4.219E+05	5.682E-04	-1.092E-03	3.332E+07	-2.038E-06	3.074E-07
4.302E+05	5.082E-04	-1.089E-03	3.398E+07	-2.006E-06	8.433E-07
4.388E+05	4.507E-04	-1.075E-03	3.465E+07	-1.803E-06	1.422E-06
4.474E+05	4.000E-04	-1.050E-03	3.534E+07	-1.391E-06	1.895E-06
4.563E+05	3.574E-04	-1.019E-03	3.604E+07	-8.054E-07	2.250E-06
4.653E+05	3.255E-04	-9.846E-04	3.675E+07	-1.410E-07	2.360E-06
4.745E+05	3.029E-04	-9.514E-04	3.748E+07	5.241E-07	2.201E-06
4.839E+05	2.869E-04	-9.230E-04	3.822E+07	1.053E-06	1.819E-06
4.935E+05	2.733E-04	-8.979E-04	3.897E+07	1.383E-06	1.317E-06
5.033E+05	2.608E-04	-8.752E-04	3.974E+07	1.481E-06	7.958E-07
5.132E+05	2.511E-04	-8.526E-04	4.053E+07	1.343E-06	3.888E-07
5.234E+05	2.450E-04	-8.301E-04	4.133E+07	1.129E-06	1.378E-07
5.337E+05	2.448E-04	-8.118E-04	4.215E+07	8.979E-07	5.707E-08
5.443E+05	2.497E-04	-7.998E-04	4.298E+07	7.991E-07	1.104E-07
5.550E+05	2.536E-04	-7.986E-04	4.383E+07	8.617E-07	1.336E-07
5.660E+05	2.521E-04	-8.065E-04	4.470E+07	9.815E-07	8.597E-08
5.772E+05	2.394E-04	-8.186E-04	4.559E+07	1.113E-06	-8.041E-08
5.887E+05	2.156E-04	-8.284E-04	4.649E+07	1.138E-06	-3.753E-07
6.003E+05	1.840E-04	-8.298E-04	4.741E+07	1.020E-06	-6.484E-07
6.122E+05	1.513E-04	-8.216E-04	4.835E+07	8.026E-07	-8.671E-07
6.243E+05	1.223E-04	-8.062E-04	4.930E+07	5.271E-07	-9.697E-07
6.366E+05	9.735E-05	-7.878E-04	5.028E+07	3.061E-07	-9.680E-07
6.492E+05	7.515E-05	-7.680E-04	5.127E+07	1.433E-07	-9.459E-07
6.621E+05	5.506E-05	-7.465E-04	5.229E+07	-1.828E-10	-9.432E-07
6.752E+05	3.769E-05	-7.220E-04	5.332E+07	-1.872E-07	-9.745E-07
6.885E+05	2.438E-05	-6.967E-04	5.438E+07	-4.739E-07	-9.170E-07
7.022E+05	1.609E-05	-6.716E-04	5.545E+07	-7.492E-07	-7.111E-07
7.161E+05	1.026E-05	-6.479E-04	5.655E+07	-8.973E-07	-3.352E-07
7.302E+05	6.986E-06	-6.254E-04	5.767E+07	-8.059E-07	5.582E-08
7.447E+05	7.982E-06	-6.038E-04	5.881E+07	-5.106E-07	2.947E-07
7.594E+05	1.375E-05	-5.855E-04	5.997E+07	-1.636E-07	2.439E-07
7.744E+05	2.236E-05	-5.755E-04			

NUMBER OF POINTS = 445

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

TIME DERIVATIVE CALCULATIONS

TIME (SEC)	DERIVATIVE OF E-RADIAL	TIME (SEC)	DERIVATIVE OF E-RADIAL	TIME (SEC)	DERIVATIVE OF E-RADIAL
8.304E-09	0.0	2.280E-07	-5.702E+09	7.294E-06	3.006E+06
9.342E-09	7.728E+08	2.330E-07	-5.654E+09	7.537E-06	4.385E+07
1.038E-08	1.104E+09	2.380E-07	-5.582E+09	7.798E-06	8.823E+07
1.153E-08	3.234E+09	2.431E-07	-5.516E+09	8.058E-06	9.690E+07
1.269E-08	6.655E+09	2.485E-07	-5.437E+09	8.318E-06	9.859E+07
1.375E-08	9.651E+09	2.538E-07	-5.345E+09	8.578E-06	7.745E+07
1.481E-08	1.332E+10	2.595E-07	-5.244E+09	8.856E-06	5.073E+07
1.593E-08	1.711E+10	2.651E-07	-5.158E+09	9.134E-06	4.674E+07
1.705E-08	2.060E+10	2.710E-07	-5.069E+09	9.429E-06	4.311E+07
1.827E-08	2.382E+10	2.769E-07	-4.968E+09	9.723E-06	3.002E+07
1.948E-08	2.600E+10	2.830E-07	-4.860E+09	1.004E-05	1.600E+07
2.070E-08	2.730E+10	2.891E-07	-4.751E+09	1.035E-05	-7.788E+06
2.191E-08	2.726E+10	2.956E-07	-4.636E+09	1.068E-05	-2.709E+07
2.298E-08	2.654E+10	3.022E-07	-4.528E+09	1.101E-05	-9.722E+06
2.406E-08	2.463E+10	3.089E-07	-4.418E+09	1.134E-05	1.149E+07
2.531E-08	2.208E+10	3.156E-07	-4.295E+09	1.167E-05	1.915E+07
2.656E-08	2.018E+10	3.227E-07	-4.170E+09	1.203E-05	2.323E+07
2.750E-08	1.911E+10	3.298E-07	-4.065E+09	1.240E-05	6.705E+06
2.843E-08	1.902E+10	3.370E-07	-3.961E+09	1.276E-05	-1.057E+07
2.943E-08	1.978E+10	3.442E-07	-3.848E+09	1.312E-05	-1.358E+06
3.043E-08	2.253E+10	3.518E-07	-3.734E+09	1.352E-05	1.010E+07
3.088E-08	2.378E+10	3.594E-07	-3.631E+09	1.392E-05	7.144E+05
3.133E-08	2.592E+10	3.670E-07	-3.533E+09	1.432E-05	-8.336E+06
3.174E-08	2.816E+10	3.745E-07	-3.442E+09	1.472E-05	-3.191E+06
3.214E-08	3.035E+10	3.866E-07	-3.306E+09	1.515E-05	3.891E+06
3.251E-08	3.253E+10	3.987E-07	-3.176E+09	1.559E-05	6.743E+06
3.287E-08	3.505E+10	4.069E-07	-3.092E+09	1.602E-05	9.107E+06
3.320E-08	3.753E+10	4.150E-07	-3.027E+09	1.646E-05	1.031E+07
3.353E-08	4.039E+10	4.233E-07	-2.966E+09	1.692E-05	1.047E+07
3.382E-08	4.315E+10	4.316E-07	-2.904E+09	1.739E-05	9.343E+06
3.412E-08	4.614E+10	4.404E-07	-2.844E+09	1.790E-05	7.412E+06
3.439E-08	4.895E+10	4.491E-07	-2.786E+09	1.840E-05	4.876E+06
3.465E-08	5.185E+10	4.621E-07	-2.710E+09	1.890E-05	2.415E+06
3.489E-08	5.452E+10	4.752E-07	-2.648E+09	1.940E-05	1.511E+06
3.513E-08	5.716E+10	4.839E-07	-2.610E+09	1.994E-05	9.889E+05
3.534E-08	5.955E+10	4.926E-07	-2.577E+09	2.048E-05	2.321E+05
3.556E-08	6.201E+10	5.066E-07	-2.531E+09	2.104E-05	-1.744E+05
3.575E-08	6.421E+10	5.205E-07	-2.485E+09	2.159E-05	2.027E+05
3.595E-08	6.637E+10	5.298E-07	-2.456E+09	2.218E-05	8.765E+05
3.612E-08	6.824E+10	5.392E-07	-2.431E+09	2.277E-05	1.734E+06
3.630E-08	6.988E+10	5.534E-07	-2.397E+09	2.340E-05	2.587E+06
3.645E-08	7.125E+10	5.677E-07	-2.369E+09	2.402E-05	2.728E+06
3.661E-08	7.247E+10	5.777E-07	-2.350E+09	2.466E-05	2.667E+06
3.675E-08	7.346E+10	5.877E-07	-2.330E+09	2.530E-05	2.733E+06
3.689E-08	7.433E+10	6.028E-07	-2.300E+09	2.598E-05	2.646E+06
3.702E-08	7.502E+10	6.178E-07	-2.271E+09	2.666E-05	1.775E+06
3.715E-08	7.560E+10	6.331E-07	-2.242E+09	2.737E-05	9.438E+05
3.726E-08	7.605E+10	6.484E-07	-2.219E+09	2.808E-05	1.414E+06
3.737E-08	7.648E+10	6.645E-07	-2.195E+09	2.881E-05	1.994E+06
3.748E-08	7.679E+10	6.807E-07	-2.167E+09	2.954E-05	2.258E+06
3.758E-08	7.703E+10	6.968E-07	-2.138E+09	3.032E-05	2.294E+06

3.768E-08	7.713E+10	7.129E-07	-2.110E+09	3.110E-05	1.271E+06
3.778E-08	7.711E+10	7.293E-07	-2.081E+09	3.191E-05	9.877E+04
3.798E-08	7.671E+10	7.457E-07	-2.055E+09	3.273E-05	-9.181E+05
3.818E-08	7.596E+10	7.630E-07	-2.027E+09	3.358E-05	-1.581E+06
3.838E-08	7.506E+10	7.803E-07	-2.001E+09	3.443E-05	-3.462E+05
3.858E-08	7.407E+10	7.976E-07	-1.973E+09	3.532E-05	1.173E+06
3.878E-08	7.302E+10	8.149E-07	-1.937E+09	3.620E-05	1.768E+06
3.898E-08	7.208E+10	8.325E-07	-1.901E+09	3.714E-05	2.121E+06
3.918E-08	7.113E+10	8.501E-07	-1.872E+09	3.807E-05	1.719E+06
3.938E-08	7.023E+10	8.687E-07	-1.842E+09	3.905E-05	1.101E+06
3.968E-08	6.879E+10	8.872E-07	-1.807E+09	4.002E-05	6.920E+05
3.998E-08	6.713E+10	9.058E-07	-1.771E+09	4.104E-05	3.088E+05
4.019E-08	6.586E+10	9.244E-07	-1.730E+09	4.206E-05	4.089E+05
4.039E-08	6.475E+10	9.494E-07	-1.672E+09	4.314E-05	5.629E+05
4.114E-08	5.955E+10	9.745E-07	-1.618E+09	4.422E-05	-5.310E+04
4.189E-08	5.134E+10	9.944E-07	-1.574E+09	4.534E-05	-5.737E+05
4.253E-08	4.466E+10	1.014E-06	-1.530E+09	4.647E-05	2.130E+05
4.316E-08	3.930E+10	1.041E-06	-1.468E+09	4.763E-05	1.064E+06
4.416E-08	3.288E+10	1.067E-06	-1.397E+09	4.880E-05	1.156E+06
4.515E-08	3.041E+10	1.094E-06	-1.323E+09	5.003E-05	1.045E+06
4.587E-08	2.914E+10	1.121E-06	-1.252E+09	5.126E-05	2.237E+05
4.659E-08	2.749E+10	1.142E-06	-1.196E+09	5.254E-05	-6.078E+05
4.743E-08	2.584E+10	1.164E-06	-1.141E+09	5.383E-05	-2.120E+05
4.827E-08	2.379E+10	1.192E-06	-1.067E+09	5.518E-05	3.328E+05
4.924E-08	2.157E+10	1.221E-06	-9.881E+08	5.653E-05	1.834E+05
5.020E-08	1.963E+10	1.249E-06	-9.089E+08	5.796E-05	2.395E+04
5.132E-08	1.795E+10	1.278E-06	-8.253E+08	5.938E-05	4.418E+05
5.245E-08	1.644E+10	1.308E-06	-7.381E+08	6.085E-05	8.029E+05
5.329E-08	1.582E+10	1.339E-06	-6.634E+08	6.233E-05	1.622E+05
5.413E-08	2.043E+10	1.369E-06	-5.913E+08	6.387E-05	-4.632E+05
5.506E-08	2.620E+10	1.400E-06	-5.165E+08	6.542E-05	-6.534E+04
5.599E-08	1.864E+10	1.430E-06	-4.443E+08	6.703E-05	4.132E+05
5.702E-08	1.166E+10	1.461E-06	-3.709E+08	6.865E-05	3.154E+05
5.804E-08	4.870E+10	1.493E-06	-2.986E+08	7.035E-05	1.698E+05
5.918E-08	8.313E+10	1.526E-06	-2.408E+08	7.205E-05	1.783E+05
6.031E-08	1.319E+10	1.567E-06	-1.775E+08	7.383E-05	1.764E+05
6.155E-08	-5.905E+10	1.608E-06	-1.179E+08	7.562E-05	5.814E+04
6.280E-08	1.134E+10	1.641E-06	-7.517E+07	7.746E-05	-4.248E+04
6.417E-08	9.519E+10	1.673E-06	-3.476E+07	7.933E-05	1.200E+05
6.555E-08	7.732E+10	1.715E-06	5.704E+06	8.128E-05	2.881E+05
6.706E-08	4.665E+10	1.756E-06	2.833E+07	8.322E-05	1.484E+05
6.858E-08	3.381E+10	1.797E-06	4.273E+07	8.527E-05	-1.264E+04
7.025E-08	2.170E+10	1.838E-06	5.334E+07	8.731E-05	3.971E+04
7.192E-08	3.797E+10	1.880E-06	5.803E+07	8.945E-05	1.059E+05
7.282E-08	4.664E+10	1.921E-06	6.049E+07	9.158E-05	6.796E+04
7.372E-08	4.546E+10	1.970E-06	5.725E+07	9.382E-05	3.115E+04
7.565E-08	3.768E+10	2.020E-06	4.290E+07	9.606E-05	6.463E+04
7.759E-08	2.867E+10	2.061E-06	2.903E+07	9.840E-05	9.830E+04
7.863E-08	2.352E+10	2.102E-06	1.586E+07	1.007E-04	1.069E+05
7.967E-08	2.831E+10	2.152E-06	1.180E+06	1.032E-04	1.006E+05
8.190E-08	3.853E+10	2.201E-06	-7.058E+06	1.057E-04	-2.370E+03
8.414E-08	2.462E+10	2.259E-06	-1.358E+07	1.082E-04	-1.010E+05
8.529E-08	1.857E+10	2.317E-06	-2.067E+07	1.108E-04	-4.323E+04
8.644E-08	7.255E+09	2.366E-06	-2.409E+07	1.163E-04	1.187E+05
8.874E-08	-8.123E+09	2.416E-06	-2.234E+07	1.218E-04	3.250E+04
9.104E-08	1.698E+10	2.474E-06	-1.614E+07	1.247E-04	-1.231E+04
9.219E-08	2.846E+10	2.531E-06	-2.619E+06	1.277E-04	4.445E+04
9.334E-08	3.582E+10	2.589E-06	1.147E+07	1.308E-04	1.010E+05
9.564E-08	4.125E+10	2.647E-06	2.020E+07	1.339E-04	5.964E+04
9.794E-08	1.560E+10	2.713E-06	2.679E+07	1.371E-04	1.220E+04

LISTING OF EMPFIT AND SAMPLE RUN (cont'd)

1.002E-07	-1.001E+10	2.779E-06	2.976E+07	1.403E-04	3.051E+04
1.025E-07	-1.725E+08	2.845E-06	2.791E+07	1.437E-04	5.299E+04
1.048E-07	1.257E+10	2.911E-06	1.982E+07	1.472E-04	5.171E+04
1.071E-07	1.305E+10	2.977E-06	6.181E+06	1.507E-04	4.745E+04
1.094E-07	1.229E+10	3.043E-06	-1.729E+07	1.542E-04	3.211E+04
1.117E-07	4.859E+09	3.117E-06	-4.713E+07	1.579E-04	1.652E+04
1.140E-07	-2.331E+09	3.192E-06	-7.698E+07	1.616E-04	2.281E+04
1.163E-07	1.455E+09	3.266E-06	-1.040E+08	1.655E-04	3.162E+04
1.188E-07	6.640E+09	3.340E-06	-1.215E+08	1.695E-04	2.875E+04
1.212E-07	8.509E+09	3.414E-06	-1.321E+08	1.735E-04	2.515E+04
1.237E-07	9.353E+09	3.489E-06	-1.351E+08	1.776E-04	2.681E+04
1.263E-07	6.182E+09	3.571E-06	-1.293E+08	1.818E-04	2.754E+04
1.289E-07	1.933E+09	3.654E-06	-1.112E+08	1.861E-04	1.776E+04
1.315E-07	-3.037E+09	3.736E-06	-8.775E+07	1.906E-04	8.286E+03
1.344E-07	-7.179E+09	3.819E-06	-5.972E+07	1.950E-04	1.343E+04
1.372E-07	-4.159E+09	3.909E-06	-2.917E+07	1.997E-04	2.003E+04
1.401E-07	-4.563E+07	4.000E-06	-1.090E+07	2.044E-04	1.854E+04
1.430E-07	1.311E+09	4.099E-06	6.731E+06	2.093E-04	1.632E+04
1.460E-07	2.073E+09	4.198E-06	2.051E+07	2.141E-04	1.707E+04
1.491E-07	4.227E+08	4.297E-06	3.768E+07	2.193E-04	1.715E+04
1.523E-07	-1.857E+09	4.396E-06	6.801E+07	2.244E-04	1.076E+04
1.555E-07	-2.819E+09	4.495E-06	1.056E+08	2.298E-04	4.738E+03
1.589E-07	-3.652E+09	4.594E-06	1.594E+08	2.351E-04	8.602E+03
1.622E-07	-4.389E+09	4.702E-06	2.124E+08	2.408E-04	1.346E+04
1.657E-07	-4.884E+09	4.809E-06	3.080E+08	2.464E-04	1.262E+04
1.692E-07	-4.874E+09	4.924E-06	3.637E+08	2.523E-04	1.126E+04
1.729E-07	-4.691E+09	5.040E-06	1.904E+08	2.581E-04	1.082E+04
1.766E-07	-4.604E+09	5.156E-06	-4.341E+06	2.643E-04	1.010E+04
1.805E-07	-4.512E+09	5.272E-06	-1.869E+08	2.705E-04	1.001E+04
1.843E-07	-4.510E+09	5.485E-06	-4.101E+08	2.770E-04	9.617E+03
1.884E-07	-4.575E+09	5.698E-06	-1.768E+08	2.834E-04	5.377E+03
1.924E-07	-4.808E+09	5.906E-06	8.041E+07	2.902E-04	1.473E+03
1.987E-07	-5.224E+09	6.115E-06	-8.735E+07	2.969E-04	4.639E+03
2.050E-07	-5.456E+09	6.340E-06	-2.674E+08	3.040E-04	7.729E+03
2.094E-07	-5.597E+09	6.566E-06	-7.168E+07	3.111E-04	6.925E+03
2.138E-07	-5.639E+09	6.809E-06	1.469E+08	4.055E-04	4.998E+01
2.185E-07	-5.641E+09	7.052E-06	8.310E+07	5.000E-04	4.432E-01
2.231E-07	-5.683E+09				

NUMBER OF POINTS = 445

APPENDIX B.--SAMPLE INPUT DATA

Figures B-1 to B-3 show examples of input card decks of EMPFIT.

```
**********************************************************************************
        1         2         3         4         5         6         7         8
**********************************************************************************


        1
        1                                 3-5.000E+05         1                   1
NEMP   PROBLEM A    OBSERVER 1
                     1 5.000E-04 1.200E+08 5.000E+04 1.000E+04 6.000E+07         1
 3.000E-04
        1          1
        2        146        204
```

Figure B-1. Example of data preparation by using disk file to enter data points, using time cutoff option, deleting data points.

```
**********************************************************************************
        1         2         3         4         5         6         7         8
**********************************************************************************


        1
        3                                 3-5.000E+05         2                   1
NEMP   PROBLEM A    OBSERVER 1
                     1 2.000E+00 1.200E+08 5.000E+04 1.000E+08 1.000E+10
        3          1          1
        2        146
        2 3.043E-04-1.289E+02 9.058E-06-1.866E+02
```

Figure B-2. Example of data preparation by using disk file to enter data points, deleting data points, adding data points.

APPENDIX B

```
*******************************************************************************
        1         2         3         4         5         6         7         8
*******************************************************************************


         1
         3                                3-1.000E+05                            2
LEMP  PROBLEM 2
        42          4 1.000E-01 1.200E+08 5.000E+05 1.000E+00 3.000E+09
         2                    1
 1.424E-07-4.389E-05
 1.563E-07-1.088E-04
 1.718E-07-2.948E-04
 1.886E-07-8.535E-04
 2.072E-07-2.522E-03
 2.498E-07-1.322E-02
 2.745E-07-2.469E-02
 3.021E-07-5.096E-02
 3.653E-07-4.974E-01
 4.003E-07-5.838E-01
 4.380E-07-6.015E-01
 4.793E-07-5.843E-01
 5.259E-07-5.215E-01
 8.368E-07-3.596E-01
 9.178E-07-3.372E-01
 1.104E-06-3.185E-01
 1.326E-06-3.054E-01
 1.595E-06-2.884E-01
 2.103E-06-2.789E-01
 2.529E-06-2.753E-01
 3.041E-06-2.641E-01
 4.399E-06-1.978E-01
 5.287E-06-1.459E-01
 6.358E-06-9.011E-02
 8.377E-06-2.672E-02
 1.007E-05-8.379E-03
 1.105E-05-4.926E-03
 1.211E-05-3.658E-03
 1.328E-05-3.954E-03
 1.456E-05-5.381E-03
 1.919E-05-1.054E-02
 2.307E-05-1.324E-02
 2.773E-05-1.464E-02
 3.334E-05-1.533E-02
 3.656E-05-1.546E-02
 4.009E-05-1.531E-02
 4.300E-05-1.546E-02
 5.284E-05-1.619E-02
 6.353E-05-1.480E-02
 7.638E-05-1.396E-02
 8.080E-05-1.367E-02
 8.374E-05-1.337E-02
```

Figure B-3. Example of data preparation by using cards to enter data points.

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