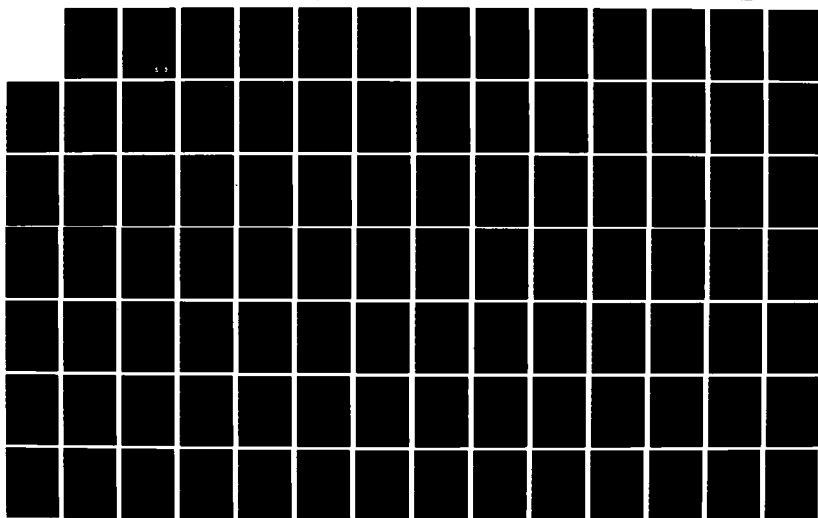


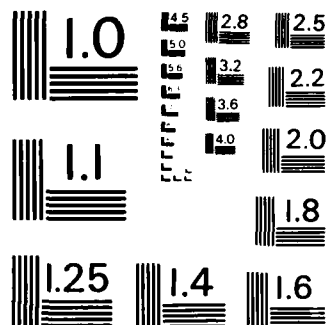
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THE OPTICAL SPECTRA OF AEROSOLS
Final Technical Report

by

F. Borghese

February 1985

United States Army
EUROPEAN RESEARCH OFFICE OF THE U.S. ARMY
London England

CONTRACT NUMBER DAJA37-81-C-0895

Contractor: F. Borghese

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
The microscopic optical constants of an aerosol of model nonspherical particles are calculated. The effect of chemical reactions on the spectra of the aerosols are taken into account. The computer programs necessary to perform the above mentioned calculations are listed and an user's guide is supplied.		

Introduction

In this Report we describe the work done by the principal investigator (Prof. F.Borghese) and his collaborators (Prof. P.Denti, Prof. G.Toscano and Dr R.Saija) under contract DAJA37-81-C-0895 from October 1981 to November 1984. The whole research has been performed in strict collaboration with Dr O. I. Sindoni, CRDC, Aberdeen P.G., 21010 Md., USA.

In Part A we connect the work done in the years 1979-1981 under Grant DAERO78-G-106, to the work done in the last three years under the present Contract. The work itself is actually described in the papers thus far published or accepted for publication. A brief account of the problems met in the course of the work as well as a suggestion of possible solutions and sketch of the lines of future progress are also included.

In Part B is described the work done by F.Borghese, P.Denti and R.Saija during their stay at CRDC from August 18th to September 23rd, 1984 under Contract Modification P0004. Essentially the work consists of two modifications of the computer programs for the scattering properties of clusters. The purpose of these modifications is twofold: on one hand they allow the treatment of relatively large clusters; on the other hand they constitute the basis for the calculations of the properties of scatterers in which resonances occur. A description of the programs as well as a guide to the input and output quantities is included.

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PART A

In the years from 1979 to 1981, working under Grant DAER078-G-106, we devised a model scatterer suitable to approximate the electromagnetic scattering properties of non-spherical particles. By inspiring to the well known stick-and-ball model of a molecule, we approximate a non-spherical particle as a cluster of spheres. The computation of the scattering properties of such an object do not require a big effort, thank to an addition theorem for vector Helmholtz harmonics⁽¹⁾ formulated by the present authors. As a consequence several calculations on clusters of various geometries proved the model to be computationally sound and able to account for the lack of overall spherical symmetry of some kind of non-spherical particles. A detailed account of the model as well as the use of the Group Theory to reduce the size of the computations is contained in the Final Report to Grant DAER078-G-106, October 1981, as well as in a number of published papers⁽²⁻⁴⁾.

In the years from 1981 to 1984, i.e. under the present Contract, we were able to take full advantage of the peculiarities of the cluster model in order to connect the scattering properties of individual clusters to the macroscopic optical properties of a dispersion of clusters of random orientation⁽⁵⁾. Furthermore, the flexibility of the cluster model allows the calculation of the changes in the macroscopic optical constants of an aerosol, when the clusters change their shape or when more clusters combine together to give scattering objects of different structure. The calculations show that these changes of shape produce quite detectable variations in the

absorption coefficient of the dispersion⁽⁶⁾.

These results have been recently presented at the 1st Joint International Conference on Aerosol Research, held in Minneapolis, MN, from September 17th to 21st^(6,7). In particular it has been emphasized the rather striking result that for a cluster of given structure and size parameter there exist a wavelength at which it behaves as a spherical particle. This conclusion is confirmed by a number of experimental findings of which we were informed during discussions on the subject.

We want to stress that the approach we used to connect the individual to the collective optical properties is rather elementary as it neglects the effects of multiple scattering among different clusters. As a consequence, our approach is applicable only to low-density dispersions such as atmospheric aerosols but it is unlikely to give reliable results when applied to dense dispersions such as e.g. smokes. We plan to overcome these difficulties by investigating the subject along three lines. First of all we plan to include the statistic of the particles into our formalism, so as to account, on the average, for the effect of multiple scattering and thus make the theory applicable to dispersions of relatively high density. Second, we are going to study the size distribution effect, for it has been shown that the occurrence of some size distributions can affect drastically the macroscopic optical properties of the dispersion.

Third, we will attempt to adapt our theory to the framework of the effective medium theories in order to calculate the effective dielectric constant of the dispersion. We got this idea at the Annual Meeting of Spectroscopy Group of the Gruppo Nazio

nale di Struttura della Materia held in Alghero, Sardinia,
where the problem of small clusters has been thoroughly discuss
sed.

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York 1984, pag.817.

The references with an asterisk were published under Grant
DAERO-78-G-106 and they are cited for the comodity of the
reader.

PART B

This part of the present Report is meant to be a user's guide to our programs for the scattering properties of clusters. Before we go into the description, however, we want to explain why we felt necessary to write two further versions of the programs we used in the past.

Our treatment of the scattering from clusters is based on a multicentered expansions of the scattered field in terms of spherical multipoles. For convergence reasons, as explained in the included literature, this expansion must be carried up to a certain order L_M which, depending on the structure and on the size parameters may be as high as 4 or 5. Now for a given L_M one has to calculate, and invert, matrices with complex elements of order $d_M = 2NL_M(L_M + 2)$, N being the number of the spheres in the cluster. Therefore, due to the storage limitations on the computer presently available in Messina, and at CRDC too, it is impossible to handle clusters of more than 5 spheres with $L_M = 5$. This is the maximum order that can be handled by the program PRG1 with a core allowance of 4 Mbytes. This limitation has been overcome by rewriting the program without requiring the storage of the intermediate matrices but requiring the storage of two vectors one for the spherical harmonics and another for the Clebsch-Gordan coefficients. This version of the program named here PRG2, allows us to handle relatively big clusters at the cost of multiplying the CPU time by a factor of 4. A second version of the program, here PRG3, do not require either the storage of the vector C-G coefficients, thus allowing us to handle even big

ster but multiplying the CPU time by a factor of 6 or 7. The capability of the three programs when a core storage of 4 Mbytes is allowed are summarized in Table I.

As can be seen the biggest cluster can be treated only at the cost of neglecting the interactions of order higher than dipole-dipole. In any case this interaction is just that that is commonly included in the calculations of other workers. On the other hand our programs allows us to get information of value on the properties of clusters including as much as 70 spheres. Furthermore these programs allow to treat with great precision the case in which resonances occur, a case in which the multipolar interactions must be included as high to an order as possible.

The formulation and testing of these programs is essentially the work done by F.Borghese, P.Denti and R.Saija during their stay at the CRDC under contract modification P0004.

PRG1

This is the original version of our scattering programs and, as listed, it can handle a cluster of 3 spheres with $L_M=4$. The maximum capability of PRG1 is a cluster of 5 spheres with $L_M=4$. In this case the dimensions of the various matrices and vectors must be carefully checked.

INPUT DESCRIPTION

Refer to DATASET H20TEST001.

CARD 1 (3A4)

DATA JDATA KDATA	}	These quantities identify the DATASET. They can be left blank if desired.
------------------------	---	---

CARD 2 blank

CARD 3 (4I2)

JGO JWMA IWCSS IWCIP	}	These quantities control the input and output operations of PRG1. Their exact meaning is explained in the comment cards within the programs. Note that if JGO is put equal to 1 for all the groups of data the program runs properly but for that it recomputes matrices whose elements have still valid values.
-------------------------------	---	--

CARD 4 (5I2)

NSPH	Number of the spheres in the cluster.
LMPO	L_M+1
IBELP	Helicity of the incident wave. Use +1 for right helicity, and -1 for left helicity.
IEXP	This quantity was originally introduced to control the convergence of the multipolar expansions. Set it to 0.
MAXIT	Number of iterations. To be used only when the inverse to the matrix (15) of ref.(2) is to be calculated iteratively.

CARD 5 (3E20.8) (NSPH cards)

$\left. \begin{array}{l} \text{RXX}(1) \\ \text{RYY}(1) \\ \text{RZZ}(1) \end{array} \right\}$ Cartesian coordinates of the centres of the l-th sphere in the cluster.

CARD 6 (4012)

$\text{IOG}(1)$ This index specifies the type of the l-th sphere in the cluster. If $\text{IOG}(l+1)=\text{IOG}(l)$ the program does not recalculate the T-matrices for the l+1-th sphere but take them identical to those of the l-th sphere.

CARD 7 (3E20.8)

$\text{ROS}(1)$ Radius of the l-th sphere.

CARD 8 (2E20.8)

$\text{CRI}(1)$ Complex refractive index of the l-th sphere.

CARD 9 (E20.8,2F10.4)

$\left. \begin{array}{l} \text{VK} \\ \text{THK} \\ \text{PHK} \end{array} \right\}$ Magnitude of the wavevector of the incident wave.
Polar angles (in degrees) of the incident wavevector.

CARD 10 (315)

INVER 0 the T-matrix of the cluster is inverted iteratively.
1 the T-matrix is inverted by LU factorization.
 MODE 0, 1, 2, 3. This parameter provides the equilibration of the T-matrix in four different modes. The value $\text{MODE}=3$ has proved to be the most suitable for dielectric clusters far from resonance.
 NDCMST Maximum dimension of the T-matrix. It must be identical to the dimension of the matrix AM.

CARD 11 (2E20.8)

CI Mixing factor for the iterative inversion of the T-matrix. The value $\text{CI}=0.5$ ensures good convergence.
 TOL Tolerance of the inverted T-matrix. In practice $\|T-T^{-1}\| \leq \text{TOL}$.
These quantities need be specified only when $\text{INVER}=0$

CARD 12 (40A4)

NAME Identifies the output. It can include any alphameric character.

.....1.....2.....3.....4.....5.....6.....7.*.....

```

SUBROUTINE SMAT
  IMPLICIT REAL*8(A-H,I-Z)
  COMMON/DUM1/ RXX(4), RYY(4), RZZ(4),
  IRCS(4), CRI(4), XIL(4),
  2XILI(4), RM(3,4), SM(3,4), TSAS(2,2), SAC(2,2),
  3N(15,2), AI(120), AF(120), AMMO(15), ALMO(15), S(15), NAME(40), ICG(4)
  COMMON/DUM2/GH(64,64), GK(64,64)
  COMMON/DUM3/AM(120,120), BV(120), V(120)
  COMPLEX*16 AM, GH, GK, RM, SM, CRI, XIL, XILI, W, AI, AF,
  1ALMO, AMMO, S, BV, SSMSP, SSESF, TSAS, SAC
  LM=LMPD-1
  NLMM=LMPD*LMPD-1
  NM=NSPH*NLMM
  NFI=NM+NM
  IK=1
  L=1
  IL=3
  DO 10 I=1,NM
    SSMSP=RY(L,IK)
    SSESF=SM(L,IK)
    IF(I.LT.IL)GO TO 5
    SF=0.
    IF(I.EQ.IL)GO TO 1
    SF=1.
    IF(I.EQ.IL+1)GO TO 1
    SF=1./LM+1
    DO 10 J=1,NM
      SJ=0.
      SJ=SJ+SK
      SJ=SJ/ALMM+1
      AX(1,J)=GH(11,JJ)*SSMSP
      AX(1,J+NM)=GH(11,JJ)*SSMSP
      AX(1+NM,J)=GH(11,JJ)*SSESF
      AX(1+NM,J+NM)=GH(11,JJ)*SSESF
    10 CONTINUE
  END

```

SOURCE STATEMENTS = 32, PROGRAM SIZE = 3072 BYTES, PROGRAM NAME = SMAT PA
 NO DIAGNOSTICS GENERATED.
 TERMINATION / *****

[illegible]

SOURCE STATEMENTS = 143, PROGRAM SIZE = 12838 BYTES, PROGRAM NAME = GIGL
NO DIAGNOSTICS GENERATED.
COMPILETIME > *****

[illegible]

```

113MC=113-1
113PC=113+1
1142=1142+M2
1142=N2+1M2
114240=1142-1
1142PC=1142+1
1143=N1+1M2
1143MC=1143-1
1143PC=1143+1
CRM =CCLEB(1,L2,L2 , 1,M2-1)
CR =CCLEB(1,L2,L2 , 0,M2 )
CRP =CCLEB(1,L2,L2 , -1,M2+1)
CRM=CCLEB(1,L2-1,L2, 1,M2-1)
CRM=CCLEB(1,L2-1,L2, 0,M2 )
CRP=CCLEB(1,L2-1,L2, -1,M2+1)
CLCR=CL*CR
C1 = CLCR *G(111 ,112 )
C2 = CLCR *G(113 ,114 )
C3 = CLCR *G(114 ,113 )
C4 = CLCR *G(112 ,111 )
CV1=CC0
CV2=CC0
CV3=CC0
CV4=CC0
IF(CV1.EQ.CC) GO TO 15
C1=C1+CV1*CLCR *G(1121 ,112 )
C2=C2+CV2*CLCR *G(1134 ,113 )
IF(CV3.EQ.CC) GO TO 20
C1=C1+CV3*CLCR *G(1143 ,114 )
C2=C2+CV4*CLCR *G(1112 ,111 )
IF(CV4.EQ.CC) GO TO 25
CLCR=CL*CRM
C1=C1+CLCR *G(111MC,112MC)
C2=C2+CLCR *G(113MC,114MC)
C3=C3+CLCR *G(114MC,113MC)
C4=C4+CLCR *G(112MC,111MC)
IF(CV1.EQ.CC) GO TO 30
CV1=CV1+CV1*CLCR *G(111MC,112MC)
CV3=CV3+CV1*CLCR *G(114MC,113MC)
IF(CV3.EQ.CC) GO TO 35
CLCR=CL*CRM
C1=C1+CLCR *G(113PC,114MC)
C2=C2+CLCR *G(114240,1114MC)
IF(CV4.EQ.CC) GO TO 40
CLCR=CL*CRP
C1=C1+CLCR *G(111PC,112PC)
C2=C2+CLCR *G(113PC,114PC)
C3=C3+CLCR *G(114PC,113PC)
C4=C4+CLCR *G(112PC,111PC)
IF(CV1.EQ.CC) GO TO 45
CV1=CV1+CV1*CLCR *G(112PC,112PC)
CV3=CV3+CV1*CLCR *G(114PC,113PC)
IF(CV3.EQ.CC) GO TO 50
CV1=CV1+CV1*CLCR *G(113PC,114PC)
CV4=CV4+CV1*CLCR *G(1142PC,111PC)
C1(111,112)=C1
C1(113,114)=C2
C1(114,113)=C3
C1(112,111)=C4
C1(111,112)=CV1*CL
C1(113,114)=CV2*CL
C1(114,113)=CV3*CL
C1(112,111)=CV4*CL
GO CONTINUE
END

```

* SOURCE STATEMENTS = 144, PROGRAM SIZE = 12714 BYTES, PROGRAM NAME = GHCK

* NO DIAGNOSTICS GENERATED.

END COMPILATION 4 *****

OBJECT NAME: NUCLEON NUCLEON NUCLEON SOURCE TERM OBJECT FIXED NO
 OPT(1) LANGEVL(77) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

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```

1  SUBROUTINE GHGK
2  (L*PC,NSPH)
3  IMPLICIT REAL*8(A-H,C-Z)
4  COMMON/DUM1/ RXX(4),RYY(4),RZZ(4),
5  1RCS(4),CRI(4),XIL(4),
6  2XILI(4),RM(3,4),SM(3,4),TSAS(2,2),SAC(2,2),
7  3S(15,2),AI(120),AF(120),AMMO(15),AEMO(15),S(15),NAME(40),IGG(4)
8  COMMON/DUM2/GH(64,64),GK(64,64)
9  COMMON/DUM6/FACTG(30),FNCRM(28)
10 COMPLEX*16 G,GH,GK,CCL,CCR,C1,C2,C3,C4,CM1,CM2,CM3,CM4,CCO,XIL,
11 1XILI,RV,SM,w,AI,AF,AMMO,AEMO,S,CRI,TSAS,SAC
12 CO=0.000
13 CCO=(0.000,0.000)
14 NL=L*PC*NSPH
15 N=NSPH*NL
16 DO 10 NF=1,N
17 DO 10 NS=1,N
18 GH(NF,NS)=CCO
19 SN(NS,NS)=CCO
20 NSMO=NSPH-1
21 NI=-NL
22 DO 20 NF=1,NSM
23 DO 20 NS=1,NSM
24 NI=(NI-1)*NSM
25 NI=NI+1
26 DO 20 NSPH=PC,NSPH
27 DO 20 NL=L
28 DO 20 LI=0,L*PC
29 C1=CF-1
30 C2=CF+CF+1
31 C3=LI+LI+1
32 C4=LI*(LI-1)+1
33 C5=LI+LI
34 XNCF=AI,NS
35 XNCF=AF
36 CCR=(0.000,1.000)*DSQRT(XNCF/XDEN)
37 C1=1
38 DO 30 NF=1,MSM
39 NI=NI+1
40 I1=LI1+NI
41 I1=NI+I1
42 I1A=I1-1
43 I1PB=I1+1
44 I14=N2+I1
45 I14C=I14-1
46 I14P=I14+1
47 I14A=LI1+I1
48 I14B=I1+I1
49 I14C=I14-1
50 I14D=I14+1
51 I14E=I1+I1
52 I14F=I14-1
53 I14G=I14+1
54 I14H=I1+I1
55 I14I=I14-1
56 I14J=I14+1
57 I14K=I1+I1
58 I14L=I14-1
59 I14M=I14+1
60 I14N=I1+I1
61 I14O=I14-1
62 I14P=I14+1
63 I14Q=I1+I1
64 I14R=I14-1
65 I14S=I14+1
66 I14T=I1+I1
67 I14U=I14-1
68 I14V=I14+1
69 I14W=I1+I1
70 I14X=I14-1
71 I14Y=I14+1
72 I14Z=I1+I1
73 I14AA=I14-1
74 I14AB=I14+1
75 I14AC=I1+I1
76 I14AD=I14-1
77 I14AE=I14+1
78 I14AF=I1+I1
79 I14AG=I14-1
80 I14AH=I14+1
81 I14AI=I1+I1
82 I14AJ=I14-1
83 I14AK=I14+1
84 I14AL=I1+I1
85 I14AM=I14-1
86 I14AN=I14+1
87 I14AO=I1+I1
88 I14AP=I14-1
89 I14AQ=I14+1
90 I14AR=I1+I1
91 I14AS=I14-1
92 I14AT=I14+1
93 I14AU=I1+I1
94 I14AV=I14-1
95 I14AW=I14+1
96 I14AX=I1+I1
97 I14AY=I14-1
98 I14AZ=I14+1
99 I14BA=I1+I1
100 I14BB=I14-1
101 I14BC=I14+1
102 I14BD=I1+I1
103 I14BE=I14-1
104 I14BF=I14+1
105 I14BG=I1+I1
106 I14BH=I14-1
107 I14BI=I14+1
108 I14BJ=I1+I1
109 I14BK=I14-1
110 I14BL=I14+1
111 I14BM=I1+I1
112 I14BN=I14-1
113 I14BO=I14+1
114 I14BP=I1+I1
115 I14BQ=I14-1
116 I14BR=I14+1
117 I14BS=I1+I1
118 I14BT=I14-1
119 I14BU=I14+1
120 I14BV=I1+I1
121 I14BW=I14-1
122 I14BX=I14+1
123 I14BY=I1+I1
124 I14BZ=I14-1
125 I14CA=I14+1
126 I14CB=I1+I1
127 I14CC=I14-1
128 I14CD=I14+1
129 I14CE=I1+I1
130 I14CF=I14-1
131 I14CG=I14+1
132 I14CH=I1+I1
133 I14CI=I14-1
134 I14CJ=I14+1
135 I14CK=I1+I1
136 I14CL=I14-1
137 I14CM=I14+1
138 I14CN=I1+I1
139 I14CO=I14-1
140 I14CP=I14+1
141 I14CQ=I1+I1
142 I14CR=I14-1
143 I14CS=I14+1
144 I14CT=I1+I1
145 I14CU=I14-1
146 I14CV=I14+1
147 I14CW=I1+I1
148 I14CX=I14-1
149 I14CY=I14+1
150 I14CZ=I1+I1
151 I14DA=I14-1
152 I14DB=I14+1
153 I14DC=I1+I1
154 I14DD=I14-1
155 I14DE=I14+1
156 I14DF=I1+I1
157 I14DG=I14-1
158 I14DH=I14+1
159 I14DI=I1+I1
160 I14DJ=I14-1
161 I14DK=I14+1
162 I14DL=I1+I1
163 I14DM=I14-1
164 I14DN=I14+1
165 I14DO=I1+I1
166 I14DP=I14-1
167 I14DQ=I14+1
168 I14DR=I1+I1
169 I14DS=I14-1
170 I14DT=I14+1
171 I14DU=I1+I1
172 I14DV=I14-1
173 I14DW=I14+1
174 I14DX=I1+I1
175 I14DY=I14-1
176 I14DZ=I14+1
177 I14EA=I1+I1
178 I14EB=I14-1
179 I14EC=I14+1
180 I14ED=I1+I1
181 I14EE=I14-1
182 I14EF=I14+1
183 I14EG=I1+I1
184 I14EH=I14-1
185 I14EI=I14+1
186 I14EJ=I1+I1
187 I14EK=I14-1
188 I14EL=I14+1
189 I14EM=I1+I1
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196 I14ET=I14-1
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198 I14EV=I1+I1
199 I14EW=I14-1
200 I14EX=I14+1
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206 I14FD=I14+1
207 I14FE=I1+I1
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211 I14FI=I14-1
212 I14FJ=I14+1
213 I14FK=I1+I1
214 I14FL=I14-1
215 I14FM=I14+1
216 I14FO=I1+I1
217 I14FP=I14-1
218 I14FQ=I14+1
219 I14FR=I1+I1
220 I14FS=I14-1
221 I14FT=I14+1
222 I14FU=I1+I1
223 I14FV=I14-1
224 I14FW=I14+1
225 I14FX=I1+I1
226 I14FY=I14-1
227 I14FZ=I14+1
228 I14GA=I1+I1
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232 I14GE=I14-1
233 I14GF=I14+1
234 I14GG=I1+I1
235 I14GH=I14-1
236 I14GI=I14+1
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241 I14GN=I14-1
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262 I14HI=I14-1
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373 I14LS=I14-1
374 I14LT=I14+1
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515 I14RJ=I14+1
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858 I14EV=I1+I1
859 I14EW=I14-1
860 I14EX=I14+1
861 I14EY=I1+I1
862 I14EZ=I14-1
86
```

.....1.....2.....3.....4.....5.....6.....7......

```
75 20 CONTINUE
76   GP(N1+11, 12)=PI4*SUM1*XILMNI
77   GP(N1+12, 11)=PI4*SUM3*XILMNI
78   GP(N1+11, 12)=PI4*SUM2*XILMNI
79   GP(N1+12, 11)=PI4*SUM4*XILMNI
80 30 CONTINUE
81   GC TC 40
82 32 DC 35 I=1,NLM
83   API=N1+I
84   DC 35 J=1,NLM
85   GM(API,J)=CCC
86 35 GP(API,J)=CCO
87 40 CONTINUE
88   RETURN
89   END
```

CS* SOURCE STATEMENTS = 88, PROGRAM SIZE = 9478 BYTES, PROGRAM NAME = GJMT PJ

CS* NO DIAGNOSTICS GENERATED.

CS* COMPILATION 3 *****

OBJECT FIXED NO
 CPT(1) LANGLEVEL(77) NCPIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

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```

1  SUBROUTINE GUMI
2  (LMPC,NSPH,VK)
3  IMPLICIT REAL*8(A-H,C-Z)
4  DIMENSION YLM( 81),FJ(100)
5  COMMON/DUMC/ RXX(4),RYY(4),RZZ(4),
6  IRCS(4),CRI(4),XIL(4),
7  2XILI(4),RM(3,4),SM(3,4),TSAS(2,2),SAC(2,2),
8  3*(15,2),A1(120),AF(120),AMMO(15),AEMO(15),S(15),NAME(40),IUG(4)
9  COMMON/DUM3/GM(64,16),GP(64,16)
10 COMMON/DUM6/FACT(30),FNCHM(28)
11 COMPLEX*16 YLM,XIL,XILI,GM,GP,XILMN,XILMNI,SUM1,SUM2,SUM3,SUM4,
12 1XILTI,XILT,AUC1,AUC2,CC0,w,A1,AF,AMMO,AEMO,S,RM,SM,CRI,TSAS,SAC
13 DATA P14/ 12.566370614356/
14 JCK=90
15 CC=0.000
16 CC0=(0.000,0.000)
17 NLM=LMPC*LMPC
18 LMTPO=LMPC+LMPC-1
19 LMI=LMTPO-1
20 NI=-NLM
21 DO 40 IF=1,NSPH
22 NI=NI+NLM
23 RX=-RXX(IF)
24 RY=-RYY(IF)
25 RZ=-RZZ(IF)
26 IF(RX.EQ.0.0.AND.RY.EQ.0.0.AND.RZ.EQ.0.0) GO TO 32
27 CALL PLLX(RX,RY,RZ,RK,CRTH,SRTH,CRPH,SRPH)
28 CALL SPHAX(CRTH,SRTH,CRPH,SRPH,LMTPO,YLM)
29 ANG=RX*VK
30 CALL RSF(ANG, LMI,JCK,FJ)
31 DO 30 LF=1,LMPC
32 LI=LF-1
33 IL1=LF*LI+1
34 M1=LF+LI
35 M1=-LI
36 DO 30 MF=1,M1
37 M1=M1+1
38 IL1=IL1+M1
39 DO 30 LS=LF,LMPC
40 L2=LS-1
41 IL2=LS*L2+1
42 ML=-L2
43 IF(L2.EQ.L1)*ML=M1
44 LMAXPO=LS+LI
45 LMINPO=LS-L1
46 XILMNI=XILI(LMINPO)
47 XILMNI=XILI(LMINPO)
48 MV=LS-ML
49 LTI=LS+L2
50 ML=ML-1
51 DO 30 MS=1,MV
52 M1=M1+1
53 L1=L1+M1
54 DO 30 M2=1,M1
55 M1=M1+1
56 DO 30 M3=1,M1
57 M1=M1+1
58 XILTI=-XILMNI
59 XILT=-XILMNI
60 LTI=LTI+LMAXPO,2
61 XILTI=-XILTI
62 XILT=-XILT
63 L1=L1-1
64 M1=M1-1
65 M2=M2-1
66 M3=M3-1
67 IF(M3.EQ.0) GO TO 20
68 N=LI*L3+M3+1
69 IF(CABS(YLM(K)).LT.1.0E-8) GO TO 20
70 M1=L1+L3
71 X=M1*
72 X=(5.0*INT(LTI*X)/(PI+*MF*M))*CG*DCLEB(L2,L3,L1,0,0)
73 FJ=FJ(LTI)*X
74 AUC1=X*DCLEB(YLM(K))
75 AUC2=X*YLM(K)
76 SUM1=SUM1+AUC1*XILTI
77 SUM2=SUM2+AUC2*XILTI
78 SUM3=SUM3+AUC1*XILT
79 SUM4=SUM4+AUC2*XILT
    
```

.....1.....2.....3.....4.....5.....6.....7.....

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74      X=MIM
75      X=DSQRT((L2I*X)/(PI4*MFM))*CG*DCLEB(L2,L3,L1,0,0)
76      FH=DC4PLX(FJ(LT),FN(LT))*X
77      AUC1=FF*DCUNJG(YLM(K))
78      AUC2=FF*YLM(K)
79      SUM1=SUM1+AUC1*XILT1
80      SUM2=SUM2+AUC1*XILT1
81      SUM3=SUM3+AUC2*XILT1
82      SUM4=SUM4+AUC2*XILT1
83      20 CONTINUE
84      G(N1+11,N2+12)=PI4*SUM1*XILMNI
85      G(N1+12,N2+11)=PI4*SUM3*XILMNI
86      G(N2+11,N1+12)=PI4*SUM2*XILMNI
87      G(N2+12,N1+11)=PI4*SUM4*XILMNI
88      30 CONTINUE
89      RETURN
90      END

```

CS* SOURCE STATEMENTS = 89, PROGRAM SIZE = 9850 BYTES, PROGRAM NAME = GHMT PJ

CS* NO DIAGNOSTICS GENERATED.

CS* COMPILATION 2 *****

EFFECT NOCTIST NCMAP NOXREF NOGOSTMT NODECK SOURCE TERM OBJECT FIXED NO
 OPT(1) LANGLEVL(77) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

.....1.....2.....3.....4.....5.....6.....7.....

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1  SUBROUTINE GHMT
2    (LMPC,NSPH,VK)
3    IMPLICIT REAL*8(A-H,O-Z)
4    DIMENSION FJ(100),FN( 9),
5    1YLM( 81)
6    CCMCN/DUM0/ RXX(4),RYY(4),RZZ(4),
7    1ROS(4),CRI(4),XIL(4),
8    2XIL1(4),RM(3,4),SM(3,4),TSAS(2,2),SAC(2,2),
9    3W(15,2),AI(120),AF(120),AMMO(15),AEMO(15),S(15),NAME(40),IOG(4)
10   COMMON/DUM1/G(64,64)
11   COMMON/DUM6/FACTO(30),FNCRM(28)
12   CCMPLX*16 G,XIL,XIL1,YLM,XILMN,XILMNI,SUM1,SUM2,SUM3,SUM4,
13   1XILT,XILTI,FH,AUC1,AUC2,CCO,RM,SM,W,AI,AF,AMMO,AEMO,S,CRI,TSAS,SAC
14   DATA PI4/ 12.566370614356/
15   JCK=90
16   CCC=(0.000,0.000)
17   NLM=LMPC*LMPC
18   N=NSPH*NLM
19   LMTPC=LMPC+LMPC-1
20   LMT=LMTPC-1
21   DO 10 NF=1,N
22   DO 10 NS=1,N
23   10 G(NF,NS)=CCC
24   NSMC=NSPH-1
25   N1=-NLM
26   DO 30 NF=1,NSMC
27   N1=N1+NLM
28   A2=(NF-1)*NLM
29   NFPU=NF+1
30   DO 30 NS=NFPC,NSPH
31   A2=A2+NLM
32   RX=RX(NF)-RXX(NF)
33   RY=RY(NF)-RYY(NF)
34   RZ=RZ(NF)-RZZ(NF)
35   CALL POLAR(RX,RY,RZ,RR,CRTH,SRTH,CRPH,SRPH)
36   CALL SPHAR(CRTH,SRTH,CRPH,SRPH,LMTPO,YLM)
37   ARG=RR*VK
38   CALL RBF(ARG, LMT,JCK,FJ)
39   CALL RNF(ARG, LMT,FN)
40   DO 30 LF=1,LMPD
41   L1=LF-1
42   IL1=LF*L1+1
43   MF4=LF+L1
44   M1=-LF
45   DO 30 MF=1,MFM
46   M1=M1+1
47   I1=IL1+M1
48   DO 30 LS=LF,LMPD
49   L2=LS-1
50   IL2=LS*L2+1
51   L2=-L2
52   IF (L2.EQ.L1) ML=M1
53   LMAXPC=LS+L1
54   LMINPC=LS-L1
55   XILMN=XIL(LMINPC)
56   XILMNI=XIL1(LMINPC)
57   MS4=LS-ML
58   L2T=LS+L2
59   M2=ML-1
60   DO 30 MS=1,MSM
61   M2=M2+1
62   I2=IL2+M2
63   SUM1=CCO
64   SUM2=CCO
65   SUM3=CCO
66   SUM4=CCO
67   XILT=-XILMN
68   XILTI=-XILMNI
69   DO 20 LT=LMINPC,LMAXPC,2
70   XILT=-XILT
71   XILTI=-XILTI
72   L3=LT-1
73   M3=M1-M2
74   CG=DCLEB(L2,L3,L1,M2,M3)
75   IF(CG.EQ.0.000) GO TO 20
76   K=LT+L3+M3+1
77   IF(CDABS(YLM(K)).LT.1.00-8) GO TO 20
78   MTM=LT+L3
  
```

REPORT NO. - DTSUTIL I C C F L I B R A R Y F I L E M A I N T E N A N C E
 1...5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...

```

      WRITE(IW,6050)(S(I),I=IINR,IFNR)
      IF(IFNR.EQ.NLMM) GO TO 328
      IINR=IFNR+1
      IFNR=IFNR+4
      GO TO 325
328  IF(JJ.EQ.1) GO TO 350
      JJ=1
      WRITE(IW,6060)
      IF(JIN.EQ.1) GO TO 335
      DO 330 I=1,NLMM
330  S(I)=AEMC(I)
      GO TO 285
335  DO 340 I=1,NLMM
      II=I+IN
340  S(II)=AF(II+NM)
      GO TO 285
350  IN=IN+NLMM
355  WRITE(IW,6080)
      IF(JIN.EQ.NSPH) GO TO 370
360  JIN=NSPH
      GO TO 260
370  SCARAT=SCASEC/GCS
      IF(ICRI.NE.0) GO TO 380
      ABSRAT=1.000
      GO TO 385
380  ABSRAT=ABSSEC/GCS
385  TOTRAT=TOTSEC/TCS
      SCA=SCASEC/GCS
      ABS=ABSSEC/GCS
      TOT=TOTSEC/GCS
      IF(NHELP.EQ.1) TSAS(ISA,ISA)=TSAS(JSA,JSA)
      REFINR=DREAL(SAC(ISA,ISA))/DREAL(TSAS(ISA,ISA))
      ABSCLR=DI4AG(SAC(ISA,ISA))/DIMAG(TSAS(ISA,ISA))
      WRITE(IW,6100)SCASEC,ABSSEC,TOTSEC
      WRITE(IW,6300)SCARAT,ABSRAT,TOTRAT
      WRITE(IW,6400)SCA,ABS,TOT
      WRITE(IW,6700)ISA,ISA,SAC(ISA,ISA),JSA,ISA,SAC(JSA,ISA)
      WRITE(IW,6800)ISA,ISA,REFINR,ISA,ISA,ABSCOR
      IF(NHELP.NE.1) GO TO 100
      REIAT=(DREAL(SAC(JSA,JSA))-DREAL(SAC(ISA,ISA)))/DREAL(SAC(JSA,JSA
      I))
      RDI4R=(DI4AG(SAC(JSA,JSA))-DI4AG(SAC(ISA,ISA)))/DIMAG(SAC(JSA,JSA
      I))
      WRITE(IW,6900)JSA,ISA,REFINR,JSA,ISA,RDI4R
      GO TO 100
400  READ(IF,5000)
      GO TO 400
500  STOP
      END
*END PRINT                    239 RECORDS

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      IF(IWCSS.EQ.1) WRITE(IW,6700)
115  ISA,ISA,TSAS(ISA,ISA),JSA,ISA,TSAS(JSA,ISA)
142  CALL SZCT(LMPO,NSPH,IHELP,IEXP,VK,THK,PHK)
      IF(INVER.NE.0) GO TO 200
      IF(IWCIP.NE.1) GO TO 143
      WRITE(IW,6000)NAME
      WRITE(IW,6500)TCL,MAXIT,CI
143  ITER=-1
      DO 145 K=1,NDIM
145  AI(K)=BV(K)
      GO TO 170
150  DO 160 K=1,NDIM
160  AI(K)=AI(K)*CI+AF(K)*CF
170  DO 190 I=1,NDIM
      DET=BV(I)
      DO 180 J=1,NDIM
      AMR=DREAL(AM(I,J))
      AMI=DIMAG(AM(I,J))
      AIR=DREAL(AI(J))
      AII=DIMAG(AI(J))
      IF(DABS(AMR).LT.1.D-36)AMR=0.000
      IF(DABS(AMI).LT.1.D-36)AMI=0.000
      IF(DABS(AIR).LT.1.D-36)AIR=0.000
      IF(DABS(AII).LT.1.D-36)AII=0.000
      AM(I,J)=DCMPLX(AMR,AMI)
      AI(J)=DCMPLX(AIR,AII)
180  DET=DET-AM(I,J)*AI(J)
      DET=DREAL(DET)
      DETI=DIMAG(DET)
      IF(DABS(DETR).LT.1.D-36)DETR=0.000
      IF(DABS(DETI).LT.1.D-36)DETI=0.000
      DET=DCMPLX(DETR,DETI)
190  AFI(I)=DET
      ITER=ITER+1
      IF(ITER.NE.0) DLSEC=SEC
      CALL CUSSEC(LMPO,NSPH,VK,IHELP,SCASEC,ABSSEC,TOTSEC)
      SEC=DLSEC
      IF(ITER.EQ.1) GO TO 150
      DELTA=DLSEC/SEC-1.000
      IF(IWCIP.EQ.1)WRITE(IW,6600)ITER,DLSEC,SEC,DELTA
      IF(DABS(DELTA).LT.FCL)GO TO 230
      IF(ITER.LT.MAXIT)GO TO 150
      IF(ITER.EQ.4) CALL SMAT(LMPO,NSPH)
      DO 200 I=1,NDIM
200  AM(I,1)=AM(I,1)+1.000
      CALL CSHIV(AA,V,NDIMST,NDIM,MODE,IER)
      IF(IER.NE.1) GO TO 400
      DO 210 I=1,NDIM
210  BV(I)=0.000
      DO 220 J=1,NDIM
220  BV(J)=BV(J)+BV(I)
      CALL CUSSEC(LMPO,NSPH,VK,IHELP,SCASEC,ABSSEC,TOTSEC)
      DLSEC=DLSEC+BV(I)*AM
      IF(IW.NE.370,380,250)
250  JIN=1
260  DO 350 J=JIN,NSPH
      JJ=
      IF(JIN.EQ.1) GO TO 275
      DO 270 I=1,NDIM
270  S(I)=A1A0(I)
      GO TO 260
275  DO 280 I=1,NDIM
280  II=1+I
      A(I)=A(II)
      IF(IW.NE.370,380,310)
310  IF(JIN.EQ.1) GO TO 310
      IF(IW.NE.370,380,320)
320  IF(JIN.EQ.1) GO TO 320
      IF(IW.NE.370,380,330)
330  IF(JIN.EQ.1) GO TO 330
      IF(IW.NE.370,380,340)
340  IF(JIN.EQ.1) GO TO 340
      IF(IW.NE.370,380,350)
350  IF(JIN.EQ.1) GO TO 350
      IF(IW.NE.370,380,360)
360  IF(JIN.EQ.1) GO TO 360
      IF(IW.NE.370,380,370)
370  IF(JIN.EQ.1) GO TO 370
      IF(IW.NE.370,380,380)
380  IF(JIN.EQ.1) GO TO 380
      IF(IW.NE.370,380,390)
390  IF(JIN.EQ.1) GO TO 390
      IF(IW.NE.370,380,400)
400  IF(JIN.EQ.1) GO TO 400
      IF(IW.NE.370,380,410)
410  IF(JIN.EQ.1) GO TO 410
      IF(IW.NE.370,380,420)
420  IF(JIN.EQ.1) GO TO 420
      IF(IW.NE.370,380,430)
430  IF(JIN.EQ.1) GO TO 430
      IF(IW.NE.370,380,440)
440  IF(JIN.EQ.1) GO TO 440
      IF(IW.NE.370,380,450)
450  IF(JIN.EQ.1) GO TO 450
      IF(IW.NE.370,380,460)
460  IF(JIN.EQ.1) GO TO 460
      IF(IW.NE.370,380,470)
470  IF(JIN.EQ.1) GO TO 470
      IF(IW.NE.370,380,480)
480  IF(JIN.EQ.1) GO TO 480
      IF(IW.NE.370,380,490)
490  IF(JIN.EQ.1) GO TO 490
      IF(IW.NE.370,380,500)
500  IF(JIN.EQ.1) GO TO 500
      IF(IW.NE.370,380,510)
510  IF(JIN.EQ.1) GO TO 510
      IF(IW.NE.370,380,520)
520  IF(JIN.EQ.1) GO TO 520
      IF(IW.NE.370,380,530)
530  IF(JIN.EQ.1) GO TO 530
      IF(IW.NE.370,380,540)
540  IF(JIN.EQ.1) GO TO 540
      IF(IW.NE.370,380,550)
550  IF(JIN.EQ.1) GO TO 550
      IF(IW.NE.370,380,560)
560  IF(JIN.EQ.1) GO TO 560
      IF(IW.NE.370,380,570)
570  IF(JIN.EQ.1) GO TO 570
      IF(IW.NE.370,380,580)
580  IF(JIN.EQ.1) GO TO 580
      IF(IW.NE.370,380,590)
590  IF(JIN.EQ.1) GO TO 590
      IF(IW.NE.370,380,600)
600  IF(JIN.EQ.1) GO TO 600
      IF(IW.NE.370,380,610)
610  IF(JIN.EQ.1) GO TO 610
      IF(IW.NE.370,380,620)
620  IF(JIN.EQ.1) GO TO 620
      IF(IW.NE.370,380,630)
630  IF(JIN.EQ.1) GO TO 630
      IF(IW.NE.370,380,640)
640  IF(JIN.EQ.1) GO TO 640
      IF(IW.NE.370,380,650)
650  IF(JIN.EQ.1) GO TO 650
      IF(IW.NE.370,380,660)
660  IF(JIN.EQ.1) GO TO 660
      IF(IW.NE.370,380,670)
670  IF(JIN.EQ.1) GO TO 670
      IF(IW.NE.370,380,680)
680  IF(JIN.EQ.1) GO TO 680
      IF(IW.NE.370,380,690)
690  IF(JIN.EQ.1) GO TO 690
      IF(IW.NE.370,380,700)
700  IF(JIN.EQ.1) GO TO 700
      IF(IW.NE.370,380,710)
710  IF(JIN.EQ.1) GO TO 710
      IF(IW.NE.370,380,720)
720  IF(JIN.EQ.1) GO TO 720
      IF(IW.NE.370,380,730)
730  IF(JIN.EQ.1) GO TO 730
      IF(IW.NE.370,380,740)
740  IF(JIN.EQ.1) GO TO 740
      IF(IW.NE.370,380,750)
750  IF(JIN.EQ.1) GO TO 750
      IF(IW.NE.370,380,760)
760  IF(JIN.EQ.1) GO TO 760
      IF(IW.NE.370,380,770)
770  IF(JIN.EQ.1) GO TO 770
      IF(IW.NE.370,380,780)
780  IF(JIN.EQ.1) GO TO 780
      IF(IW.NE.370,380,790)
790  IF(JIN.EQ.1) GO TO 790
      IF(IW.NE.370,380,800)
800  IF(JIN.EQ.1) GO TO 800
      IF(IW.NE.370,380,810)
810  IF(JIN.EQ.1) GO TO 810
      IF(IW.NE.370,380,820)
820  IF(JIN.EQ.1) GO TO 820
      IF(IW.NE.370,380,830)
830  IF(JIN.EQ.1) GO TO 830
      IF(IW.NE.370,380,840)
840  IF(JIN.EQ.1) GO TO 840
      IF(IW.NE.370,380,850)
850  IF(JIN.EQ.1) GO TO 850
      IF(IW.NE.370,380,860)
860  IF(JIN.EQ.1) GO TO 860
      IF(IW.NE.370,380,870)
870  IF(JIN.EQ.1) GO TO 870
      IF(IW.NE.370,380,880)
880  IF(JIN.EQ.1) GO TO 880
      IF(IW.NE.370,380,890)
890  IF(JIN.EQ.1) GO TO 890
      IF(IW.NE.370,380,900)
900  IF(JIN.EQ.1) GO TO 900
      IF(IW.NE.370,380,910)
910  IF(JIN.EQ.1) GO TO 910
      IF(IW.NE.370,380,920)
920  IF(JIN.EQ.1) GO TO 920
      IF(IW.NE.370,380,930)
930  IF(JIN.EQ.1) GO TO 930
      IF(IW.NE.370,380,940)
940  IF(JIN.EQ.1) GO TO 940
      IF(IW.NE.370,380,950)
950  IF(JIN.EQ.1) GO TO 950
      IF(IW.NE.370,380,960)
960  IF(JIN.EQ.1) GO TO 960
      IF(IW.NE.370,380,970)
970  IF(JIN.EQ.1) GO TO 970
      IF(IW.NE.370,380,980)
980  IF(JIN.EQ.1) GO TO 980
      IF(IW.NE.370,380,990)
990  IF(JIN.EQ.1) GO TO 990
      IF(IW.NE.370,380,1000)
1000 IF(JIN.EQ.1) GO TO 1000

```

140 00511525

[illegible]

```

0001 FCRZAI(4,12)
0010 FCRAAI(3E20.8)
0015 FCFZAI(E21.8,2F10.4)
0020 FCFZAI(1,16)
0025 FCFZAI(2,16)
0030 FCFZAI(3,16)
0035 FCFZAI(4,16)
0040 FCFZAI(5,16)
0045 FCFZAI(6,16)
0050 FCFZAI(7,16)
0055 FCFZAI(8,16)
0060 FCFZAI(9,16)
0065 FCFZAI(10,16)
0070 FCFZAI(11,16)
0075 FCFZAI(12,16)
0080 FCFZAI(13,16)
0085 FCFZAI(14,16)
0090 FCFZAI(15,16)
0095 FCFZAI(16,16)
0100 FCFZAI(17,16)
0105 FCFZAI(18,16)
0110 FCFZAI(19,16)
0115 FCFZAI(20,16)
0120 FCFZAI(21,16)
0125 FCFZAI(22,16)
0130 FCFZAI(23,16)
0135 FCFZAI(24,16)
0140 FCFZAI(25,16)
0145 FCFZAI(26,16)
0150 FCFZAI(27,16)
0155 FCFZAI(28,16)
0160 FCFZAI(29,16)
0165 FCFZAI(30,16)
0170 FCFZAI(31,16)
0175 FCFZAI(32,16)
0180 FCFZAI(33,16)
0185 FCFZAI(34,16)
0190 FCFZAI(35,16)
0195 FCFZAI(36,16)
0200 FCFZAI(37,16)
0205 FCFZAI(38,16)
0210 FCFZAI(39,16)
0215 FCFZAI(40,16)
0220 FCFZAI(41,16)
0225 FCFZAI(42,16)
0230 FCFZAI(43,16)
0235 FCFZAI(44,16)
0240 FCFZAI(45,16)
0245 FCFZAI(46,16)
0250 FCFZAI(47,16)
0255 FCFZAI(48,16)
0260 FCFZAI(49,16)
0265 FCFZAI(50,16)
0270 FCFZAI(51,16)
0275 FCFZAI(52,16)
0280 FCFZAI(53,16)
0285 FCFZAI(54,16)
0290 FCFZAI(55,16)
0295 FCFZAI(56,16)
0300 FCFZAI(57,16)
0305 FCFZAI(58,16)
0310 FCFZAI(59,16)
0315 FCFZAI(60,16)
0320 FCFZAI(61,16)
0325 FCFZAI(62,16)
0330 FCFZAI(63,16)
0335 FCFZAI(64,16)
0340 FCFZAI(65,16)
0345 FCFZAI(66,16)
0350 FCFZAI(67,16)
0355 FCFZAI(68,16)
0360 FCFZAI(69,16)
0365 FCFZAI(70,16)
0370 FCFZAI(71,16)
0375 FCFZAI(72,16)
0380 FCFZAI(73,16)
0385 FCFZAI(74,16)
0390 FCFZAI(75,16)
0395 FCFZAI(76,16)
0400 FCFZAI(77,16)
0405 FCFZAI(78,16)
0410 FCFZAI(79,16)
0415 FCFZAI(80,16)
0420 FCFZAI(81,16)
0425 FCFZAI(82,16)
0430 FCFZAI(83,16)
0435 FCFZAI(84,16)
0440 FCFZAI(85,16)
0445 FCFZAI(86,16)
0450 FCFZAI(87,16)
0455 FCFZAI(88,16)
0460 FCFZAI(89,16)
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1220 FCFZAI(241,16)
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1230 FCFZAI(243,16)
1235 FCFZAI(244,16)

```

100-16897-1000-1A SET JUNE=1.
 100-16897-1000-2A SET JUNE=2.
 100-16897-1000-3A SET JUNE=3.
 100-16897-1000-4A SET JUNE=4.
 100-16897-1000-5A SET JUNE=5.

1. THE FIRST POLYNOMIAL MULTIPOLE EXPANSION COEFFICIENT IS WRITTEN
2. THE FIRST POLYNOMIAL MULTIPOLE EXPANSION COEFFICIENTS
AROUND SITES ARE ALSO WRITTEN.
3. THE FIRST QUANTUM SECTIONS OF THE SINGLE SPHERES ARE WRITTEN.
4. THE FIRST DATA ABOUT CONVERGENCE OF ITERATIVE
PROCEDURE ARE WRITTEN.

```

1F(JJ,0.5F(4),,1,1,50)
  LEAD(1,0.50)TSPH,EMP,THLPL,LEXP,MAXIT
  DO(1,1,0.10)CAX(1),CYY(1),CZZ(1),I=1,NSPH)
  CAX(1,0.50)(1,0(1),I=1,NSPH)
  CAY(1,0.50)(1,0(1),I=1,NSPH)
  CAZ(1,0.50)(1,0(1),I=1,NSPH)
  CR(1,0.50)VR,THK,PHK
  F=0.1,0.5)INVR,MODE,NORMST
  F=0.1,0.5)CIC(1,1)

```

..........1.....2.....3.....4.....5.....6.....7.....*

COMPLAINT, *****

..........1.....2.....3.....4.....5.....6.....7.*.....

... ..

...#...1.....2.....3.....4.....5.....6.....7....:

Journal of Management Studies, 19(1), 67-80.

....1.....2.....3.....4.....5.....6.....7.*...

```

1 SUBROUTINE AUXIL
2 1(LMPC)
3 IMPLICIT REAL*8(A-F,C-Z)
4 COMMON/DUM0/ RXX(4),RYY(4),KZZ(4),
5 IRCS(4),CRI(4),XIL(4),
6 2XIL1(4),RM(3,4),SM(3,4),TSAS(2,2),SAC(2,2),
7 3w(15,2),AI(120),AF(120),AMMO(15),AEMO(15),S(15),NAME(40),IOG(4)
8 COMMON/DUM6/FACFC(30),FNCKM(28)
9 COMPLEX*16 XIL,XIL1,CRI,RM,SM,w,AI,AF,AMMO,AEMO,S,TSAS,SAC
10 DATA PI4/ 12.566370614356/
11 NFAC=30
12 FACFC(1)=1.000
13 DO 1 I=2,NFAC
14 A=I-1
15 FACFC(I)=A*FACFC(I-1)
16 LMTPC=LMPC+LMPC-1
17 DO 5 LF=1,LMTPC
18 L=LF-1
19 LTPC=LF+L
20 DO 6 LY=1,L
21 A=1+1
22 L=LF-1
23 LY=LF+LY
24 C=1+1+1
25 FACFC(LY)=FACFC(LY)/FACFC(LY)
26 A=1+1
27 FACFC(LY)=C5.XI(A)
28 I=1
29 I=I+1
30 XIL1(I)=1
31 XIL(I)=1
32 IF(1.EQ.LMPC) GO TO 15
33 I=I+1
34 XIL1(I)=(0.000,-1.000)
35 XIL(I)=(0.000, 1.000)
36 IF(1.EQ.LMPC) GO TO 15
37 I=I+1
38 XIL1(I)=-1
39 XIL(I)=-1
40 IF(1.EQ.LMPC) GO TO 15
41 I=I+1
42 XIL1(I)=(0.000, 1.000)
43 XIL(I)=(0.000,-1.000)
44 IF(1.LT.LMPC) GO TO 12
45 RETURN
46 END

```

STATEMENTS = 42, PROGRAM SIZE = 2888 BYTES, PROGRAM NAME = AUXIL

ANALYTICAL RESULTS.

```

1  FUNCTION SCLEB(JA,JB,JC,MA,MB)
2  IMPLICIT REAL*8(A-H,C-Z)
3  COMMON/COMMON/FAC1(30),FNCRN(28)
4  MC=MA+MB
5  IF(MA-JA)4,4,3
6  SCLEB=0.00
7  GO TO 35
8  IF(MA+JA)5,6,6
9  SCLEB=0.00
10 SCLEB=0.00
11 GO TO 35
12 IF(MB-JB)7,7,7
13 SCLEB=0.00
14 GO TO 35
15 IF(MB+JB)9,10,10
16 SCLEB=0.00
17 GO TO 35
18 IF(MC-JC)12,12,11
19 SCLEB=0.00
20 GO TO 35
21 IF(MC+JC)13,14,14
22 SCLEB=0.00
23 GO TO 35
24 IF(MA-JA-MB+JB)15,16,15
25 SCLEB=0.00
26 GO TO 35
27 IF(MA+JA-MB+JB)17,17,20
28 IF(MB+JB-MC+JC)18,18,19
29 K=0
30 GO TO 24
31 K=JB+JB
32 GO TO 24
33 IF(MB+JB)21,21,22
34 K=JB+JB
35 GO TO 24
36 IF(MB+JB-MC+JC)19,19,21
37 IF(MB+JB-MC+JC)20,20,22
38 IF(MB+JB-MC+JC)21,21,23
39 K=JB+JB
40 GO TO 24
41 IF(MB+JB-MC+JC)22,22,23
42 K=JB+JB
43 GO TO 24
44 IF(MB+JB-MC+JC)23,23,24
45 K=JB+JB
46 GO TO 24
47 IF(MB+JB-MC+JC)24,24,25
48 K=JB+JB
49 GO TO 24
50 IF(MB+JB-MC+JC)25,25,26
51 K=JB+JB
52 GO TO 24
53 IF(MB+JB-MC+JC)26,26,27
54 K=JB+JB
55 GO TO 24
56 IF(MB+JB-MC+JC)27,27,28
57 K=JB+JB
58 GO TO 24
59 IF(MB+JB-MC+JC)28,28,29
60 K=JB+JB
61 GO TO 24
62 IF(MB+JB-MC+JC)29,29,30
63 K=JB+JB
64 GO TO 24
65 IF(MB+JB-MC+JC)30,30,31
66 K=JB+JB
67 GO TO 24
68 IF(MB+JB-MC+JC)31,31,32
69 K=JB+JB
70 GO TO 24
71 IF(MB+JB-MC+JC)32,32,33
72 K=JB+JB
73 GO TO 24
74 IF(MB+JB-MC+JC)33,33,34
75 K=JB+JB
76 GO TO 24
77 IF(MB+JB-MC+JC)34,34,35
78 K=JB+JB
79 GO TO 24
80 IF(MB+JB-MC+JC)35,35,36
81 K=JB+JB
82 GO TO 24
83 IF(MB+JB-MC+JC)36,36,37
84 K=JB+JB
85 GO TO 24
86 IF(MB+JB-MC+JC)37,37,38
87 K=JB+JB
88 GO TO 24
89 IF(MB+JB-MC+JC)38,38,39
90 K=JB+JB
91 GO TO 24
92 IF(MB+JB-MC+JC)39,39,40
93 K=JB+JB
94 GO TO 24
95 IF(MB+JB-MC+JC)40,40,41
96 K=JB+JB
97 GO TO 24
98 IF(MB+JB-MC+JC)41,41,42
99 K=JB+JB
100 GO TO 24

```

```

7:      SQUA 1=ARG*FACTC (JJ1)*FACTC (JJ2)*FACTC (JJ3)
7:      SQUA 2=FACTC (JJ4)
8:      SQUA 3=FACTC (JJ5)*FACTC (JJ6)*FACTC (JJ7)
8:      1*FACTC (JJ8)*FACTC (JJ9)*FACTC (JJ10)
8:      SQUA 4=SQUA 1*SQUA 3/SQUA 2
8:      DCLEB=SUM*DSQRT(SQUA 4)
8:      RETURN
8:      END

```

CS* SOURCE STATEMENTS = 84, PROGRAM SIZE = 4774 BYTES, PROGRAM NAME = DCLEB

CS* NO DIAGNOSTICS GENERATED.

CS* COMPILATION 12 *****

.....1.....2.....3.....4.....5.....6.....7......

```

1  SUBROUTINE RBF(X,N,JCK,FJ)
2  IMPLICIT REAL*8(A-H,O-Z)
3  DIMENSION FJ(100)
4  ICK=JCK
5  IF(X-1.E-8)7,11,11
6  7 FJ(1)=1.
7  IF( )10,10,8
8  8 MM=N+1
9  DO 9 M=2,MM
10 FJ(M)=0.
11 DO 10 IC 50
12 FNC=1.04*X+6.5
13 TST=4.21*.43429+4815*DLOG(X)+3.
14 IF(2.-TST)13,12,12
15 12 DELTA=2.
16 DO 13 IC 14
17 DELTA=TST
18 IF( )
19 IF(FN-FNC)15,15,16
20 F=FNC+DELTA
21 DO 16 IC 17
22 F=F+DELTA
23 F=F+1.
24 IF( )
25 IF( )
26 IF( )
27 IF( )
28 IF( )
29 IF( )
30 IF( )
31 IF( )
32 IF( )
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83 IF( )
84 IF( )
85 IF( )

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..........1.....2.....3.....4.....5.....6.....7.*.....

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      NO OF STATEMENTS = 29, PROGRAM SIZE = 1804 BYTES, PROGRAM NAME = RNF     PAG
      NO VARIABLES DECLARED.
      END OF COMPILATION. 14 *****

```

```

10 PLMRS(J)=(C+A*PLMRS(K)-C*PLMRS(M))/A
11 IF(L-LV)30,31,31
12 L=L+1
13 DO T=2,
14 L=3
15 J=(L+(L+1))/2+2
16 K=L-1
17 S=2*L-1
18 C=L
19 K=J-L
20 M=J-2*L+1
21 PLMRS(J)=(S*K+PLMRS(K)-C*PLMRS(M))/A
22 IF(L-L4)33,34,34
23 L=L+1
24 DO T=32,
25 L=2
26 M=1
27 LAVE=(L*(L+1))/2+1
28 J=LAVE+4+1
29 K=J-1
30 K=K-1
31 LAVE=1
32 Y=(C-J)*SIN(X)/Y
33 S=(Y+1)/(L-M+1)
34 PLMRS(J)=A*PLMRS(K)-S*PLMRS(N)
35 Y=(Y+1-C)/(J-32,32,32)
36
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```

1. **NAME** = **NAME** (Name of the person who is the owner of the car)
 2. **MODEL** = **MODEL** (Model of the car)
 3. **PRICE** = **PRICE** (Price of the car)
 4. **YEAR** = **YEAR** (Year of the car)
 5. **TYPE** = **TYPE** (Type of the car)
 6. **STATUS** = **STATUS** (Status of the car)
 7. **LOCATION** = **LOCATION** (Location of the car)
 8. **OWNER** = **OWNER** (Owner of the car)
 9. **REGISTRATION** = **REGISTRATION** (Registration of the car)
 10. **INSURANCE** = **INSURANCE** (Insurance of the car)
 11. **MAINTENANCE** = **MAINTENANCE** (Maintenance of the car)
 12. **REPAIRS** = **REPAIRS** (Repairs of the car)
 13. **SALES** = **SALES** (Sales of the car)
 14. **RENTAL** = **RENTAL** (Rental of the car)
 15. **FINANCING** = **FINANCING** (Financing of the car)
 16. **LEASING** = **LEASING** (Leasing of the car)
 17. **EXPORT** = **EXPORT** (Export of the car)
 18. **IMPORT** = **IMPORT** (Import of the car)
 19. **TRADE** = **TRADE** (Trade of the car)
 20. **ACQUISITION** = **ACQUISITION** (Acquisition of the car)
 21. **DISPOSAL** = **DISPOSAL** (Disposal of the car)
 22. **RECALL** = **RECALL** (Recall of the car)
 23. **SAFETY** = **SAFETY** (Safety of the car)
 24. **SECURITY** = **SECURITY** (Security of the car)
 25. **COMPLAINTS** = **COMPLAINTS** (Complaints of the car)
 26. **WARRANTY** = **WARRANTY** (Warranty of the car)
 27. **DEFECTS** = **DEFECTS** (Defects of the car)
 28. **RECALLS** = **RECALLS** (Recalls of the car)
 29. **SALES** = **SALES** (Sales of the car)
 30. **RENTAL** = **RENTAL** (Rental of the car)
 31. **FINANCING** = **FINANCING** (Financing of the car)
 32. **LEASING** = **LEASING** (Leasing of the car)
 33. **EXPORT** = **EXPORT** (Export of the car)
 34. **IMPORT** = **IMPORT** (Import of the car)
 35. **TRADE** = **TRADE** (Trade of the car)
 36. **ACQUISITION** = **ACQUISITION** (Acquisition of the car)
 37. **DISPOSAL** = **DISPOSAL** (Disposal of the car)
 38. **RECALL** = **RECALL** (Recall of the car)
 39. **SAFETY** = **SAFETY** (Safety of the car)
 40. **SECURITY** = **SECURITY** (Security of the car)
 41. **COMPLAINTS** = **COMPLAINTS** (Complaints of the car)
 42. **WARRANTY** = **WARRANTY** (Warranty of the car)
 43. **DEFECTS** = **DEFECTS** (Defects of the car)
 44. **RECALLS** = **RECALLS** (Recalls of the car)
 45. **SALES** = **SALES** (Sales of the car)
 46. **RENTAL** = **RENTAL** (Rental of the car)
 47. **FINANCING** = **FINANCING** (Financing of the car)
 48. **LEASING** = **LEASING** (Leasing of the car)
 49. **EXPORT** = **EXPORT** (Export of the car)
 50. **IMPORT** = **IMPORT** (Import of the car)
 51. **TRADE** = **TRADE** (Trade of the car)
 52. **ACQUISITION** = **ACQUISITION** (Acquisition of the car)
 53. **DISPOSAL** = **DISPOSAL** (Disposal of the car)
 54. **RECALL** = **RECALL** (Recall of the car)
 55. **SAFETY** = **SAFETY** (Safety of the car)
 56. **SECURITY** = **SECURITY** (Security of the car)
 57. **COMPLAINTS** = **COMPLAINTS** (Complaints of the car)
 58. **WARRANTY** = **WARRANTY** (Warranty of the car)
 59. **DEFECTS** = **DEFECTS** (Defects of the car)
 60. **RECALLS** = **RECALLS** (Recalls of the car)
 61. **SALES** = **SALES** (Sales of the car)
 62. **RENTAL** = **RENTAL** (Rental of the car)
 63. **FINANCING** = **FINANCING** (Financing of the car)
 64. **LEASING** = **LEASING** (Leasing of the car)
 65. **EXPORT** = **EXPORT** (Export of the car)
 66. **IMPORT** = **IMPORT** (Import of the car)
 67. **TRADE** = **TRADE** (Trade of the car)
 68. **ACQUISITION** = **ACQUISITION** (Acquisition of the car)
 69. **DISPOSAL** = **DISPOSAL** (Disposal of the car)
 70. **RECALL** = **RECALL** (Recall of the car)
 71. **SAFETY** = **SAFETY** (Safety of the car)
 72. **SECURITY** = **SECURITY** (Security of the car)
 73. **COMPLAINTS** = **COMPLAINTS** (Complaints of the car)
 74. **WARRANTY** = **WARRANTY** (Warranty of the car)
 75. **DEFECTS** = **DEFECTS** (Defects of the car)
 76. **RECALLS** = **RECALLS** (Recalls of the car)
 77. **SALES** = **SALES** (Sales of the car)
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 79. **FINANCING** = **FINANCING** (Financing of the car)
 80. **LEASING** = **LEASING** (Leasing of the car)
 81. **EXPORT** = **EXPORT** (Export of the car)
 82. **IMPORT** = **IMPORT** (Import of the car)
 83. **TRADE** = **TRADE** (Trade of the car)
 84. **ACQUISITION** = **ACQUISITION** (Acquisition of the car)
 85. **DISPOSAL** = **DISPOSAL** (Disposal of the car)
 86. **RECALL** = **RECALL** (Recall of the car)
 87. **SAFETY** = **SAFETY** (Safety of the car)
 88. **SECURITY** = **SECURITY** (Security of the car)
 89. **COMPLAINTS** = **COMPLAINTS** (Complaints of the car)
 90. **WARRANTY** = **WARRANTY** (Warranty of the car)
 91. **DEFECTS** = **DEFECTS** (Defects of the car)
 92. **RECALLS** = **RECALLS** (Recalls of the car)
 93. **SALES** = **SALES** (Sales of the car)
 94. **RENTAL** = **RENTAL** (Rental of the car)
 95. **FINANCING** = **FINANCING** (Financing of the car)
 96. **LEASING** = **LEASING** (Leasing of the car)
 97. **EXPORT** = **EXPORT** (Export of the car)
 98. **IMPORT** = **IMPORT** (Import of the car)
 99. **TRADE** = **TRADE** (Trade of the car)
 100. **ACQUISITION** = **ACQUISITION** (Acquisition of the car)
 101. **DISPOSAL** = **DISPOSAL** (Disposal of the car)
 102. **RECALL** = **RECALL** (Recall of the car)
 103. **SAFETY** = **SAFETY** (Safety of the car)
 104. **SECURITY** = **SECURITY** (Security of the car)
 105. **COMPLAINTS** = **COMPLAINTS** (Complaints of the car)
 106. **WARRANTY** = **WARRANTY** (Warranty of the car)
 107. **DEFECTS** = **DEFECTS** (Defects of the car)
 108. **RECALLS** = **RECALLS** (Recalls of the car)
 109. **SALES** = **SALES** (Sales of the car)
 110. **RENTAL** = **RENTAL** (Rental of the car)
 111. **FINANCING** = **FINANCING** (Financing of the car)
 112. **LEASING** = **LEASING** (Leasing of the car)
 113. **EXPORT** = **EXPORT** (Export of the car)
 114. **IMPORT** = **IMPORT** (Import of the car)
 115. **TRADE** = **TRADE** (Trade of the car)
 116. **ACQUISITION** = **ACQUISITION** (Acquisition of the car)
 117. **DISPOSAL** = **DISPOSAL** (Disposal of the car)
 118. **RECALL** = **RECALL** (Recall of the car)
 119. **SAFETY** = **SAFETY** (Safety of the car)
 120. **SECURITY** = **SECURITY** (Security of the car)
 121. **COMPLAINTS** = **COMPLAINTS** (Complaints of the car)
 122. **WARRANTY** = **WARRANTY** (Warranty of the car)
 123. **DEFECTS** = **DEFECTS** (Defects of the car)
 124. **RECALLS** = **RECALLS** (Recalls of the car)
 125. **SALES** = <

PT(1)	EXP(7)	NAME(1)	DATE(8)	TIME(6)	STATUS(1)	REASON(1)	SOURCE	TERM	OBJECT	FIXED	NOT
							NAME(MAIN)			LINECOUNT(85)	

.....7.*.....

4017 CALL NODL=CTEMP
4018 CONTINUE
4019 CONTINUE
5000 RETURN
5001 IF=1
5002 RETURN
END

LOCAL STATEMENTS = 64, PROGRAM SIZE = 6592 BYTES, PROGRAM NAME = CSMINV

NO DIAGNOSTICS GENERATED.

COMPILATION IS *****

LT NOLIST MAP NOXREF GOSTMT NOCHECK SOURCE TERM OBJECT FIA
OPT(0) LARGVL(66) NCFIPS FLAG(1) NAME(MAIN) LINECOUNT(5)

*.....1.....2.....3.....4.....5.....6.....7.....

```

SUBROUTINE AOXIL
  DIMENSION YLV(31),FJ(100),FA(5)
  COMMON/DO40/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
  1VC3(50025),VH(27),VYH(243),VJ(27),VYJ(243)
  2,NH(4,3),SM(4,3),TSAS(2,2),SAC(2,2),
  3,(24,2),AI(14,4),AF(144),AYND(24),AEMC(24),S(24),NAME(40),ICG(3)
  COMMON/DO41/ CH1,VH,VYH,VYJ,FM,SM,TSAS,SAC,
  1,AI,HI,AMV,AL,AS,
  2,N/DO42/FACTC(140),FACFM(45)
  3,N/DO43/EMPC,LM,NLM,NLMM,N,NM,NDIM,NSPH,LMTPLS,LMT,LMTPLS,
  1NSAS,NX,NXS,NXM
  DATA P147/12.006370614356/
  IF(JOBC.NE.1) GO TO 18
  LX=LMP-1
  NL=LXPC*EMPC
  NLM=NLM-1
  N=NSPH*NLM
  NX=N-NSPH
  NDI=N+NX
  LMTPLS=LXPC+LMP-1
  LMT=LMTPLS-1
  LMTPLS=LMTPLS*LMTPLS
  NSAS=NSAS-1
  NX=LX*LXPC+LXPC
  NXAS=NX*NX
  NXS=NXS+NX
  FACTC(1)=1.000
  DO 17 I=2,NFAC
    A=1-1
    FACTC(I)=A*FACTC(I-1)
    DO 15 LF=1,LMTPLS
      C=CF-1
      L1=CF+L
      DO 13 I4=1,Lf
        I=1-1
        L2=CF-I
        L3=LF+I
        A=CF*L/2+14
        A=1704*FACTC(LF4)/FACTC(LFM)
        A=N/P14
        FACTC(I4)=OSN-I(A)
        DO 17 LF=1,LXPC
          L1=LF-1
          L2=LF+L1
          L3=-LF
          DO 17 MF=1,NFV
            M1=1+1
            DO 17 L3=1,LXPC
              L4=L3-1
              L5=L3+L2
              L6=-L5
              L7INP=145(L2-L1)+1
              LMAXPC=L5+L1
              DO 17 MS=1,NST
                M2=M2+1
                M3=M1+M2
                DO 17 LT=L7INP,LMAXPC
                  L3=LT-1
                  IF(M3.LT.-L3.OR.M3.GT.L3) GO TO 17
                  IV=INT(L1,L2,L3,M1,M2,M3)
                  VCB(IV)=CLSC(L1,L2,L3,M1,M2,M3)
                17 CONTINUE
              IF(JOBC.GT.2) RETURN
              IVY=0
              IVNH=0
              DO 20 NF=1,NSP
                NFPC=Nf+1
                DO 20 NS=NFPC,NSPH
                  RX=RAX(NS)-RAX(NF)
                  RY=RYY(NS)-RYY(NF)
                  RZ=RZZ(NS)-RZZ(NF)
                  CALL POLAR(RX,RY,RZ,RH,UTH,SRTH,CRPH,SRPH)
                  CALL SPHAR(CRTH,SRTH,CRPH,SRPH,LMTPLS,YLV)
                20 CONTINUE
              IV=1,LMTPLS
              IVT=IV+IVY

```

' 1983)

VS FOREIGN

DATE 1964 NOV 07

TIME 17 54

1	NOLIST	MAP	NOXREF	GUSTMT	NOJCK	SOURCE	TEAM	OBJECT	FIXED	AL-
	OPT(0)	LARGEVL(00)	NOFIPS	FLAG(1)	NAME(MAIN)			LINECOUNT(55)		

1. 2. 3. 4. 5. 6. 7.

```

SUBROUTINE ASM
1  CALL (LYPC, NGRMX, VK, JCL)
1  IF (LCLIF, RCL, L#R(A-F, L-2)
    GRMX, ZDJZ, RXX(3), RYY(3), RZZ(3), RLS(3), CRI(3),
    LVCS(536, 23), VYH(27), VYF(243), VJ(27), VYJ(243)
2  F4(+, 3), SM(4, 3), TSAS(2, 2), SAC(2, 2),
3  A(24, 2), AI(144), AF(14+), AMCO(24), S(2+), NAME(40), ILS(3)
    COMPLEX*10 CFI, VF, VYF, VYJ, FM, SM, TSAS, SAC,
14, AI, AF, AMCO, AEMCO, S
1  IF (KSIEN
1  CFJ(1+), FN(7), FU(100)
    COMPLEX*10 CFJ, CRII, VKK, CFIJ, A, B, C, D
    LA=LYPC-1
    LYFI=LYPC+1
    DO 20 I=1, GRMX
    IOGI=IOG(I)+1
    IF (I+IOGI, SI, I) GO TO 6
    I, SI=I, IOI-1
    DO 5 L=1, L4
    F(L, I)=F(L, IOGI)
5  S(L, I)=SM(L, IOGI)
    GO TO 20
6  VKK=VK*RC(1)
    CRII=CRI(I)
    VKK=VKK*CRII
    CRII=CRII*CFII
    IF (D134, (VKK), DO, C, DOO) GO TO 7
    CALL CCF(VKK, LYPC, JCL, CFIJ)
    GO TO 5
7  FVKK=CFI*VKK
    CALL CCF(FVKK, LYPC, JCL, FUJ)
    DO 5 J=1, LYFI
    CFJ(J)=FUJ(J)
8  CALL CCF(VYF, LYPC, JCL, FUJ)
    CALL CCF(VKK, LYPC, FN)
    DO 20 LD=2, LYPC
    LE=LD-1
    FE=L3+E
    LYPC=LE+1
    FV=(L3*FN(L)-LE*FN(LEPC))
    FJ=(L3*FU(L)-LE*FU(LEPC))
    CFJ=(L3*CFJ(L)-LE*CFJ(LEPC))
    A=CFJ(LE)+FV*F*FN(LD)+FN(LD)*E
    B=VKK*CFJ+CFJ(LE)*E
    C=CFJ(LE)+(VKK*FJ+FJ(LE)*F)
    D=FU(LE)*C
    FE=FE*(LD)*E
    C(L, I)=1.000/(1.000+(C, DOO, 1.000)*((A-B)/(C-D)))
    D(L, I)=1.000/(1.000+(C, DOO, 1.000)*((CRII*A-B)/(CRII*C-D)))
20 CONTINUE
    RETURN
END

```

TIME 11 52

.....1.....2.....3.....4.....5.....6.....7.*.....

```

SUBROUTINE WLM
1(KHLLP,TH,PH,LMPC)
11PLICIT REAL*8(A-H,C-Z)
11AENSIGN YLM(26)
11C1H, /DO40/ KXX(3),KYY(3),KZZ(3),RCS(3),CFL(3),
1VCS(20020),VH(27),VYH(243),VJ(27),VYJ(243)
11C1I(4,3),C1I(4,3),TSAS(2,2),SAC(2,2),
1A(24,2),AI(1+4),AF(144),AMV(24),AMC(24),S(24),NAME(40),LCS(3)
11C4PLX#16, C-1,VH,VYH,VYJ,CV,SM,TSAS,SAC,
1A,AI,AF,AMV,AMC,S
11C1H, /DO5/FAC(41),FACF(45)
11C1PLX#15 YL2,AP,AN,AL,CL
11C1H, /12.566370014356/
11LMP=L*DE*LMPC+1
1YLM(,L*P)=(0.000,0.000)
1HLLP=1
1IF(KHLLP.EQ.2) 1HLLP=-1
1P=-11HLLP
1COST=CCOS(TH)
1SINT=SSIN(TH)
1COSP=CCOS(PH)
1SINP=SSIN(PH)
1CALL SP1A(COST,SINT,COSP,SINP,LMPC,YLM)
1ALPH1=-COST*CCOSP
1BETA1=-COST*SINP
1S1=SINT
1ALPH2=-SINT
1BETA2=-COSP
1CA1=0.000
1CA2=0.000
1A=0.5*(DO4PLX(ALPH1,P*ALPH2)+DO4PLX(BETA1,P*BETA2)*(0.000,1.000))
1A=0.5*(DO4PLX(ALPH1,P*ALPH2)-DO4PLX(BETA1,P*BETA2)*(0.000,1.000))
1A=0.5*PLX(CA1,P*CA2)
1DO10 L=1,L*P
1L=L+1
1HLL=CH*L
1A=HLL
1CL=P13*(0.000,1.000)*L/DSQRT(X)
1V=CL+L
1V=-1
1DO10 V=1,V
1V=V+1
1A=HLL+V
1X=HLL-V*(V+1)
1C=SSINT(X)
1X=HLL-V*(V-1)
1C=SSINT(X)
1CZ=0
1DO10 LMP=DOO100(AH*CP*YLM(K+2)+AP*CM*YLM(K)+A2*CZ*YLM(K+1))*CL
11C1H, /
11C1H, /

```

FCCT NLIST MAP NOXREL GUSTMT NOCHECK SOURCE TERM OBJECT FIXEL NO
 OPT(3) LANGLEV(26) NCFIPS FLAG(1) NAME(MAIN) LINECOUNT(25)

..........1.....2.....3.....4.....5.....6.....7.*.....

```

SUBROUTINE SZOT
1  (IHELP, IEXP, VK, THK, PHK, VOUTA)
IMPLICIT REAL*8(A-H, O-Z)
COMMON /D040/ PXX(3), KYY(3), RZZ(3), RCS(3), CKI(3),
1VC3(50025), VH(27), VYH(243), VJ(27), VYJ(243)
2, KAI(4,3), SM(4,3), TSAS(2,2), SAC(2,2),
3A(24,2), AI(144), AH(144), AVMS(24), AEVC(24), S(24), NAME(40), ICG(3)
COMPLEX*16 CHI, VHI, VYH, VYJ, KM, SM, TSAS, SAC,
1A, AI, AF, AMX, AEVC, S
COMMON /D045/ AV(144,144), BV(144), V(144)
COMPLEX*16 AM, BV
COMMON /INTCC/ LMPD, LM, NLM, ALMM, K, NM, KDIM, NSPH, LMTPL, LMT, LMTPE,
1, SSM, NXX, NXS, NMAN
COMPLEX*16 CCC, GIM, GLM, SCM, SSMSP, SSES, PHAS
C=1.0D0
CC=(0.0D0,0.0D0)
IF (IHELP.EQ.1) GO TO 20
ISA=2
JSA=1
30 TC=30
ISA=1
JSA=2
40 IF (IEXP.NE.0) GO TO 60
I1=0
DO 50 I1=1, NSPH
DO 50 L1=1, LM
SSMSP=RV(L1, N1)
SSES=SV(L1, N1)
L1TPC=L1+L1+1
I1=-L1-1
50 IF (I1=1, L1TPC)
I1=I1+1
I1=I1+1
S=CC
I2=0
DO 45 I2=1, L2
L2TPC=L2+L2+1
I2=-L2-1
60 IF (I2=1, L2TPC)
I2=I2+1
I2=I2+1
45 SUI=SCV+K*(I2, JSA)+(SCM(N1, L1, M1, L2, I2)*IHELP+GIM(N1, L1, M1, L2, I2))
IF (VOUTA.EQ.0) GO TO 47
SCV=JREAL(SCV)
SUI=JIMAG(SCV)
IF (JABS(SCV).LT.VOUTA) SCV=CC
IF (JABS(SUI).LT.VOUTA) SUI=CC
SCV=CCOMPLEX(SCV, SUI)
47 BV(I1)=-SCV*SSMSP
50 BV(I1+K)=SCV*SSES*IHELP
RETURN
60 CKK=VK*OSIN(THK)*CCOS(PHK)
CKY=VK*OSIN(THK)*OSIN(PHK)
CKZ=VK*CCOS(THK)
DO 70 I=1, NSPH
IJ=(I-1)*LM
PKOR=CKK*KAX(I)+CKY*KYY(I)+CKZ*RZZ(I)
PHAS=CCEXP((0.0,1.0)*PKOR)
K=1
KTPC=K+K+1
SSMSP=K4(K, I)
SSES=SV(K, I)
70 J=1, NLM
I1=IJ+J
BV(I1)=-K(J, ISA)*PHAS*SSMSP
BV(I1+K)=K(J, ISA)*PHAS*SSES*IHELP
IF (J.LT.KTPC) GO TO 70
K=K+1
KTPC=KTPC+K+K+1
SSMSP=K4(K, I)
SSES=SV(K, I)
70 CONTINUE
RETURN
END

```

MAY 1983)

VS FORTRAN

DATE 1984 NOV 07

TIME 17

46

TECT NOLIST MAP NOXREF GOSINT ACDECK SOURCE TERM OBJECT FIXEL
 (PT(0)) LANGEVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

.....1.....2.....3.....4.....5.....6.....7....

```

SUBROUTINE SMAT
  IMPLICIT REAL*8(A-H,C-Z)
  COMMON/JOBS/ RXX(3),FYY(3),RZZ(3),RCS(3),CRI(3),
  1/CS(24,25),VH(27),VYH(243),VJ(27),VYJ(243)
  2,RA(4,3),SA(4,3),TSAS(2,2),SAC(2,2),
  3,CA(24,2),AI(144),AF(144),AYMO(24),AEMO(24),S(24),NAME(40),IGS(3)
  4,COMPLEX*16 C1,I,VH,VYH,VYJ,RM,SM,TSAS,SAC,
  10,AI,AF,AYMO,AEMO,S
  11,MOD/JOBS/AY(144,144),BV(144),V(144)
  12,COMPLEX*16 AY,BV
  13,CON/1,IGPH/LMPC,LX,NLX,NLXM,A,NM,NDIM,ASPH,LMTPC,LMT,LMTPCS,
  14,AS,X,NX,NXS,NXM
  15,COMPLEX*16 GH,GK,SSMSP,SSESP,CGO,CGH,CGK
  CGO=(0.000,0.000)
  I1=0
  DO 30 L1=1,ASPH
    DO 30 L1=1,LX
      SS=SA(L1,K1)
      SSMSP=SM(L1,N1)
      L1TPC=L1+L1+1
      M1=-L1-1
      DO 30 M1=1,L1TPC
        M1=M1+1
        I1=I1+1
        I2=0
        DO 20 M2=1,ASPH
          DO 20 M2=N1,NDIM GO TO 20
          DO 10 M2=1,NLXM
            I2=I2+1
            AY(I1,I2)=CGO
            AY(I1,I2+NM)=CGO
            AY(I1+NM,I2)=CGO
            AY(I1+NM,I2+NM)=CGO
          10 CONTINUE
          M2=L2+1,ASPH)
          DO 20 L2=1,LX
            L1TPC=L2+L2+1
            M2=-L2-1
            DO 20 M2=1,L1TPC
              M2=M2+1
              I2=I2+1
              CGH=GH(L2,L1,M1,L2,M2)
              CGK=GK(L2,L1,M1,L2,M2)
              AY(I1,I2)=CGH*SSMSP
              AY(I1,I2+NM)=CGK*SSMSP
              AY(I1+NM,I2)=CGH*SSESP
              AY(I1+NM,I2+NM)=CGK*SSESP
            20 CONTINUE
          20 CONTINUE
        20 CONTINUE
      30 CONTINUE
    30 CONTINUE
  END

```

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 07

TIME 17 55 27

EFFECT NOLIST MAP NOREF GOSINT NODECK SOURCE TERM OBJECT FIXED NO
 OPT(0) LANGEVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECCC(1185)

..........1.....2.....3.....4.....5.....6.....7.....*

```

SUBROUTINE CRESSE
1  VVK, IHELP,
2  SCASEC, ABSSEC, TOTSEC, VCUTA)
1  PLICIT REAL*8 (A-F, C-Z)
  CCMEN/DOO/ RXX(3), RYY(3), RZZ(3), RCS(3), CRI(3),
1  VCG(20025), VH(27), VYH(243), VJ(27), VYJ(243)
2, R4(4,3), SM(4,3), TSAS(2,2), SAC(2,2),
3A(24,2), AI(144), AE(144), AMNC(24), AEMC(24), S(24), NAME(40), ICS(3)
  COMPLEX*16 CRI, VH, VYH, VYJ, FM, SM, TSAS, SAC,
1  A, AI, AE, AMNC, AEMC, S
  CCMEN/DOO/ LNPL, LN, LLM, ALMM, N, NM, NDIP, NSPH, LMTPL, LMT, LMTPLS,
1  NSAC, NAX, NNAS, NVMX
  COMPLEX*16 GIP, GLP, AM, AE, GI, GL, SUMY, SUME, CCC, CCCN, CFDET
  CC=0.000
  CCC=(0.000,0.000)
  CK=.5/(VVK*VVK)
  CCN=-((0.000,1.000)*(0.5*CK/VK)
  IF (IHELP.EQ.-1) GO TO 10
  ISA=1
  JSA=2
  GO TO 12
10  ISA=2
  JSA=1
12  I1=0
  DO 20 I1=1, LM
  L1TPC=L1+L1+1
  L1=-L1-1
  DO 20 I1=1, L1TPC
  L1=V1+1
  I1=I1+1
  L1=0
  SUMY=CCC
  SUME=CCC
  DO 15 I2=1, NSPH
  DO 15 I2=1, LM
  L2TPC=L2+L2+1
  L2=-L2-1
  DO 15 I2=1, L2TPC
  L2=L2+1
  L2=I2+1
  AE=AE(I2)
  AI=AI(I2+LM)
  GI=GIP(L1, I1, I2, L2, V2)
  GL=GLP(L1, I1, I2, L2, V2)
  SUMY=SUMY+AM*GI+AE*GL
10  SUME=SUME+AM*GL+AE*GI
  AMYC(I1)=SUMY
20  AEMC(I1)=SUME
  IF (VCUTA.EQ.CC) GO TO 27
  DO 20 I=1, NLMY
  AM=ORCAL(AMNC(I))
  AI=ORCAL(AMNC(I))
  AER=ORCAL(AEMC(I))
  AEI=ORCAL(AEMC(I))
  IF (DABS(AM).LT.VCUTA) AM=CC
  IF (DABS(AI).LT.VCUTA) AI=CC
  IF (DABS(AER).LT.VCUTA) AER=CC
  IF (DABS(AEI).LT.VCUTA) AEI=CC
  AMYC(I)=COMPLEX(AM, AI)
20  AEMC(I)=COMPLEX(AER, AEI)
27  SUMY=CCC
  SUME=CCC
  CFDET=CCC
  DO 30 I=1, NLMY
  AM=AMNC(I)
  AE=AEMC(I)
  GI=ORCAL(AM)
  GL=CCC*GL(AE)
  SUMY=SUMY+GI*AM+GL*AE
  CFDET=CFDET+CCCNJG((A(I, JSA)))*(AM-IHELP*AE)
30  SUME=SUME+CCCNJG((A(I, ISA)))*(AM+IHELP*AE)
  SCASEC=CK*ORCAL(SUMY)
  TOTSEC=-CK*ORCAL(SUME)
  ABSSEC=TOTSEC-SCASEC
  SAC(ISA, ISA)=SUME*CCCN
  SAC(JSA, ISA)=CFDET*CCCN
  RETURN
END

```

[illegible]

```

      WRITE (14,500) IAK=
      WRITE (14,500) IUL,MAXIT,CI
140  ILE=-1
      DO 141 K=1,NB14
145  A(I)=247(K)
      IF (VCOT(K).GT.0) GO TO 177
147  DO 148 I=1,NB14
      DO 149 J=1,NB14
      A(I)=0.0
      A(I)=0.0
      IF (ABS(A(I)).GT.VCOT(I)) A(I)=0
      IF (ABS(A(I)).GT.VCOT(I)) A(I)=0
149  A(I)=0.0
      GO TO 177
150  DO 151 K=1,NB14
155  A(I)=A(I)+0.01+A(I)+0.01
17  IF (VCOT(K).GT.0) GO TO 175
      DO 171 I=1,NB14
      A(I)=0.0
      A(I)=0.0
      IF (ABS(A(I)).GT.VCOT(I)) A(I)=0
      IF (ABS(A(I)).GT.VCOT(I)) A(I)=0
171  A(I)=0.0
175  DO 176 I=1,NB14
      A(I)=0.0
      DO 177 J=1,NB14
180  DEL=0.0
      IF (VCOT(K).GT.0) GO TO 190
      DEL=0.0
      IF (ABS(DEL).GT.VCOT(K)) DEL=0
      IF (ABS(DEL).GT.VCOT(K)) DEL=0
      DEL=0.0
190  A(I)=0.0
      A(I)=0.0+1
      IF (VCOT(K).GT.0) GO TO 200
      CALL CS1(VK,INTER,SCASEC,VCOT,VCOT)
      SC=1.0
      IF (VCOT(K).GT.0) GO TO 150
      A(I)=0.0/3.14-1.30
      IF (VCOT(K).GT.0) GO TO 150
      IF (VCOT(K).GT.0) GO TO 150
      IF (VCOT(K).GT.0) GO TO 150
      IF (VCOT(K).GT.0) GO TO 150
200  IF (VCOT(K).GT.0) GO TO 200
      DO 201 I=1,NB14
      A(I)=0.0
      DO 202 J=1,NB14
205  A(I)=0.0
210  A(I)=0.0
      CALL CS1(VK,INTER,SCASEC,VCOT,VCOT)
220  WRITE (14,500) IAK=
      IF (VCOT(K).GT.0) GO TO 230
      IF (VCOT(K).GT.0) GO TO 230
230  JIA=1
      DO 231 J=JIA,320
      DO 232 I=1,NB14
      IF (VCOT(K).GT.0) GO TO 270
270  A(I)=0.0
      DO 271 I=1,NB14
      IF (VCOT(K).GT.0) GO TO 270
275  A(I)=0.0
280  A(I)=0.0
285  WRITE (14,500)
      IF (VCOT(K).GT.0) GO TO 290
      IF (VCOT(K).GT.0) GO TO 290
290  A(I)=0.0
      IF (VCOT(K).GT.0) GO TO 300
      IF (VCOT(K).GT.0) GO TO 300
300  A(I)=0.0
      IF (VCOT(K).GT.0) GO TO 310
      IF (VCOT(K).GT.0) GO TO 310
310  A(I)=0.0
320  WRITE (14,500) (S(I),I=1,NB14)
      IF (VCOT(K).GT.0) GO TO 330

```


CARD 13 (2E20.8)

CI Mixing factor for the iterative inversion of the T-matrix. The value CI=0.5 ensures good convergence.

TOL Tolerance of the inverted T-matrix. In practice $T^*T^{-1} \leq TOL$.

 These quantities need be specified only when INVER=0.

CARD 14

VCUTM The elements of the T-matrix with magnitude smaller than this parameter are set to zero.

VCUTA The multipolar amplitudes of the scattered wave smaller than this value are set to zero.

VCUTN The multipolar amplitudes of the incident plane wave smaller than this value are set to zero.

The three quantities above are usually set to 1.0E-36, a value that prevents the occurrence of program interrupts due to underflow.

MAXIT Number of the iterations if the T-matrix is to be
 inverted iteratively.
 NFAC Maximum value of the factorials to be used in the nor-
 malization factors.
 JCK }
 JCL } Dimension of the vector of the Bessel functions.
CARD 7 (3E20.8) (NSPH card)
 RXX(1) }
 RYY(1) } Cartesian coordinates of the centre of the l-th sphere
 RZZ(1) } in the cluster.
CARD 8 (4012)
 IOG(1) This index specifies the type of the l-th sphere in
 the cluster. If IOG(l+1)=IOG(l) the program does not
 recalculate the T-matrices for the l+1-th sphere but
 assume they are identical to those of the l-th sphere.
CARD 9 (3E20.8)
 ROS(1) Radius of the l-th sphere.
CARD 10 (2E20.8) (NSPH card)
 CRI(1) Complex refractive index of the l-th sphere.
CARD 11 (E20.8, 2F10.4)
 VK Magnitude of the wavevector of the incident wave
 THK }
 PHK } Polar angles (in Degrees) of the incident wavevector.
CARD 12 (315)
 INVER 0 the T-matrix is inverted iteratively.
 1 the T-matrix is inverted by LU factorization.
 MODE 0, 1, 2, 3. This parameter provides the equilibration
 of the T-matrix in four different modes. The value
 MODE=3 has proved to be the most suitable for dielec-
 tric clusters far from resonance.
 NDDMST Maximum dimension of the T-matrix. must be equal to
 the dimension of the matrix AM.

PRG2 and PRG3

These programs were written at the CRDC by F. Borghese, P. Denti and R. Saija in order to handle relatively big clusters (see Table 1), even at the cost of increasing the CPU time. PRG3 differs from PRG2 in that it does not require the storage of the Clebsch-Gordan coefficients.

INPUT DESCRIPTION

Refer to DATASET TEST001.

CARD 1 (3A4)

IDATA JDATA KDATA	}	These quantities identify the DATASET. They can be left blank if desired.
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CARD 2 blank

CARD 3 (12)

NCAL Number of the group of data within the DATASET.

CARD 4 (40A4) (2 cards)

NAME This heading identifies the output. Any alphameric character can be used.

CARD 5 (412)

JG0 IWMA IWSS IWCIP	}	These quantities control the input and output operations of PRG2 and PRG3. Their meaning is explained in the comment cards within the programs. Note that if JG0 is put equal to 1 for all groups of data the programs run properly but for that they recompute matrices whose elements have still valid values.
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CARD 6 (812)

NSPH Number of the spheres in the cluster.

LMPO L_M+1

IHELP Helicity of the incident plane wave. Use +1 for right helicity and -1 for left helicity.

IEXP This quantity was originally introduced to control the convergency of the multipolar expansions. Set it to 0.

4.....1.....3.....4.....5.....6.....7.*.....

1

PAGE-

0

END OF COMPILATION IS *****

*.....1.....2.....3.....4.....5.....6.....7.....

```

7+ 20 VYH(IVT)=DCCNUG(YLM(IV))
75   IVY=IVY+LMTPCS
76   ARG=FR*VK
77   CALL RBF(ARG,LMT,JCK,FJ)
78   CALL RNF(ARG,LMT,FN)
79   DO 20 IV=1,LMTPO
80     IVT=IV+IVH3
81 25 VY(IVT)=CCVPLX(FJ(IV),FN(IV))
82   IVH3=IVH3+LMTPO
83 30 CONTINUE
84   IVY=0
85   IVH3=0
86   CC=0.000
87   DO 55 IF=1,NSPH
88     RX=-XXI(IF)
89     RY=-YYI(IF)
90     RZ=-ZZI(IF)
91     IF (RX.EQ.CO.AND.RY.EQ.CO.AND.RZ.EQ.CO) GO TO 50
92     CALL POLAR(RX,RY,RZ,RA,CRTH,SRTH,CRPH,SRPH)
93     CALL SPHAR(CRTH,SRTH,CRPH,SRPH,LMTPO,YLM)
94     DO 40 IV=1,LMTPCS
95       IVT=IV+IVY
96 40 VYJ(IVT)=JCCNUG(YLM(IV))
97   ARG=AR*VK
98   CALL RBF(ARG,LMT,JCK,FJ)
99   DO 45 IV=1,LMTPO
100    IVI=IV+IVH3
101 45 VJ(IVI)=FJ(IV)
102   IVY=IVY+LMTPCS
103 50 IVH3=IVH3+LMTPO
104   RETURN
105   END

```

IN, L1, C1, ADELIS, MAP, NOX, LF, COSTANT, NOSECK, SOURCE, TERM, CUECT, FIA, LINECOUNT(5),
PT(1) LANGEVL(66) NLFINS, FLAG(1) NAME(MAIN) LINECOUNT(5).

8.....1.....2.....3.....4.....5.....6.....7.....

```
1      CALL EX_F01CILL, CH#15(NLL, L1, Y1, L2, Y2)
2      IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
3      C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
4      1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
5      2VS(3)=VH(3), VY(4), VY3(2,2), VY3(2,2),
6      2VS(2)=VH(114), VY(114), VY3(14), VY3(14), S(24), NAME(40), ICS(3)
7      CALL EX_F01CILL, CH#15(NLL, L1, Y1, L2, Y2),
8      1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
9      C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
10     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
11     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
12     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
13     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
14     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
15     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
16     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
17     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
18     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
19     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
20     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
21     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
22     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
23     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
24     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
25     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
26     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
27     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
28     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
29     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
30     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
31     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
32     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
33     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
34     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
35     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
36     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
37     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
38     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
39     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
40     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
41     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
42     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
43     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
44     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
45     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
46     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
47     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
48     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
49     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
50     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
51     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
52     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
53     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
54     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
55     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
56     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
57     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
58     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
59     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
60     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
61     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
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63     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
64     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
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66     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
67     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
68     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
69     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
70     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
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72     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
73     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
74     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
75     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
76     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
77     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
78     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
79     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
80     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
81     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
82     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
83     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
84     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
85     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
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91     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
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93     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
94     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
95     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
96     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
97     1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
98     IF (L1.GT.1) THEN L1=L1-1, C1=C1-1
99     C1=C1/20.0/2.0, XAX(1)=XY(3), XZ(3)=RES(3), CH1(3),
100    1VS(3)=VH(27), VY(243), VJ(27), VY3(243)
```

EFFECT NOLIST MAP NAREF DISTMT NCODECK SOURCE TEFV OBJECT FIELD NAME
 (PTC) (L) (L) (L) (L) (L) (L) (L) (L) (L) (L)

1.....2.....3.....4.....5.....6.....7.....

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1  COMPLEX FUNCTION, OR*10 (REFL, L1, M1, L2, M2)
2  1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40/41/42/43/44/45/46/47/48/49/50/51/52/53/54/55/56/57/58/59/60/61/62/63/64/65/66/67/68/69/70/71/72/73/74/75/76/77/78/79/80/81/82/83/84/85/86/87/88/89/90/91/92/93/94/95/96/97/98/99/100/101/102/103/104/105/106/107/108/109/110/111/112/113/114/115/116/117/118/119/120/121/122/123/124/125/126/127/128/129/130/131/132/133/134/135/136/137/138/139/140/141/142/143/144/145/146/147/148/149/150/151/152/153/154/155/156/157/158/159/160/161/162/163/164/165/166/167/168/169/170/171/172/173/174/175/176/177/178/179/180/181/182/183/184/185/186/187/188/189/190/191/192/193/194/195/196/197/198/199/200/201/202/203/204/205/206/207/208/209/210/211/212/213/214/215/216/217/218/219/220/221/222/223/224/225/226/227/228/229/230/231/232/233/234/235/236/237/238/239/240/241/242/243/244/245/246/247/248/249/250/251/252/253/254/255/256/257/258/259/260/261/262/263/264/265/266/267/268/269/270/271/272/273/274/275/276/277/278/279/280/281/282/283/284/285/286/287/288/289/290/291/292/293/294/295/296/297/298/299/300/301/302/303/304/305/306/307/308/309/310/311/312/313/314/315/316/317/318/319/320/321/322/323/324/325/326/327/328/329/330/331/332/333/334/335/336/337/338/339/340/341/342/343/344/345/346/347/348/349/350/351/352/353/354/355/356/357/358/359/360/361/362/363/364/365/366/367/368/369/370/371/372/373/374/375/376/377/378/379/380/381/382/383/384/385/386/387/388/389/390/391/392/393/394/395/396/397/398/399/400/401/402/403/404/405/406/407/408/409/410/411/412/413/414/415/416/417/418/419/420/421/422/423/424/425/426/427/428/429/430/431/432/433/434/435/436/437/438/439/440/441/442/443/444/445/446/447/448/449/450/451/452/453/454/455/456/457/458/459/460/461/462/463/464/465/466/467/468/469/470/471/472/473/474/475/476/477/478/479/480/481/482/483/484/485/486/487/488/489/490/491/492/493/494/495/496/497/498/499/500/501/502/503/504/505/506/507/508/509/510/511/512/513/514/515/516/517/518/519/520/521/522/523/524/525/526/527/528/529/530/531/532/533/534/535/536/537/538/539/540/541/542/543/544/545/546/547/548/549/550/551/552/553/554/555/556/557/558/559/560/561/562/563/564/565/566/567/568/569/570/571/572/573/574/575/576/577/578/579/580/581/582/583/584/585/586/587/588/589/590/591/592/593/594/595/596/597/598/599/600/601/602/603/604/605/606/607/608/609/610/611/612/613/614/615/616/617/618/619/620/621/622/623/624/625/626/627/628/629/630/631/632/633/634/635/636/637/638/639/640/641/642/643/644/645/646/647/648/649/650/651/652/653/654/655/656/657/658/659/660/661/662/663/664/665/666/667/668/669/670/671/672/673/674/675/676/677/678/679/680/681/682/683/684/685/686/687/688/689/690/691/692/693/694/695/696/697/698/699/700/701/702/703/704/705/706/707/708/709/710/711/712/713/714/715/716/717/718/719/720/721/722/723/724/725/726/727/728/729/730/731/732/733/734/735/736/737/738/739/740/741/742/743/744/745/746/747/748/749/750/751/752/753/754/755/756/757/758/759/760/761/762/763/764/765/766/767/768/769/770/771/772/773/774/775/776/777/778/779/780/781/782/783/784/785/786/787/788/789/790/791/792/793/794/795/796/797/798/799/800/801/802/803/804/805/806/807/808/809/810/811/812/813/814/815/816/817/818/819/820/821/822/823/824/825/826/827/828/829/830/831/832/833/834/835/836/837/838/839/840/841/842/843/844/845/846/847/848/849/850/851/852/853/854/855/856/857/858/859/860/861/862/863/864/865/866/867/868/869/870/871/872/873/874/875/876/877/878/879/880/881/882/883/884/885/886/887/888/889/890/891/892/893/894/895/896/897/898/899/900/901/902/903/904/905/906/907/908/909/910/911/912/913/914/915/916/917/918/919/920/921/922/923/924/925/926/927/928/929/930/931/932/933/934/935/936/937/938/939/940/941/942/943/944/945/946/947/948/949/950/951/952/953/954/955/956/957/958/959/960/961/962/963/964/965/966/967/968/969/970/971/972/973/974/975/976/977/978/979/980/981/982/983/984/985/986/987/988/989/990/991/992/993/994/995/996/997/998/999/1000/1001/1002/1003/1004/1005/1006/1007/1008/1009/1010/1011/1012/1013/1014/1015/1016/1017/1018/1019/1020/1021/1022/1023/1024/1025/1026/1027/1028/1029/1030/1031/1032/1033/1034/1035/1036/1037/1038/1039/1040/1041/1042/1043/1044/1045/1046/1047/1048/1049/1050/1051/1052/1053/1054/1055/1056/1057/1058/1059/1060/1061/1062/1063/1064/1065/1066/1067/1068/1069/1070/1071/1072/1073/1074/1075/1076/1077/1078/1079/1080/1081/1082/1083/1084/1085/1086/1087/1088/1089/1090/1091/1092/1093/1094/1095/1096/1097/1098/1099/1100/1101/1102/1103/1104/1105/1106/1107/1108/1109/1110/1111/1112/1113/1114/1115/1116/1117/1118/1119/1120/1121/1122/1123/1124/1125/1126/1127/1128/1129/1130/1131/1132/1133/1134/1135/1136/1137/1138/1139/1140/1141/1142/1143/1144/1145/1146/1147/1148/1149/1150/1151/1152/1153/1154/1155/1156/1157/1158/1159/1160/1161/1162/1163/1164/1165/1166/1167/1168/1169/1170/1171/1172/1173/1174/1175/1176/1177/1178/1179/1180/1181/1182/1183/1184/1185/1186/1187/1188/1189/1190/1191/1192/1193/1194/1195/1196/1197/1198/1199/1200/1201/1202/1203/1204/1205/1206/1207/1208/1209/1210/1211/1212/1213/1214/1215/1216/1217/1218/1219/1220/1221/12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(MAY 1983)

VS FJ TRAN

DATE 1984 NOV 07

TIME 17 10

REPORT: ALIST, MAP, NCKREF, GOSTIN, NCKDECK, SOURCE, TERN, OBJECT, FIVE, ...
 (1) LAN, LVL(00), KOFIPS, FLAG(1), NAME(MAIN), LI, ECCOUNT(00)

.....1.....2.....3.....4.....5.....6.....7.....

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1  COMPLEX FUNCTION GP#16(X1,L1,Y1,L2,Y2)
2  IMPLICIT REAL*8 (A-H,C-Z)
3  COMMON/VSCH/ XA(2),RYY(3),RZZ(3),FUS(3),C-1(3),
4  VCS(3),C2(3),VU(27),VYH(243),VU(27),VYU(243)
5  2,RH(3),S(4,3),TSAS(2,2),SAC(2,2),
6  SA(24,2),SI(14,4),AF(14,4),FAC(24),ALAL(24),S(24),RAY(14),IGS(3)
7  COMPLEX*8 C-1,VH,VYH,VYU,FM,S*,TSAS,SAC,
8  1,AF,SI,AS,AC,AFAC,S
9  COMMON/1 TO 7/LTPO,LM,LEW,ALW,N,NV,KOIV,KOPH,LTPO,LEI,LYTPO,
10  1,SA,S*,FAS,FAC
11  DATA P14/12.960370614555/
12  C-1=(0.000,0.000)
13  SI=0.0
14  C-1=0.0
15  IF (XA(1).E1.00.AND. RYY(1).EQ.00.AND. RZZ(1).E1.00) GO TO 20
16  L1=L1+1
17  L2=L2+1
18  L3=L3+1
19  L4=L4+1
20  L5=L5+1
21  L6=L6+1
22  L7=L7+1
23  L8=L8+1
24  L9=L9+1
25  L10=L10+1
26  L11=L11+1
27  L12=L12+1
28  L13=L13+1
29  L14=L14+1
30  L15=L15+1
31  L16=L16+1
32  L17=L17+1
33  L18=L18+1
34  L19=L19+1
35  L20=L20+1
36  L21=L21+1
37  L22=L22+1
38  L23=L23+1
39  L24=L24+1
40  L25=L25+1
41  L26=L26+1
42  L27=L27+1
43  L28=L28+1
44  L29=L29+1
45  L30=L30+1
46  L31=L31+1
47  L32=L32+1
48  L33=L33+1
49  L34=L34+1
50  L35=L35+1
51  L36=L36+1
52  L37=L37+1
53  L38=L38+1
54  L39=L39+1
55  L40=L40+1
56  L41=L41+1
57  L42=L42+1
58  L43=L43+1
59  L44=L44+1
60  L45=L45+1
61  L46=L46+1
62  L47=L47+1
63  L48=L48+1
64  L49=L49+1
65  L50=L50+1
66  L51=L51+1
67  L52=L52+1
68  L53=L53+1
69  L54=L54+1
70  L55=L55+1
71  L56=L56+1
72  L57=L57+1
73  L58=L58+1
74  L59=L59+1
75  L60=L60+1
76  L61=L61+1
77  L62=L62+1
78  L63=L63+1
79  L64=L64+1
80  L65=L65+1
81  L66=L66+1
82  L67=L67+1
83  L68=L68+1
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[illegible]

FILE 11-22

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[illegible]

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 07

TIME 17 0 14

OBJECT NAMELIST MAP NAMELEN GDSIM1 MCODEN SOURCE TERM OBJECT FIXED
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```

1  C=PLX*FUNCTION,CLP*1,(L1,M1,N2,L2,M2)
2  I=PLX*1,CLP*2(A-H,C-2)
3  C=PLX*1,CLP*3(A-H,C-2)
4  C=PLX*1,CLP*4(A-H,C-2)
5  C=PLX*1,CLP*5(A-H,C-2)
6  C=PLX*1,CLP*6(A-H,C-2)
7  C=PLX*1,CLP*7(A-H,C-2)
8  C=PLX*1,CLP*8(A-H,C-2)
9  C=PLX*1,CLP*9(A-H,C-2)
10 C=PLX*1,CLP*10(A-H,C-2)
11 C=PLX*1,CLP*11(A-H,C-2)
12 C=PLX*1,CLP*12(A-H,C-2)
13 C=PLX*1,CLP*13(A-H,C-2)
14 C=PLX*1,CLP*14(A-H,C-2)
15 C=PLX*1,CLP*15(A-H,C-2)
16 C=PLX*1,CLP*16(A-H,C-2)
17 C=PLX*1,CLP*17(A-H,C-2)
18 C=PLX*1,CLP*18(A-H,C-2)
19 C=PLX*1,CLP*19(A-H,C-2)
20 C=PLX*1,CLP*20(A-H,C-2)
21 C=PLX*1,CLP*21(A-H,C-2)
22 C=PLX*1,CLP*22(A-H,C-2)
23 C=PLX*1,CLP*23(A-H,C-2)
24 C=PLX*1,CLP*24(A-H,C-2)
25 C=PLX*1,CLP*25(A-H,C-2)
26 C=PLX*1,CLP*26(A-H,C-2)
27 C=PLX*1,CLP*27(A-H,C-2)
28 C=PLX*1,CLP*28(A-H,C-2)
29 C=PLX*1,CLP*29(A-H,C-2)
30 C=PLX*1,CLP*30(A-H,C-2)
31 C=PLX*1,CLP*31(A-H,C-2)
32 C=PLX*1,CLP*32(A-H,C-2)
33 C=PLX*1,CLP*33(A-H,C-2)
34 C=PLX*1,CLP*34(A-H,C-2)
35 C=PLX*1,CLP*35(A-H,C-2)
36 C=PLX*1,CLP*36(A-H,C-2)
37 C=PLX*1,CLP*37(A-H,C-2)
38 C=PLX*1,CLP*38(A-H,C-2)
39 C=PLX*1,CLP*39(A-H,C-2)
40 C=PLX*1,CLP*40(A-H,C-2)
41 C=PLX*1,CLP*41(A-H,C-2)
42 C=PLX*1,CLP*42(A-H,C-2)
43 C=PLX*1,CLP*43(A-H,C-2)
44 C=PLX*1,CLP*44(A-H,C-2)
45 C=PLX*1,CLP*45(A-H,C-2)
46 C=PLX*1,CLP*46(A-H,C-2)
47 C=PLX*1,CLP*47(A-H,C-2)
48 C=PLX*1,CLP*48(A-H,C-2)
49 C=PLX*1,CLP*49(A-H,C-2)
50 C=PLX*1,CLP*50(A-H,C-2)
51 C=PLX*1,CLP*51(A-H,C-2)
52 C=PLX*1,CLP*52(A-H,C-2)
53 C=PLX*1,CLP*53(A-H,C-2)
54 C=PLX*1,CLP*54(A-H,C-2)
55 C=PLX*1,CLP*55(A-H,C-2)
56 C=PLX*1,CLP*56(A-H,C-2)
57 C=PLX*1,CLP*57(A-H,C-2)
58 C=PLX*1,CLP*58(A-H,C-2)
59 C=PLX*1,CLP*59(A-H,C-2)
60 C=PLX*1,CLP*60(A-H,C-2)
61 C=PLX*1,CLP*61(A-H,C-2)
62 C=PLX*1,CLP*62(A-H,C-2)
63 C=PLX*1,CLP*63(A-H,C-2)
64 C=PLX*1,CLP*64(A-H,C-2)
65 C=PLX*1,CLP*65(A-H,C-2)
66 C=PLX*1,CLP*66(A-H,C-2)
67 C=PLX*1,CLP*67(A-H,C-2)
68 C=PLX*1,CLP*68(A-H,C-2)
69 C=PLX*1,CLP*69(A-H,C-2)
70 C=PLX*1,CLP*70(A-H,C-2)
71 C=PLX*1,CLP*71(A-H,C-2)
72 C=PLX*1,CLP*72(A-H,C-2)
73 C=PLX*1,CLP*73(A-H,C-2)
74 C=PLX*1,CLP*74(A-H,C-2)
75 C=PLX*1,CLP*75(A-H,C-2)
76 C=PLX*1,CLP*76(A-H,C-2)
77 C=PLX*1,CLP*77(A-H,C-2)
78 C=PLX*1,CLP*78(A-H,C-2)
79 C=PLX*1,CLP*79(A-H,C-2)
80 C=PLX*1,CLP*80(A-H,C-2)
81 C=PLX*1,CLP*81(A-H,C-2)
82 C=PLX*1,CLP*82(A-H,C-2)
83 C=PLX*1,CLP*83(A-H,C-2)
84 C=PLX*1,CLP*84(A-H,C-2)
85 C=PLX*1,CLP*85(A-H,C-2)
86 C=PLX*1,CLP*86(A-H,C-2)
87 C=PLX*1,CLP*87(A-H,C-2)
88 C=PLX*1,CLP*88(A-H,C-2)
89 C=PLX*1,CLP*89(A-H,C-2)
90 C=PLX*1,CLP*90(A-H,C-2)
91 C=PLX*1,CLP*91(A-H,C-2)
92 C=PLX*1,CLP*92(A-H,C-2)
93 C=PLX*1,CLP*93(A-H,C-2)
94 C=PLX*1,CLP*94(A-H,C-2)
95 C=PLX*1,CLP*95(A-H,C-2)
96 C=PLX*1,CLP*96(A-H,C-2)
97 C=PLX*1,CLP*97(A-H,C-2)
98 C=PLX*1,CLP*98(A-H,C-2)
99 C=PLX*1,CLP*99(A-H,C-2)
100 C=PLX*1,CLP*100(A-H,C-2)

```

(MAY 1963)

VS FORTRAN

DATE 1964 NOV 07

TIME 17 16

OBJECT LIST MAP DECKE SUBMIT NODECK SOURCE TERM OBJECT FIXED
OPT(7) LAUSIVE(20) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(35)

.....1.....2.....3.....4.....5.....6.....7....

10 CONTINUE NOC(N1,N2,N)

11 IF(1.01.12) GO TO 20

12 N1=N1

13 N2=N2

14 N3=N3

15 IF(N1) GO TO 17

16 N1=N1

17 N2=N2

18 N3=N3

19 IF(N1) GO TO 21

20 N1=N1

21 N2=N2

22 IF(1.01.12) GO TO 20

23 N1=N1

24 N2=N2

25 N3=N3

26 IF(1.01.12) GO TO 20

27 N1=N1

28 N2=N2

29 N3=N3

30 N1=N1

AY 1983)

VS FORTRAN

DATE 1984 NOV 07

TIME 17 56 17

ECR RELIST MAP NOREF GUSTMT NOJECK SOURCE TERM OBJECT FIXED NCT
OPT(0) LANGLEV(6) NCFIPS FLAG(1) NAME(MAIN) LINECOUNT(55)

*.....1.....2.....3.....4.....5.....6.....7.4....

```
FUNCTION IND(L1,L2,L3,M1,M2,M3)  
COMMON/INDC/CM,LM,NLM,LL,M,N,NDIM,NSPH,LMTPC,LMT,LMTPLS,  
1,NM,NMA,NVAC,NXX  
N1=L1+(L1+1)+M1+1  
N2=L1+(L2+1)+M2+1  
N3=L1+(L3+1)+M3+1  
IND=N1+((N2-N1)*L2+N3-N1)*NXX  
END
```


AY 1983)

VS FLKTRAN

DATE 1984 NOV 07

TIME 17

18

1.....2.....3.....4.....5.....6.....7.....

S404 =FACIO (JJ4)

S404 =FACIO (JJ5)*FACIO (JJ6)*FACIO (JJ7)

1*FACIO (JJ8)*FACIO (JJ9)*FACIO (JJ10)

S404 +=S404 1*S404 5/S404 2

CL04=SC 405,AT(C,CA 4)

10

11

12

7 1983)

VS FORTAN

DATE 1984 NOV 07

TIME 17

20

BT ANALYST MAP PEOPLE SUSINT NOLOCK SOURCE TERM OBJECT FILE NO
 OPT(0) LANGUAGE(00) ACPIPS FLAG(1) NAME(MAIN) LINECOUNT(15)

.....1.....2.....3.....4.....5.....6.....7.....

```

      SUM=0
      IF (X,N,JOK,FJ)
      1  P=1.0E-06*(A-F,C-2)
      2  DIMENSION FU(100)
      3  I=JOK
      4  IF (X-1.0E-06) 7,11,11
      5  FU(I)=P
      6  I=I+1
      7  IF (I-100) 7,11,11
      8  IF (I-100) 7,11,11
      9  IF (I-100) 7,11,11
      10 IF (I-100) 7,11,11
      11 IF (I-100) 7,11,11
      12 IF (I-100) 7,11,11
      13 IF (I-100) 7,11,11
      14 IF (I-100) 7,11,11
      15 IF (I-100) 7,11,11
      16 IF (I-100) 7,11,11
      17 IF (I-100) 7,11,11
      18 IF (I-100) 7,11,11
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      88 IF (I-100) 7,11,11
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      92 IF (I-100) 7,11,11
      93 IF (I-100) 7,11,11
      94 IF (I-100) 7,11,11
      95 IF (I-100) 7,11,11
      96 IF (I-100) 7,11,11
      97 IF (I-100) 7,11,11
      98 IF (I-100) 7,11,11
      99 IF (I-100) 7,11,11
      100 IF (I-100) 7,11,11
  
```

TIME 17 . 23

.....1.....2.....3.....4.....5.....6.....7.....8.....

[illegible]

TIME 17 00 21

..... 8 9 10 11 12 13 14 15 16 17 18

[illegible]

1) VS FORTRAN DATE 1984 NOV 03 TIME 10 00 48

CLIST MAP NOXREF GCSTMT NODECK SOURCE TERM OBJECT FIXED NOTE
OPT(0) LANGLV(66) NCFIPS FLAG(1) NAME(MAIN) LINECCNT(85)

.....1.....2.....3.....4.....5.....6.....7.*.....

```
SUBROUTINE WLM  
  I(KHELP,TH,PH,LVPC)  
  IMPLICIT REAL*8(A-H,C-Z)  
  DIMENSION YLM(26)  
  COMMON/DC10/ RXX(3),YY(3),RZZ(3),RCS(3),CRI(3),  
  LVH(27),VYH(243),VJ(27),VYJ(243)  
  DATA A(4,3),S(4,3),TSAS(2,2),SAC(2,2),  
  A(24,2),AI(144),AF(144),AMMO(24),S(24),NAME(40),IUG(3)  
  COMPLEX*16 CRI,VH,VYH,VYJ,RV,SM,TSAS,SAC,  
  A,AI,AF,AVHO,AEVC,S  
  COMMON/DC15/FACIT(40),FACRM(45)  
  COMPLEX*16 YLM,AP,AM,AZ,CL  
  DATA PI/ 12.566370614356/  
  LVPC=LVPC+1  
  YLM(LVPC)=(0.000,0.000)  
  IHELP=1  
  IF(KHELP.EQ.2) IHELP=-1  
  P=-IHELP  
  COST=CCOS(TH)  
  SINT=CSIN(TH)  
  COSP=CCOS(PH)  
  SINT=CSIN(PH)  
  CALL SPHAR(COST,SINT,COSP,SINT,LVPC,YLM)  
  ALPH1=-COST*CCSP  
  BETA1=-COST*SINT  
  GAM1=SINT  
  ALPH2=-SINT  
  BETA2=-CCSP  
  GAM2=COSP  
  AP=.5*(DC4PLX(ALPH1,P*ALPH2)+DC4PLX(BETA1,P*BETA2)*(0.000,1.000))  
  A1=.5*(DC4PLX(ALPH1,P*ALPH2)-DC4PLX(BETA1,P*BETA2)*(0.000,1.000))  
  AZ=DC4PLX(GAM1,P*GAM2)  
  DC10/CF=2,LVPC  
  L=CF-1  
  LFTL=L*L  
  X=LFTL  
  X=X*(0.000,1.000)+*L/OSQRT(X)  
  X=L+LX  
  X=X  
  IF=1,VV  
  X=X+1  
  X=LFTL+X  
  X=LFTL-X*(X+1)  
  X=OSQRT(X)  
  X=LFTL-X*(X-1)  
  X=OSQRT(X)  
  X=X  
  YLM(K,KHELP)=DC4JG(AI*LVPC*YLM(K+2)+AP*CM*YLM(K)+AZ*GZ*YLM(K+1))*CL  
  RETURN  
END
```



```

083)          VS FORTRAN          DATE  1984 NOV 08          TIME  10 00 42
NGLIST  MAP NOXREF  GUSTMT NODECK  SOURCE  TERM  OBJECT FIXED  NOTE
OPT(0)  LANGVLVL(66) NOFIPS  FLAG(1)  NAME(MAIN )  LINECOUNT(85)
..*....1.....2.....3.....4.....5.....6.....7.*....

```

```

SUBROUTINE SMAT
  IMPLICIT REAL*8(A-H,C-Z)
  COMMON/SSVS/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
  1VH(27),VYH(243),VJ(27),VYJ(243)
  2,PA(4,3),SM(4,3),TSAS(2,2),SAC(2,2),
  3AL(24,2),AL(144),AF(144),AMVO(24),AEMO(24),S(24),NAME(40),IDG(3)
  4COMPLEX*16 CH1,VH,VYH,VYJ,AM,SM,TSAS,SAC,
  1A,AL,AF,AMVO,AEMO,S
  2CZCZ/CC15/A*(144,144),bV(144),V(144)
  3COMPLEX*16 AV,BV
  4COMMON/INTCC/LMPC,LV,NLV,NLMM,N,NM,NDIM,NSPH,LMTPC,LMT,LMTPCS,
  1SSVS,NX,NXS,NMAM
  2COMPLEX*16 GH,GK,SSVSP,SSESP,CCO,CGH,CGK
  3CCO=(0.000,0.000)
  4I1=0
  5DO 30 N1=1,NSPH
  6DO 30 L1=1,LV
  7SSISP=X1(L1,N1)
  8SSESP=S4(L1,N1)
  9L1TPC=L1+L1+1
  10M1=-L1-1
  11DO 30 M1=1,L1TPC
  12V1=V1+1
  13I1=I1+1
  14I2=0
  15DO 20 N2=1,NSPH
  16AF(12,N2,N1) DO TO 20
  17DO 10 J=1,NLV
  18I2=I2+1
  19AV(I1,I2)=CCO
  20AV(I1,I2+1)=CCO
  21AV(I1+N2,I2)=CCO
  22AV(I1+N2,I2+N2)=CCO
  23DO TO 20
  24N1L=CCO(N1,N2,NSPH)
  25DO 27 L2=1,LV
  26L2TPC=L2+L2+1
  27M2=-L2-1
  28DO 27 M2=1,L2TPC
  29I2=I2+1
  30I2=I2+1
  31C1=0.0,AL,L1,M1,L2,M2)
  32C2=0.0,AL,L1,M1,L2,M2)
  33AV(I1,I2)=C1H*SSVSP
  34AV(I1,I2+1)=C2H*SSVSP
  35AV(I1+N2,I2)=C1H*SSESP
  36AV(I1+N2,I2+N2)=C2H*SSESP
  37DO 27 I1=1,NSPH
  38CONTINUE
  39CONTINUE
  40RETURN
  41END

```

1953)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 00 39

NOLIST MAP NCXREF GOSTMT NCDECK SOURCE TERM OBJECT FIXED NOTE
 CPT(0) LANGLVL(66) NCIFPS FLAG(1) NAME(MAIN) LINECOUNT(85)

....*....1.....2.....3.....4.....5.....6.....7.*.....

```

SUBROUTINE CROSSE
1(VK, IHLP,
2SCASEC, ABSSEC, TOTSEC, VCUTA)
  IMPLICIT REAL*8(A-H, O-Z)
  COMMON/JO40/ RXX(3), RYY(3), RZZ(3), RCS(3), CRI(3),
  1VH(27), VYH(243), VJ(27), VYJ(2+3)
  2, R4(4,3), S4(4,3), TSAS(2,2), SAC(2,2),
  3, L(24,2), AI(144), AF(144), AMX(24), AEM(24), S(24), NAME(40), ICG(3)
  COMPLEX*16 CRI, VH, VYH, VYJ, RM, SM, TSAS, SAC,
  1W, AI, AF, AMX, AEM, S
  COMMON/INTCCV/LMPL, LM, NLY, NLMV, N, NM, NDIN, NSPH, LMTPC, LMT, LMTPCS,
  1NS*0, NMX, NMXS, NMXV
  COMPLEX*16 GIP, GLP, AM, AE, GI, GL, SUM4, SUME, CCO, CCCN, OFDET
  CC=0.000
  CC=(0.000, 0.000)
  CK=.5/(VK*VK)
  CCON=-(0.000, 1.000)*(.5*CK/VK)
  IF(IHLP.EQ.-1) GO TO 10
  ISA=1
  JSA=2
  GO TO 12
10 ISA=2
  JSA=1
12 I1=0
  DO 20 L1=1, LM
    L1TPC=L1+L1+1
    I1=-L1-1
    DO 20 I1=1, L1TPC
      I1=I1+1
      I2=0
      DO 15 A=CCO
        DO 15 A=CCO
        DO 15 L2=1, NSPH
          DO 15 L2=1, LM
            L2TPC=L2+L2+1
            I2=-L2-1
            DO 15 I2=1, L2TPC
              I2=I2+1
              I2=I2+1
              A1=AF(I2)
              A2=AF(I2+NLY)
              G1=GIP(L1, I1, A2, L2, V2)
              G2=GLP(L1, I1, A2, L2, V2)
              SUMV=SUMV+AM*G1+AE*G2
              SUME=SUME+AM*G2+AE*G1
              A1*(I1)=SUMV
              A2*(I1)=SUME
              IF(VCUTA.EQ.CC) GO TO 27
              DO 25 I=1, NLMV
                A1=UREAL(AMX(I))
                A2=DIAG(AMX(I))
                A1=UREAL(AEM(I))
                A2=DIAG(AEM(I))
                IF(DABS(A1).LT.VCUTA) A1=CC
                IF(DABS(A2).LT.VCUTA) A2=CC
                IF(DABS(A1).LT.VCUTA) A1=CC
                IF(DABS(A2).LT.VCUTA) A2=CC
                A1*(I)=COMPLEX(A1, A2)
                A2*(I)=COMPLEX(A2, A1)
              25 SUMV=CCO
              27 SUME=CCO
              SUME=CCO
              OFDET=CCO
              DO 30 I=1, NLMV
                A1=AMX(I)
                A2=AEM(I)
                G1=CCCNJG(AM)
                G2=CCCNJG(AE)
                SUM4=SUM4+G1*AM+G2*AE
                OFDET=OFDET+CCCNJG(A1, JSA))**(A2-IHLP*AE)
              30 SUME=SUM4+CCCNJG(A1, JSA))**(A2+IHLP*AE)
              SCASEC=CK*OREAL(SUMV)
              TOTSEC=-CK*OREAL(SUME)
              ABSSEC=ABSSEC-SCASEC
              SAC(ISA, ISA)=SUME*CCCN
              SAC(JSA, ISA)=OFDET+CCCN

```

AT NE. - DTSJIL ICCF LIBRARY FILE MAINTENANC

5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...80

```

IF (JIN.EQ.1) GO TO 335
SC=330 I=1,NLMM
S(I)=MEMO(I)
SC TO 235
SC=340 I=1,NLMM
II=I+IN
S(I)=IF(II+NM)
SC TO 235
IN=IN+NLMM
WRITE (IA,6300)
IF (JIN.EQ.1) GO TO 370
JIN=1000
SC TO 160
SC=AT=SCASEC/SCS
IF (JIN.EQ.1) GO TO 330
ABSEAT=1.000
SC TO 385
ABSEAT=ABSSEC/ACS
I=I-AT=TI SEC/TCS
TSC=SCASEC/SCS
ALSC=ABSSEC/SCS
STCT=TI SEC/TCS
IF (JIN.EQ.1) TSAS(ISA,ISA)=TSAC(JSA,JSA)
REFIN=CKEAL(SAC(ISA,ISA))/CKEAL(TSAS(ISA,ISA))
DIANG=(DIANG(SAC(ISA,ISA))/DIANG(TSAS(ISA,ISA)))
WRITE (IA,6100) SCASEC,ABSSEC,TI SEC
WRITE (IA,6300) SC=AT,ABSEAT,STCT
WRITE (IA,6400) ISA,ISA,ABS,TCI
WRITE (IA,6700) ISA,ISA,SAC(ISA,ISA),JSA,ISA,SAC(JSA,ISA)
WRITE (IA,6800) ISA,ISA,REFIN,ISA,ISA,ABSCTX
IF (JIN.EQ.1) GO TO 300
IF (REF=(CKEAL(SAC(JSA,JSA))-CKEAL(SAC(ISA,ISA)))/CKEAL(SAC(JSA,JSA)
1))
DIANG=(DIANG(SAC(JSA,JSA))-DIANG(SAC(ISA,ISA)))/DIANG(SAC(JSA,JSA
1))
WRITE (IA,6900) JSA,ISA,REFIN,JSA,ISA,ABSCTX
END

```

RT NO. - DTSUTIL ICCF LIBRARY FILE MAINTENANC
 5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...80

```

3  ITER=-1
4  DO 140 K=1,NDIM
5  AI(K)=SV(K)
6  IF(VOUTA.EQ.CO) GO TO 170
7  DO 140 I=1,NDIM
8  DO 140 J=1,NDIM
9  DET=DETERM(AL(AI(I,J)))
10 AII=DETERM(AI(I,J))
11 IF(ABS(AII).LT.VCUTM) AII=CO
12 IF(ABS(AII).LT.VCUTM) AII=CC
13 A(I,J)=COMPLX(AVR,AII)
14 GO TO 170
15 DO 140 K=1,NDIM
16 AI(K)=AI(K)*CI+AF(K)*CF
17 IF(VOUTA.EQ.CO) GO TO 173
18 DO 172 I=1,NDIM
19 AII=DETERM(AI(I))
20 AII=DETERM(AI(I))
21 IF(ABS(AII).LT.VCUTM) AII=CO
22 IF(ABS(AII).LT.VCUTM) AII=CC
23 A(I)=COMPLX(AIR,AII)
24 DO 172 I=1,NDIM
25 DET=DET*AI(I)
26 DO 172 J=1,NDIM
27 DET=DET-34(I,J)*AI(J)
28 IF(VOUTA.EQ.CO) GO TO 190
29 AII=DETERM(DET)
30 AII=DETERM(DET)
31 IF(ABS(AII).LT.VCUTM) AII=CO
32 IF(ABS(AII).LT.VCUTM) AII=CC
33 DET=COMPLX(DETR,AII)
34 A(I)=DET
35 ITER=ITER+1
36 IF(ITER.EQ.10) GO TO 150
37 CALL CUSSE(VK,INELP,SCASEC,VCSSEC,ETSEC,VOUTA)
38 VC=VCSSEC
39 IF(ITER.EQ.1) GO TO 150
40 DELTA=VSEC/SEC-1.0
41 IF(ABS(DELTA).LT.VCUTM) GO TO 150
42 IF(ABS(DELTA).LT.VCUTM) GO TO 150
43 IF(ITER.EQ.1) GO TO 150
44 IF(ITER.EQ.1) CALL SWAT
45 IF(ITER.EQ.1) GO TO 150
46 CALL CUSSE(VK,INELP,SCASEC,VCSSEC,ETSEC,VOUTA)
47 NAME=VOUTA
48 IF(ITER.EQ.1) GO TO 150
49 IF(ITER.EQ.1) GO TO 150
50 IF(ITER.EQ.1) GO TO 150
51 IF(ITER.EQ.1) GO TO 150
52 IF(ITER.EQ.1) GO TO 150
53 IF(ITER.EQ.1) GO TO 150
54 IF(ITER.EQ.1) GO TO 150
55 IF(ITER.EQ.1) GO TO 150
56 IF(ITER.EQ.1) GO TO 150
57 IF(ITER.EQ.1) GO TO 150
58 IF(ITER.EQ.1) GO TO 150
59 IF(ITER.EQ.1) GO TO 150
60 IF(ITER.EQ.1) GO TO 150
61 IF(ITER.EQ.1) GO TO 150
62 IF(ITER.EQ.1) GO TO 150
63 IF(ITER.EQ.1) GO TO 150
64 IF(ITER.EQ.1) GO TO 150
65 IF(ITER.EQ.1) GO TO 150
66 IF(ITER.EQ.1) GO TO 150
67 IF(ITER.EQ.1) GO TO 150
68 IF(ITER.EQ.1) GO TO 150
69 IF(ITER.EQ.1) GO TO 150
70 IF(ITER.EQ.1) GO TO 150
71 IF(ITER.EQ.1) GO TO 150
72 IF(ITER.EQ.1) GO TO 150
73 IF(ITER.EQ.1) GO TO 150
74 IF(ITER.EQ.1) GO TO 150
75 IF(ITER.EQ.1) GO TO 150
76 IF(ITER.EQ.1) GO TO 150
77 IF(ITER.EQ.1) GO TO 150
78 IF(ITER.EQ.1) GO TO 150
79 IF(ITER.EQ.1) GO TO 150
80 IF(ITER.EQ.1) GO TO 150

```


0 (MAY 1983)

VS FORTRAN

DATE 1984 NOV 07

TIME 17

34

W EFFECT WLIST MAP MAXREF CDSINT CDECK SOURCE TEAM CDSCT FIAF
CPI(0) LARGLEV(66) CDEIPS FLAC(1) NAME(MAIN) LINECOUNT(66)

#.....*.....1.....2.....3.....4.....5.....6.....7.*..

```
1      COMPLEX FUNCTION CDSCT*10(Z,A,B,N,ISTEP)
2      COMPLEX A*10 Z,A(1),B(1)
3      CDSCT=Z
4      IF (N) 4,1,2
5      2  J=1,N
6      3  CDSCT=CDSCT+A*(1+(J-1)*ISTEP)*B(J)
7      RETURN
8      END
```

10.0 (MAY 1953)

VS FLATFAN

DATE 1984 NOV 07

TIME 17 31

*.....1.....2.....3.....4.....5.....6.....7.....

```

75  AM(1,KOOL)=CTEMP
80  CONTINUE
81  4300  CONTINUE
82  5100  IF(I)=1
83  5200  RETURN
84  5300  IF(VCOI,1,0.0) RETURN
85  5400  CO=(0.0,0.0)
86  5500  I=1
87  5600  I=1,N
88  5700  J=1,N
89  5800  CO=CO+(1,J)
90  5900  AM=AM+L(CO)
91  6000  AM=AM+L(CO)
92  6100  IF(AM,1,0.0) GO TO 6200
93  6200  IF(AM,1,0.0) GO TO 6250
94  6300  CO=CO
95  6400  I=I+1
96  6500  IF(AM,1,0.0) GO TO 6250
97  6600  AM=AM
98  6700  I=I+1
99  6800  AM(1,0)=CO*CO*(AM,AM)
100  6900  CONTINUE
101  7000  RETURN
102  7100  END

```

TIME 17 3 31

.....1.....2.....3.....4.....5.....6.....7,8.....9

[illegible]

.....1.....2.....3.....4.....5.....6.....7.....

```

70 PLMNS(J)=(B*X*PLMNS(K)-C*PLMNS(M))/A
71 IF (L-LV) 30, 31, 31
30 L=L+1
31 T=29
32 L=3
33 J=(L*(L+1))/L+2
34 A=L-1
35 B=L*L-1
36 J=L
37 A=J-1
38 J=J+1
39 PLMNS(J)=(L*X*PLMNS(K)-B*PLMNS(M))/A
40 IF (L-LV) 30, 31, 31
41 L=L+1
42 T=2
43 L=2
44 J=1
45 A=L*(L+1)/L+1
46 J=L+L+M+1
47 A=J-1
48 B=L-1
49 T=2
50 A=(2.0D+L*A+K)/Y
51 B=(L+L)*(L+M+1)
52 PLMNS(J)=A*PLMNS(K)-B*PLMNS(M)
53 IF (L-LV) 37, 38, 38
54 L=L+1
55 T=30
56 IF (L-LV) 30, 40, 40
57 L=L+1
58 T=30
59 J=1
60 J=L
61 J=L
62 J=L
63 J=L
64 J=L
65 J=L
66 J=L
67 J=L
68 J=L
69 J=L
70 J=L
71 J=L
72 J=L
73 J=L
74 J=L
75 J=L
76 J=L
77 J=L
78 J=L
79 J=L
80 J=L
81 J=L
82 J=L
83 J=L
84 J=L
85 J=L
86 J=L
87 J=L
88 J=L
89 J=L
90 J=L
91 J=L
92 J=L
93 J=L
94 J=L
95 J=L
96 J=L
97 J=L
98 J=L
99 J=L
100 J=L

```

OBJECT	COLIST	2ND NAME	POSTAL CODE	SOURCE	TERM	OBJECT FIXED
	PT(1)	LANGUEVE(40)	NO IPS	FLAG(1)	NAME(MAIN)	LIRECOUNT(55)

03 (MAY 1983)

VS FORTAN

DATE 1984 NOV 07

TIME 17 25

EFFECT K LIST MAP NOXREF JUSTVT NODECK SOURCE TERM OBJECT FILE
LPT10) LANGEV(00) AFFIPS FLAS(1) NAME(2A1K) LINECOUNT(5)

.....*.....1.....2.....3.....4.....5.....6.....7.*.....

SUSP. CITE POLAR(X,Y,Z,P,CTH,STH,CPH,SPH)

EXPLICIT FIAL*2(A-P,C-2)

CH = A*Y + Y*Y

IF (P1.01.0.000) GO TO 10

CPH = 1.000

STH = 1.000

CTH = 0.000

IF (C1.01.0.000) GO TO 10

CTH = 1.000

STH = 1.000

CTH = 1.000

10 C = 2.000

CTH = 1.000

STH = 1.000

CTH = 1.000

10 CTH = 2.000

STH = 1.000

CTH = 1.000

STH = 1.000

CTH = 1.000

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 00 51

EFFECT NOLIST MAP NOXREF GOSTMT NODECK SOURCE TERM OBJECT FIXED NOTE
 OPT(0) LONGLVL(66) NCFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

.....1.....2.....3.....4.....5.....6.....7......

```

1  SUBROUTINE RSM
2    (LMPC,NGRMX,VK,JCL)
3    IMPLICIT REAL*8(A-H,C-Z)
4    COMMON/DUMC/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
5    VVH(27),VYH(243),VJ(27),VYJ(243)
6    2,R1(4,3),SM(4,3),TSAS(2,2),SAC(2,2),
7    3,(24,2),AI(144),AF(144),AVMC(24),AEAC(24),S(24),NAME(40),IOG(3)
8    COMPLEX*16 CRI,VH,VYH,VYJ,KV,SM,TSAS,SAC,
9    1A,AI,AF,AVMC,AEAC,S
10   DIMENSION
11   IOFU(100),FN(7),FU(100)
12   COMPLEX*16 CFU,CRII,VKN,DCFU,A,B,C,D
13   LM=LMPC-1
14   LMPT=LMPC+1
15   DO 20 I=1,NGRMX
16     IOGI=IOG(I)+1
17     IF(IOGI.GT.1) GO TO 6
18     IOGI=IOGI-1
19     DO 5 L=1,LM
20       RXX(L,I)=KV(L,IOGI)
21       SM(L,I)=SM(L,IOGI)
22     GO TO 20
23   VKR=VK*RCS(I)
24   CRII=CRI(I)
25   VAI=VKR*CRII
26   CRII=CRII*CRII
27   IF(DIMAG(VKN).EQ.0.000) GO TO 7
28   CALL CSF(VKN,LMPC,JCL,CFU,IIR)
29   IF(IIR.EQ.0) STOP
30   GO TO 9
31   7 VKN=UREAL(VKN)
32   CALL RBF(VKN,LMPC,JCL,FU,IIR)
33   IF(IIR.EQ.1) STOP
34   DO 3 J=1,2*PT
35     CFU(J)=FU(J)
36   CALL RBF(VKR,LMPC,JCL,FU,IIR)
37   IF(IIR.EQ.1) STOP
38   CALL RNF(VKR,LMPC,FN)
39   DO 20 LO=2,LMPC
40     L=LO-1
41     L=LO+L
42     LCP=LO+1
43     CFU=(L*FN(L)-LO*FN(LDPL))
44     CFU=(L*FU(L)-LO*FU(LDPC))
45     CCFU=(L*CFU(L)-LO*CFU(LDPC))
46     A=CFU(LD)* (VKR*DFN+FN(LD)*L)
47     B=VAI*DCFU+CFU(LD)*L
48     C=CFU(LD)* (VKR*DFU+FU(LD)*L)
49     D=FU(LD)*B
50     E=FN(LD)*C
51     A(L,I)=1.000/(1.000+(0.000,1.000)*((A-B)/(C-D)))
52     B(L,I)=1.000/(1.000+(0.000,1.000)*((C-D)/(A-B)))
53   CONTINUE
54   RETURN
55   END

```

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 00 53

EFFECT NOLIST MAP NCXREF GCSMT NCDECK SOURCE TERM OBJECT FIXED NOTE
 OPT(0) LANGLVL(66) NCIPPS FLAG(1) NAME(MAIN) LINECOUNT(85)

.....1.....2.....3.....4.....5.....6.....7......

```

SUBROUTINE AUXIL
  IMPLICIT REAL*8(A-H,C-Z)
  DIMENSION YLM(81),FJ(100),FN(9)
  COMPLEX*16 YLM
  COMMON/COMMON/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
  1VH(27),VYH(243),VJ(27),VYJ(243)
  2VH(4,3),SM(4,3),TSAS(2,2),SAC(2,2),
  3X(24,2),AI(144),AF(144),AMMC(24),AEMC(24),S(24),NAME(40),ICG(3)
  COMPLEX*16 CRI,VH,VYH,VYJ,RX,SM,TSAS,SAC,
  1X,AI,AF,AMMC,AEMC,S
  COMMON/COMMON/FACTC(40),FNCRM(45)
  COMMON/INTCOM/LMPC,LM,NLM,NLMM,N,NM,NDIM,NSPH,LMTPC,LMT,LMTPCS,
  1NSMC,NMX,NMXS,NMXM
  DATA PI4/ 12.566370614356/
  IF(JSG.EQ.1) GO TO 18
  LM=LMPD-1
  NLM=LMPD+LMPC
  NLMM=NLM-1
  N=NSPH+NLM
  NM=N-NSPH
  NDIM=NM+NM
  LMTPC=LMPD+LMPC-1
  LMT=LMTPC-1
  LMTPCS=LMTPC+LMTPC
  NSMC=NSPH-1
  NMX=L4+LMPD+LMPC
  NMXS=NMX+NMX
  NMXM=NMXS+NMX
  FACTC(1)=1.000
  DO 10 I=2,NFAC
    A=I-1
    10 FACTC(I)=A*FACTC(I-1)
    DO 15 LF=1,LMTPC
      L=LF-1
      LTPC=LF+L
      DO 15 LM=1,LF
        X=LM-1
        LX=LF-X
        LY=LF+X
        X=LF+L/2+LM
        A=LTPC*FACTC(LMX)/FACTC(LMY)
        15 FJ(LM)=COS(PI4*A)
    IF(JSG.EQ.2) RETURN
    IVY=0
    IVH=0
    DO 30 NF=1,NSMC
      LTPC=NF+1
      DO 30 NS=NFPC,NSPH
        RX=RXX(NS)-RXX(NF)
        RY=RYY(NS)-RYY(NF)
        RZ=RZZ(NS)-RZZ(NF)
        CALL POLAR(RX,RY,RZ,RR,CRIH,SRTH,CRPH,SRPH)
        CALL SPHAR(CRIH,SRTH,CRPH,SRPH,LMTPC,YLM)
      20 IV=1,LMTPCS
      IVT=IV+IVY
      20 VJ(IVT)=COMPLX(FJ(IV),FN(IV))
      IVY=IVY+LMTPCS
      A3=FM+VK
      CALL RSH(AR3,LMT,JCK,FJ,IIR)
      IF(IIR.EQ.1) STOP
      CALL RSH(AR3,LMT,FN)
      DO 25 IV=1,LMTPC
        IVT=IV+IVH
        25 VH(IVT)=COMPLX(FJ(IV),FN(IV))
      IVH=IVH+LMTPC
      30 CONTINUE
      IVY=0
      IVH=0
      DO 35 NF=1,NSPH
        RX=-RXX(NF)
        RY=-RYY(NF)
        RZ=-RZZ(NF)
        IF(RA.EQ.CO.AND.RY.EQ.CO.AND.RZ.EQ.CO) GO TO 50
        CALL POLAR(RX,RY,RZ,RR,CRIH,SRTH,CRPH,SRPH)

```

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 00 53

.....1.....2.....3.....4.....5.....6.....7......

CC 40 IV=1,LMTPCS
IVT=IV+IVY
40 VYJ(IVT)=JCCNJG(YLM(IV))
ARG=RR+VK
CALL R3F(ARG,LMT,JCK,FJ,IIR)
IF(IIR.EQ.1) STOP
CC 45 IV=1,LMTPC
IVT=IV+IVH3
45 VJ(IVT)=FJ(IV)
50 IVY=IVY+LMTPCS
55 IVH3=IVH3+LMTPC
RETURN
END

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 00 57

EFFECT NOLIST MAP NCXREF GOSTMT NCDECK SOURCE TERM CBJECT FIXED NCTE
 UPT(0) LANGLVL(66) NDFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

..........1.....2.....3.....4.....5.....6.....7.*.....

```

COMPLEX FUNCTION GH*16(NBL,L1,M1,L2,M2)
IMPLICIT REAL*8(A-H,C-Z)
CCL401/DC10/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
1VH(27),VYH(243),VJ(27),VYJ(243)
2,R*(4,3),SM(4,3),ISAS(2,2),SAC(2,2),
3A(24,21),AI(144),AF(144),AMMO(24),ALMO(24),S(24),NAME(40),IDG(3)
COMPLEX*16 CRI,VH,VYH,VYJ,RM,SM,ISAS,SAC,
1A,AI,AF,AMMO,ALMO,S
CCL401/INTCOM/LMPC,LM,NLM,NLMY,N,NM,NDIM,NSPH,LMTPO,LMT,LMTPCS,
1VSHO,NMX,NXKS,NMXY
COMPLEX*16 CSUM,CCC,CFUN
DATA PI/7/12.566370614356/
CC)=(C.CDS,C.CDC)
GH=CCC
L1PO=L1+1
LAIPO=IABS(L2-L1)+1
LVAXPC=L2+L1PO
CX=PI*4*(L1+L1PO)*(L2+L2+1)
CCR=DSQRT(CX)
ISN=1
IF(L2.GT.L1.AND.MOD(LMINPC,2).EQ.0) ISN=-ISN
IF(MOD(M2,2).NE.0) ISN=-ISN
IF(NBL.LT.0) GO TO 22
NBL40=NBL-1
GO TO 23
NBL40=-NBL-1
NBY=NBL40#LMTPO
NBY=NBL40#LMTPCS
GO 50 J4=1,3
CSUM=CCC
MC=J4-2
MUPM1=40+M1
MUPM2=40+M2
IF(MUPM1.LT.-L1.OR.MUPM1.GT.L1.OR.MUPM2.LT.-L2.OR.MUPM2.GT.L2)
1GO TO 50
JSN=ISN
CGC1=CLSG(1,L1,L1,-40,MUPM1,M1)
CGC2=CLSG(1,L2,L2,-40,MUPM2,M2)
CX=CGC1#CGC2
5555 F=CMAT(3110,6E15,6)
GO 40 LT=LMINPC,LVAXPC,2
L3=L1-1
M1M2=M1-M2
IF(M1M2.LT.-L3.OR.M1M2.GT.L3) GO TO 40
NY=L3#L3+LT+M1M2
ALB=L3+LT
CGC3=CLSG(L2,L1,L3,0,0,0)
CGC4=CLSG(L2,L1,L3,MUPM2,-MUPM1,M2-M1)
CFUN=JSN#VH(NBH+LT)#VYH(NPY+NY)#CGC3#CGC4/DSQRT(ACRS)
IF(NBL.GT.0) GO TO 35
IF(MOD(L3,2).NE.0) CFUN=-CFUN
35 CSUM=CSUM+CFUN
40 JSN=-JSN
CSUM=CSUM#CR
IF(40.NE.0) CSUM=-CSUM
50 GH=3#CSUM
GH=3#CCR
RETURN
END

```

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 00 59

EFFECT NOLIST MAP NOXREF GCSTMT NODECK SOURCE TERM OBJECT FIXED NCT
 OPT(0) LONGLVL(66) NCFIPS FLAG(1) NAME(MAIN) LINECCUNT(85)

..........1.....2.....3.....4.....5.....6.....7.*.....

```

1  COMPLEX FUNCTION GK*16(NBL,L1,M1,L2,M2)
2  IMPLICIT REAL*8(A-H,L-Z)
3  COMMON/DC47/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
4  1VH(27),VYH(243),VJ(27),VYJ(243)
5  2,R4(4,3),S4(4,3),TSAS(2,2),SAC(2,2),
6  3,(24,2),AI(144),AF(144),AYMO(24),AEMC(24),S(24),NAME(40),IOG(3)
7  COMPLEX*16 CRI,VH,VYH,VYJ,R4,S4,TSAS,SAC,
8  1V,AF,AEMC,AEMC,S
9  COMMON/INTCOM/L4PC,LM,NLM,NLMM,A,NM,ADIM,NSPH,LMTPO,LMT,LMTPCS,
10 1NS4G,NMX,NMXS,NMXM
11 COMPLEX*16 CCR,CSCM,CCC,CCI,CFUN
12 DATA PI/7/12.566370614356/
13 CCR=(0.000,0.000)
14 CCI=(0.000,1.000)
15 GK=CCR
16 L1M=L1-1
17 L1P=L1+1
18 LMINPC=IABS(L2-L1M)+1
19 LMAXPC=L2+L1
20 CK=PI*(L1+L1M)*(L1+L1P)*(L2+L2+1)/L1P
21 CCR=DSQRT(CK)*CCI
22 ISN=1
23 IF(L2.GT.L1M.AND.MOD(LMINPC,2).EQ.0) ISN=-ISN
24 IF(MOD(42,2).NE.0) ISN=-ISN
25 IF(NBL.L1.0) GO TO 22
26 NBLM=NBL-1
27 GO TO 23
28 NBLM=-NBL-1
29 NBM=NBLM*LMTPO
30 NBY=NBLM*LMTPCS
31 DO 50 JX=1,3
32 CSCM=CCR
33 AC=J4-2
34 MPM1=M1+M1
35 MPM2=M2+M2
36 IF(MPM1.LT.-L1M.OR.MPM1.GT.L1M.OR.MPM2.LT.-L2.OR.MPM2.GT.L2)
37 GO TO 50
38 JSN=ISN
39 CGC1=CLGO(1,L1M,L1,-VU,MPM1,M1)
40 CGC2=CLGO(1,L2,L2,-VU,MPM2,M2)
41 CR=CGC1*CGC2
42 DO 40 LT=LMINPC,LMAXPC,2
43 L3=LT-1
44 MPM2=M1-M2
45 IF(M142.LT.-L3.OR.MPM2.GT.L3) GO TO 40
46 NY=L3*L3+LT+M142
47 AGRS=L3+LT
48 CGC3=CLGO(L2,L1M,L3,0,0,0)
49 CGC4=CLGO(L2,L1M,L3,MPM2,-MPM1,M2-M1)
50 CFU=JSN*VH(NBH+LT)*VYH(NBY+NY)*CGC3*CGC4/DSQRT(AGRS)
51 NBH=NBH+LT
52 NBY=NBY+NY
53 IF(NBL.GT.0) GO TO 35
54 IF(MOD(L3,2).NE.0) CFUN=-CFUN
55 CSCM=CSCM+CFU
56 JSN=-JSN
57 CR=CGC4*CR
58 IF(MU.NE.0) CSCM=-CSCM
59 GK=GK+CSCM
60 GK=GK+CCR
61 RETURN
62 EN

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AY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 02

ECT NCLIST MAP NCXREF GOSINT NCDECK SOURCE TERM OBJECT FIXED NOTES
 CPT(0) LANGLVL(66) NCFIPS FLAG(1) NAME(MAIN) LINECOUNT(85) C

..........1.....2.....3.....4.....5.....6.....7.*.....

```

COMPLEX FUNCTION GIM*16(N1,L1,M1,L2,M2)
  IMPLICIT REAL*8(A-H,C-Z)
  COMMON/COMMON/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
  1VH(27),VYH(243),VJ(27),VYJ(243)
  2,S(4,3),SM(4,3),TSAS(2,2),SAC(2,2),
  3A(24,2),AI(144),AF(144),AMVO(24),AEMC(24),S(24),NAME(40),IDG(3)
  COMPLEX*16 CRI,VH,VYH,VYJ,RM,SM,TSAS,SAC,
  1A,AI,AF,AMVO,AEMC,S
  COMMON/INTCOMMON/ L1PC,L1,ALM,ALMM,N,AM,NDIM,NSPH,LMTPC,LMT,LMTPCS,
  1NSID,NXX,NMKS,NMAX
  COMPLEX*16 CSUM,CCC,CFUN
  DATA PI/712.566370614356/
  CCO=(0.000,0.000)
  J14=CCO
  CC=0.000
  IF(RXX(N1).EQ.CC.AND.RYY(N1).EQ.CC.AND.RZZ(N1).EQ.CC) GO TO 60
  L1PC=L1+1
  LMINPC=IAHS(L2-L1)+1
  LMAXPC=L2+L1PC
  CR=PI4*(L1+L1PC)*(L2+L2+1)
  CCR=DSXRT(CR)
  ISN=1
  IF(L2.GT.L1.AND.MOD(LMINPC,2).EQ.0) ISN=-ISN
  IF(MOD(M2,2).NE.0) ISN=-ISN
  NINC=N1-1
  NSJ=NINC#LMTPC
  NBY=N1#LMTPCS
  DO 50 J=1,3
  CSUM=CCC
  MU=J4-2
  MUPM1=MU+M1
  MUPM2=MU+M2
  IF(MUPM1.LT.-L1.OR.MUPM1.GT.L1.OR.MUPM2.LT.-L2.OR.MUPM2.GT.L2)
  1GO TO 50
  JSN=ISN
  CCG1=CLSG(1,L1,L1,-MU,MUPM1,M1)
  CCG2=CLSG(1,L2,L2,-MU,MUPM2,M2)
  CC=CCG1#CCG2
  DO 40 LT=LMINPC,LMAXPC,2
  L3=LT-1
  M1M2=M1-M2
  IF(M1M2.LT.-L3.OR.M1M2.GT.L3) GO TO 40
  NY=L3+L3+LT+M1M2
  ACS=L3+LT
  CCG3=CLSG(L2,L1,L3,0,0,0)
  CCG4=CLSG(L2,L1,L3,MUPM2,-MUPM1,M2-M1)
  CFUN=JSN#VJ(NSJ+LT)*VYJ(NBY+NY)*CCG3#CCG4/DSQRT(ACS)
  CSUM=CSUM+CFUN
  40 JSN=-JSN
  CSUM=CSUM#CR
  IF(MU.NE.0) CSUM=-CSUM
  50 J14=J14+CSUM
  J14=J14#CCR
  RETURN
  60 IF(L1.EQ.L2.AND.M1.EQ.M2) GIM=(1.000,0.000)
  RETURN
  END

```

TIME 10 01 05

.....*.....1.....2.....3.....4.....5.....6.....7*.....

1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 07

BT NOLIST MAP NOXREF GOSTMT NODECK SOURCE TERM OBJECT FIXED NOTES
CPT(0) LONGLVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(85) C

..........1.....2.....3.....4.....5.....6.....7.*.....

```

COMPLEX FUNCTION GIP*16(L1,M1,N2,L2,M2)
IMPLICIT REAL*8(A-H,C-Z)
CC*43N/DOUMD/ RXX(3),RYY(3),RZZ(3),RCS(3),CRI(3),
1V=(27),VYH(243),VJ(27),VYJ(243)
2,X4(4,3),SM(4,3),TSAS(2,2),SAC(2,2),
3A(2,2),AI(144),AF(144),AMMO(24),AEMO(24),S(24),NAME(40),IDG(3)
CC*4PLEX*16 CRI,VH,VYH,VYJ,RV,SV,TSAS,SAC,
1W,AI,AF,AMVC,AEMC,S
CC*4MCM/INTCCM/LMPC,LM,NLM,NLMM,N,NM,NDIM,NSPH,LMTPL,LMT,LMTPCS,
1SAD,VXX,NMXS,NMXX
CC*4PLEX*16 CSUM,CCC,CFUN
DATA PI4/12.566370614356/
CCD=(0.000,0.000)
GIP=CCD
CC=0.000
IF(RXX(N2).EQ.CC.AND.RYY(N2).EQ.CC.AND.RZZ(N2).EQ.CC) GO TO 60
LIPC=L1+1
LMINPC=IABS(L2-L1)+1
LMAXPC=L2+LIPC
CR=PI4*(L1+LIPC)*(L2+L2+1)
CCR=DSQRT(CR)
ISN=1
IF(L2.GT.L1.AND.VCD(LMINPC,2).EQ.0) ISN=-ISN
IF(MOD(M2,2).NE.0) ISN=-ISN
N21C=N2-1
NBU=N2VC+LMTPL
NBY=N2VC+LMTPCS
DO 50 J=1,3
CSUM=CCC
VC=JN-2
MUPM1=VC+M1
MUPM2=VC+M2
IF(MUPM1.LT.-L1.OR.MUPM1.GT.L1.OR.MUPM2.LT.-L2.OR.MUPM2.GT.L2)
1GO TO 50
JN=ISN
CGC1=CLGC(1,L1,L1,-M1,MUPM1,M1)
CGC2=CLGC(1,L2,L2,-M2,MUPM2,M2)
CR=CGC1*CGC2
DO 40 LT=LMINPC,LMAXPC,2
L3=LT-1
M1M2=M1-M2
IF(M1M2.LT.-L3.OR.M1M2.GT.L3) GO TO 40
Y=L3+L3+LT+M1M2
L33=L3+LT
CGC3=CLGC(L2,L1,L3,C,0,0)
CGC4=CLGC(L2,L1,L3,MUPM2,-MUPM1,M2-M1)
CFUN=JN*VJ(NBU+LT)*VYJ(NBY+NY)*CGC3*CGC4/DSQRT(ALRS)
IF(MOD(L3,2).NE.0) CFUN=-CFUN
CSUM=CSUM+CFUN
40 JN=-JN
CSUM=CSUM*CR
IF(AJ.NE.0) CSUM=-CSUM
50 GIP=GIP+CSUM
GIP=GIP*CCR
RETURN
60 IF(L1.L2.AND.M1.EQ.M2) GIP=(1.000,0.000)
RETURN
END

```

1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 10

NOLIST MAP NOXREF GCSTMT NODECK SOURCE TERM OBJECT FIXED NOTE
 OPT(0) LANGLVL(66) NCFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

.....*.....1.....2.....3.....4.....5.....6.....7.*.....

```

COMPLEX FUNCTION GLP*16(L1,M1,N2,L2,M2)
IMPLICIT REAL*8(A-H,C-Z)
CC440N/DUMO/ RXX(3),RYY(3),RZZ(3),RDS(3),CRI(3),
1VH(27),VYH(243),VJ(27),VYJ(243)
2,R4(4,3),SM(4,3),TSAS(2,2),SAC(2,2),
3W(24,2),AI(144),AF(144),AMMO(24),AEMC(24),S(24),NAME(40),ICG(3)
COMPLEX*16 CRI,VH,VYH,VYJ,WM,SM,TSAS,SAC,
1A,AI,AF,AMMO,AEMC,S
COMCON/INICOM/LMPC,LM,NLM,NLMM,N,AM,NDIM,NSPH,LMTPO,LMT,LMTPCS,
1ASAC,NXX,NXXS,NXXY
COMPLEX*16 CCP,CSUM,CCO,CCI,CFUN
DATA PI4/12.566370614356/
CCO=(0.000,C.000)
GLP=CCO
CC=0.000
IF(RXX(N2).EQ.CO.AND.RYY(N2).EQ.CO.AND.RZZ(N2).EQ.CO) RETURN
CCI=(C.CCO,1.CCO)
L1MC=L1-1
L1PC=L1+1
LMINPC=IABS(L2-L1MC)+1
LMAXPC=L2+L1
CR=PI4*(L1+L1PC)*(L2+L2+1)/L1PC
CCR=DSQRT(CR)*CCI
ISN=1
IF(L2.GT.L1MC.AND.MCO(LMINPC,2).EQ.0) ISN=-ISN
IF(MCO(M2,2).NE.C) ISN=-ISN
N2MC=N2-1
NBJ=N2*CC*LMTPC
NEY=N2*CC*LMTPCS
CC=50 JJ=1,3
CSUM=CCO
MU=JM-2
40P41=MU+M1
40P42=MU+M2
IF(40P41.LT.-L1MC.OR.40P41.GT.L1MC.OR.40P42.LT.-L2.OR.40P42.GT.L2)
100 TO 50
JSN=ISN
CCG1=CLGC(1,L1MC,L1,-MU,40P41,M1)
CCG2=CLGC(1,L2,L2,-MU,40P42,M2)
CR=CCG1*CCG2
CC40 LT=LMINPC,LMAXPC,2
L3=LT-1
41440=41-42
IF(41440.LT.-L3.OR.41440.GT.L3) GO TO 40
NY=L3+L3+LT+41440
ACRS=L3+LT
CCG3=CLGC(L2,L1MC,L3,C,C,C)
CCG4=CLGC(L2,L1MC,L3,40P42,-40P41,42-41)
CFUN=JSN*VJ(NBJ+LT)*VYJ(NEY+NY)*CCG3*CCG4/DSQRT(ACRS)
IF(MCO(L3,2).NE.C) CFUN=-CFUN
CSUM=CSUM+CFUN
40 JSN=-JSN
CSUM=CSUM+CFUN
IF(MU.NE.0) CSUM=-CSUM
50 GLP=GLP+CSUM
GLP=GLP*CCR
RETURN
END

```

33)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 12

*GLIST MAP NOXREF GCSTMT NODECK SOURCE TERM OBJECT FIXED NOTES
 OPT(0) LONGLVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(65) C

.*...1.....2.....3.....4.....5.....6.....7.*.....

```

FUNCTION NCCU(N1,N2,N)
  IF(N1.GT.N2) GO TO 20
  NF=N1
  NS=N2
  ISN=0
  DO 10 I=1,30
    NF=N2
    NS=N1
    ISN=1
  10 NCCU=NS-NF
    NFMC=NF-1
    IF(NFMC.EQ.0) GO TO 50
    JCCU=0
    DO 40 I=1,NFMC
  40 JCCU=JCCU+1
    NCCU=NCCU+NFMC*N-JCCU
  50 IF(ISN.EQ.1) NCCU=-NCCU
  RETURN
END
  
```

83) VS FORTRAN DATE 1984 NOV 08 TIME 10 01 13

NOLIST MAP NOXREF GOSTMT NCDECK SOURCE TERM OBJECT FIXED NOTES
OPT(0) LANGVL(66) NCFIPS FLAG(1) NAME(MAIN) LINECOUNT(85) C

.....1.....2.....3.....4.....5.....6.....7......

```
REAL FUNCTION CLGC*8(JA,JB,JC,MA,MB,MC)
IMPLICIT REAL*8(A-H,C-Z)
COMMON/COMMON/FAC1C(40),FACRM(45)
IF(MA-JA)3,4,3
CLGC=0.000
GOTO 35
IF(MA+JA)5,6,6
CLGC=0.000
GOTO 35
IF(MB-JB)3,8,7
CLGC=0.000
GOTO 35
IF(MB+JB)9,10,10
CLGC=0.000
GOTO 35
IF(MC-JC)12,12,11
CLGC=0.000
GOTO 35
IF(MC+JC)13,14,14
CLGC=0.000
GOTO 35
IF(JC-JA-JB)16,16,15
CLGC=0.000
GOTO 35
JJ1=JA+JB-JC+1
JJ2=JC+JA-JB+1
JJ3=JC-JA+JB+1
JJ4=JC+JA+JB+2
JJ5=JA+MA+1
JJ6=JA-MA+1
JJ7=JB+MB+1
JJ8=JB-MB+1
JJ9=JC+MC+1
JJ10=JC-MC+1
JJ17=-JC+JB-MA
JJ18=-JC+JA+MB
JJ19=JA+JB-JC
JJ20=JA-MA
JJ21=JB+MB
IF(JJ17)17,17,20
IF(JJ18)18,18,19
K=0
GOTO 24
K=JJ19
GOTO 24
IF(JJ19)21,21,22
K=JJ17
GOTO 24
IF(JJ17-JJ18)19,19,21
IF(JJ21-JJ19)25,25,26
IF(JJ19-JJ20)23,23,27
KK=JJ21
GOTO 25
KK=JJ19
GOTO 25
IF(JJ21-JJ20)25,25,26
KK=JJ20
GOTO 25
I=K
IF(K-2*(K/2))31,30,31
BOY=1.000
GOTO 32
BOY=-1.000
JJ11=I+1
JJ12=JJ1-I
JJ13=JJ6-I
JJ14=JJ7-I
JJ15=JC-JB+MA+I+1
JJ16=JC-JA-MB+I+1
P=BOY*FAC1C(JJ11)*FAC1C(JJ12)*FAC1C(JJ13)
I=FAC1C(JJ14)*FAC1C(JJ15)*FAC1C(JJ16)
SC4=SC4+BOY/PACCU
IF(I-KK)33,34,34
I=I+1
BOY=-BOY
GOTO 32
ARG=2*JC+1
```

33)

VS FORTRAN

DATE 1984 NOV 03

TIME 10 01 13

.*....1.....2.....3.....4.....5.....6.....7.*.....

```
SQUA 2=FACTC (JJ4)
SQUA 3=FACTC (JJ5)*FACTC (JJ6)*FACTC (JJ7)
1*FACTC (JJ8)*FACTC (JJ9)*FACTC (JJ10)
SQUA 4=SQUA 1*SQUA 3/SQUA 2
CLGO=SUM*DSQRT(SQUA 4)
RETURN
END
```

```

3)          VS FORTRAN          DATE  1984 NOV 08          TIME  10 01 16
VOLIST      MAP ACXREF      GUSTMT NODECK      SOURCE      TERM      OBJECT FIXED      NOTE
OPT(0)      LANGLVL(66)    NOFIPS      FLAG(1)      NAME(MAIN  )      LINECOUNT(85)

```

...1.....2.....3.....4.....5.....6.....7......

```

SUBROUTINE KBF(X,N,JCK,FJ,IIR)
IMPLICIT REAL*8(A-H,C-Z)
DIMENSION FJ(100)
IIR=0
JCK=JCK
IF(X-1.00-5)7,11,11
FJ(1)=1.
IF(N)10,10,8
N=N+1
GO TO 4
FJ(N)=0.
GO TO 30
FNC=1.34*X+6.5
TST=+.21*+.342944819*DLG(X)+3.
IF(2.-TST)13,12,12
DELTA=2.
GO TO 14
DELTA=TST
FN=1.
IF(FN-FNC)15,15,16
FNS=FNC+DELTA
GO TO 17
FNS=FN+DELTA
NS=FNS+1.
JCK=JCK+2
IF(JCK-JCK)21,21,18
IIS=1
N=N+1
FJ(NS+1)=0.
FJ(NS)=1.00-45
N=NS-1
N=N-1
FJ(N)=((FJ(N)+FJ(N+3.))/X)*FJ(N+1)-FJ(N+2)
IF(1433(FJ(N))-1.00+40)23,33,33
IF(1-1)25,25,24
N=N-1
N=N-1.
GO TO 26
IF(X-.2)26,27,27
XX=X*X
XXX=X*XX
X=XXX*XX
SER=1.-XX/6.+XXX/120.-X6/5040.
CON=FJ(1)/SER
JU=1
GO TO 31
SER=CON*(X)
IF(1433(SER)-.1)28,29,29
IF(X-.11)29,29,30
CON=X+FJ(1)/SER
JU=1
GO TO 31
CON1=X+FJ(1)/SER
FJ(1)=FJ(1)/CON1
CON=X+FJ(2)/(SER/X-LOGS(X))
JU=2
N=N+1
GO TO 32
N=JU,N
FJ(N)=FJ(N)/CON
GO TO 50
JU=JU+1
N=JU,N
FJ(N)=FJ(N)+1.00-45
GO TO 31
N=N+1
GO TO 31

```

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 18

LIST	MAP	NOXREF	SUSTMT	NODECK	SOURCE	TERM	OBJECT	FIXED	NOTES
OPT(0)	LANG	LVL(66)	NCFIPS	FLAG(1)	NAME(MAIN)		LINECOUNT(85)		C

..1.....2.....3.....4.....5.....6.....7.*.....

```

SUBROUTINE RNF(X,L,FN)
  IMPLICIT REAL*8(A-H,O-Z)
  DIMENSION FN(9)
  F(X,LT,0.000,GR,L,LT,0) RETURN
  PJ=L+1
  F(X,LT,0.000) GO TO 20
  DO 10 I=1,LPU
    N(I)=-1.00+50
  RETURN
  N1=-0.000(X)/X
  N2=(F,N1-0.5 SIN(X))/X
  N(1)=FN1
  N(2)=FN2
  F(L,LT,2) RETURN
  I=1.000/X
  NC=L-1
  DO 30 I=1,L*G
    IPU=1+I+1
    PT=I+2
    NO=FN1
    N1=FN2
    NC=FN1*X1*ITPU-FNC
    N(IPU)=FN2
  RETURN
  NO

```

AD-A158 057

THE OPTICAL SPECTRA OF AEROSOLS(U) MESSINA UNIV (ITALY) 2/2
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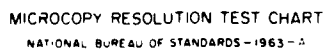
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

IN EFFECT NOLIST MAP NCXREF GLSTMT NCDECK SOURCE TERM OBJECT FIXED
 LPT(0) LANGVL(66) NCFIPS FLAG(1) NAME(MAIN) LINECUNT(85)

.....1.....2.....3.....4.....5.....6.....7....

```

1  SUBROUTINE CBF(X,N,JCN,FJ,IIR)
2  IMPLICIT REAL*8(A-H,C-Z)
3  DIMENSION FJ(100)
4  COMPLEX*16 FJ,X,XX,XXXX,X6,SER,CCN,CCN1
5  IIR=0
6  Y=CDABS(X)
7  ICK=JCN
8  IF(Y-1.00-2)7,11,11
9  7 FJ(1)=1.
10 IF(I)11,10,8
11 NV=N+1
12 DO 5 V=2,NV
13 FJ(V)=0.
14 RETURN
15 FNC=1.04*Y+6.5
16 TST=4.21*CDCLS(X)+3.
17 IF(2.-TST)13,12,12
18 DELTA=2.
19 DO 10 I=14
20 DELTA=TST
21 FN=FN
22 IF(FN-FNC)15,15,16
23 FN=FNC+DELTA
24 DO 10 I=17
25 FN=FN+DELTA
26 NS=FN+1.
27 ICK=NS+2
28 IF(ICK-JCN)21,21,16
29 IIR=1
30 RETURN
31 FJ(NV+1)=1.
32 FJ(,5)=(1.00-37,1.00-37)
33 V=5-1
34 NV=V-1
35 FJ(V)=((F1+FN+3.)/X)*FJ(V+1)-FJ(V+2)
36 IF(CDABS(FJ(V))-1.033)23,33,33
37 IF(N-1)25,25,24
38 V=4-1
39 FN=FN-1.
40 DO 10 I=22
41 IF(Y-.2)26,27,27
42 XX=X*X
43 XXXX=XX*XX
44 AC=XXXX*XX
45 SER=1.-XX/6.+XXXX/120.-X6/5040.
46 CC1=FJ(1)/SER
47 JU=1
48 DO 10 I=31
49 SE=CDOSIN(X)
50 IF(CDABS(SE)-.1)28,29,29
51 IF(Y-.11)29,29,30
52 CC1=X*FJ(1)/SER
53 JU=1
54 DO 10 I=31
55 CC1=X*FJ(1)/SER
56 FJ(1)=FJ(1)/CCN1
57 CC1=X*FJ(2)/(SER/X-CDCLS(X))
58 JU=2
59 NV=N+1
60 DO 22 V=JU,NV
61 FJ(V)=FJ(V)/CCN
62 RETURN
63 JU=V+1
64 DO 34 J=JU,NS
65 FJ(J)=FJ(J)*1.00-33
66 DO 10 I=22
67 END

```

MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 21

EFFECT NOLIST MAP NOXREF GCSTMT NCDECK SOURCE TERM OBJECT FIXED NOTES
OPT(3) LANGLVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECCUNT(85) C.

.....1.....2.....3.....4.....5.....6.....7......

SUBROUTINE POLAR(X,Y,Z,R,CTH,STH,CPH,SPH)

IMPLICIT REAL*8(A-H,C-Z)

RHC=X*X+Y*Y

IF(RHC.GT.0.000) GO TO 10

CPH=1.000

SPH=0.000

R=ABS(Z)

IF(R.GT.0.000) GO TO 15

CTH=1.000

STH=0.000

RETURN

10 R=DSQRT(RHC+Z*Z)

RHC=DSQRT(RHC)

CPH=X/RHC

SPH=Y/RHC

15 CTH=Z/R

STH=RHC/R

RETURN

END

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 22

EFFECT ACLIST MAP NCXREF GCSTMT NCDECK SOURCE TERM OBJECT FIXED NOTES
 OPT(0) LANGLVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

..........1.....2.....3.....4.....5.....6.....7.*.....

SUBROUTINE SPHAR

1 (CCSRTH, SINRTH, CCSRPH, SINRPH, LMPC, YLJRS)

IMPLICIT REAL*8(A-H, C-Z)

DIMENSION SINRMP(9), CCSRMP(9), PLMRS(45), YLJRS(81)

CC44CN/DUM6/FACTC(40), FNCKM(45)

COMPLEX*16 YLJRS

LM=LMPC-1

SINRMP(1)=0.000

CCSRMP(1)=1.000

SINRMP(2)=SINRPH

CCSRMP(2)=CCSRPH

IF(LMPC-2) 3, 5, 6

DO 7 J=3, LMPC

K=J-1

SINRMP(J)=SINRPH*CCSRMP(K)+CCSRPH*SINRMP(K)

CCSRMP(J)=CCSRPH*CCSRMP(K)-SINRPH*SINRMP(K)

CONTINUE

X=CCSRTH

AA=CC44S(X)

Y=CC44S(SINRTH)

IF(AA-1.00-6) 9, 9, 18

L=0

LAVE=(L*(L+1))/2+1

TAVE=2.000*L

M=0

K=L+M

IF(A-2*(K/2)) 12, 13, 12

J=LAVE+M

PLMRS(J)=0.000

GO TO 14

IA=K+1

IC=I/2+1

IC=(L-M)/2

IC=IC+1

J=LAVE+M

PLMRS(J)=(((-1)**IC)*FACTC(IA))/(TAVE*FACTC(IC)*FACTC(IC))

IF(L-LM) 15, 16, 16

M=M+1

GO TO 11

IF(L-LM) 17, 40, 40

L=L+1

GO TO 10

IF(AA-0.999999999) 28, 19, 19

PLMRS(1)=1.000

PLMRS(2)=X

L=2

J=(L*(L+1))/2+1

A=L

B=2*L-1

C=L-1

K=J-L

M=J-L+1

PLMRS(J)=(3*X*PLMRS(K)-C*PLMRS(M))/A

IF(L-LM) 21, 22, 22

L=L+1

GO TO 20

L=1

M=1

LAVE=(L*(L+1))/2+1

J=LAVE+M

PLMRS(J)=0.000

IF(L-LM) 25, 26, 26

M=M+1

GO TO 24

IF(L-LM) 27, 40, 40

L=L+1

GO TO 23

PLMRS(1)=1.000

PLMRS(2)=X

PLMRS(3)=Y

PLMRS(5)=3.000*Y*X

L=5

J=(L*(L+1))/2+1

A=L

B=2*L-1

C=L-1

29

(MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 22

.....1.....2.....3.....4.....5.....6.....7......

```

      PLMRS(J)=(B*X*PLMRS(K)-C*PLMRS(M))/A
      IF(L-LM) 30,31,31
30    L=L+1
      GO TO 29
31    L=3
32    J=(L*(L+1))/2+2
      A=L-1
      B=2*L-1
      C=L
      K=J-L
      M=J-2*L+1
      PLMRS(J)=(B*X*PLMRS(K)-C*PLMRS(M))/A
      IF(L-LM) 33,34,34
33    L=L+1
      GO TO 32
34    L=2
35    M=1
      LAVE=(L*(L+1))/2+1
36    J=LAVE+M+1
      K=J-1
      M=K-1
      EAT=M
      A=(2.000*EAT*X)/Y
      B=(M+L)*(L-M+1)
      PLMRS(J)=A*PLMRS(K)-B*PLMRS(M)
      IF(M+1-L) 37,38,38
37    M=M+1
      GO TO 36
38    IF(L-LM) 39,40,40
39    L=L+1
      GO TO 35
40    CONTINUE
      L=3
41    J=3
      KAVE=L*(L+1)
      LAVE=KAVE+1
      MAVE=KAVE/2+1
42    IF(J) 44,43,44
43    YLUPS(LAVE)=FUCMP(MAVE)*PLMRS(MAVE)
      GO TO 45
44    JA=MAVE+J
      SAVE=FUCMP(JA)*PLMRS(JA)
      MA=J+1
      IA=LAVE+J
      YLUPS(IA)=SAVE*DCMPLX(COSMMP(MA), SINMMP(MA))
      IF(MA-2) 46,47,47
      YLUPS(IA)=-YLUPS(IA)
      IA=LAVE-J
      YLUPS(IA)=SAVE*DCMPLX(COSMMP(MA), -SINMMP(MA))
45    IF(J-L) 46,47,47
46    J=J+1
      GO TO 44
47    IF(L-LM) 48,49,49
48    L=L+1
      GO TO 41
49    CONTINUE
      RETURN
      END

```

MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 26

OBJECT NOLIST MAP NOXREF GCSTMT NODECK SOURCE TERM OBJECT FIXED NOTEST
 OPT(0) LANGVLVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(85) CH

.....1.....2.....3.....4.....5.....6.....7......

```

SUBROUTINE CSMINV(AM,V,NDDMST,N,MODE,IER,VCUT)
IMPLICIT REAL*8 (A-H,O-Z)
DIMENSION AM(NDDMST,1),V(1)
COMPLEX*16 AM,DET,CSUM,CTEMP,CDET
DATA CCONST/3.5527136738005D-17/
IER=0
NMINUS=N-1
PTEST = (4.000*CCONST*N)**2
1200 IF(N.NE.1) GO TO 1300
DET=AM(1,1)
IF( DABS(DREAL(DET))+DABS(DIMAG(DET)) .EQ. 0.000) GO TO 5200
AV(1,1) = (1.000,C.000)/DET
RETURN
1300 DO 1309 I=1,N
SUM=0.000
DO 1319 J=1,N
SUM = SUM +DREAL(AM(I,J))**2 +DIMAG(AM(I,J))**2
1319 CONTINUE
V(I)=1.000/SUM
1309 CONTINUE
DET=1.000
DO 2019 K=1,N
KPLUS=K+1
KMINUS=K-1
L=K
PSMAX=0.000
DO 2029 I=K,N
CTEMP = -CDET*(-AM(I,K),AM(I,1),AM(1,K),KMINUS,NDDMST)
AM(I,K)=CTEMP
PSJ = V(I)*(DREAL(CTEMP)**2 +DIMAG(CTEMP)**2 )
IF(PSJ.LE.PSMAX) GO TO 2029
PSMAX=PSJ
L=I
2029 CONTINUE
VTEMP=V(K)
IF(L.EQ.K) GO TO 2011
DO 2049 J=1,N
CTEMP=AM(K,J)
AM(K,J)=AM(L,J)
AM(L,J)=CTEMP
2049 CONTINUE
VTEMP=V(L)
V(L)=V(K)
DET=-DET
2011 DET = AM(K,K)*DET
IF(MODE.NE.0) DET=DSQRT(VTEMP)*DET
V(K)=L
IF(PSMAX.LE.PTEST) GO TO 5200
CTEMP = 1.000/AM(K,K)
AM(K,K)=CTEMP
IF(KPLUS.GT.N) GO TO 2019
DO 2059 J=KPLUS,N
AM(K,J) = -CTEMP*CDET*(-AM(K,J),AM(K,1),AM(1,J),KMINUS,NDDMST)
2059 CONTINUE
2019 CONTINUE
DO 4109 K=1,NMINUS
KPLUS=K+1
DO 4119 I=KPLUS,N
AM(I,K) = -AM(I,1)*CDET((0.000,0.000),AM(I,K),AM(K,K),I-K,
NDDMST)
AM(K,I) = -CDET(AM(K,I),AM(K,KPLUS),AM(KPLUS,I),I-K-1,NDDMST)
4119 CONTINUE
4109 CONTINUE
DO 4209 K=1,N
DO 4219 I=1,N
IF(I.GE.K) GO TO 4212
AM(I,K) = CDET((0.000,0.000),AM(I,K),AM(K,K),N-K+1,NDDMST)
GO TO 4219
4212 AM(I,K) = CDET(AM(I,K),AM(I,I+1),AM(I+1,K),N-I,NDDMST)
4219 CONTINUE
4209 CONTINUE
DO 4309 L=1,N
K=I-L+1
KCOL=ICINT(V(K))
IF(KCOL.EQ.K) GO TO 4309
DO 4319 I=1,N
CTEMP=AM(I,K)

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MAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 26

.....1.....2.....3.....4.....5.....6.....7......

```

      AV(I,KCCL)=CTEMP
4319  CONTINUE
4309  CONTINUE
      GO TO 6000
5200  IER=1
      RETURN
6000  IF(VCUT.EQ.C.CDO) RETURN
      CDO=(0.000,C.000)
      CO=0.000
      ICUT=0
      DO 6260 I=1,N
      DO 6250 J=1,N
      DET=AV(I,J)
      AMR=DREAL(DET)
      AMI=DIVAG(DET)
      IF(AMR.EQ.CO.AND.AMI.EQ.CO) GO TO 6260
      IF(AMR.EQ.CO.OR.DABS(AMR).GT.VCUT) GO TO 6250
      AMR=CO
      ICUT=ICUT+1
6250  IF(AMI.EQ.CO.OR.DABS(AMI).GT.VCUT) GO TO 6255
      AMI=CO
      ICUT=ICUT+1
6255  AV(I,J)=DCVPLX(AMR,AMI)
6260  CONTINUE
      RETURN
      END
```

DAY 1983)

VS FORTRAN

DATE 1984 NOV 08

TIME 10 01 30

ECT NOLIST MAP NOXREF CDSMT NODECK SOURCE TERM OBJECT FIXED NOTES
EPT(0) LANGLEVL(66) NOFIPS FLAG(1) NAME(MAIN) LINECOUNT(85)

.....1.....2.....3.....4.....5.....6.....7......

COMPLEX FUNCTION CDSMT*16(Z,A,B,N,ISTEP)

COMPLEX*16 Z,A(1),B(1)

CDSMT=Z

IF(N) 4,1,2

2 DO 3 J=1,N

3 CDSMT=CDSMT+A*(1+(J-1)*ISTEP)*B(J)

4 RETURN

END

OUTPUT DESCRIPTION

In this section we give the meaning of the output quantities of all the programs.

When IWCSS=1 the programs write the cross sections of each one of the spheres in the cluster:

SCASEC	}	Scattering, absorption and total cross section for the spheres in the cluster, respectively.
ABSSEC		
TOTSEC		

QSCAS	}	Ratio between the scattering, absorption and total cross section, respectively, and the geometrical cross section of the spheres.
QARSS		
QTOTS		

The some quantities are written for the cluster as a whole, so that:

SCASEC	}	Scattering, absorption and total cross section, respectively, for the cluster.
ABSSEC		
TOTSEC		

QSCAS	}	Ratio between the scattering, absorption and total cross section of the cluster, and the sum of the geometrical cross section of the constituent spheres, respectively.
QARSS		
QTOTS		

Furthermore the programs write the following informations relative to the cluster as a whole:

SCARAT	}	Ratio between the cross sections of the cluster and the sum of the corresponding cross sections of the constituent spheres calculated according to the Mie theory.
ABSRAT		
TOTRAT		

The last information written by the programs is marked 11 and 21 if IHELP=+1, and 22, 12 if IHELP=-1.

11 is the 11 component of the normalized forward scattering cross section of the cluster, while 21 is the 21 component of

the same quantity. Analogous meaning have the quantities marked 22 and 12.

Furthermore, 11 also marks the quantities

$$\frac{\operatorname{Re} \underline{f}_{\gamma\gamma}(\text{cluster})}{\operatorname{Re} \sum \underline{f}_{\gamma\gamma}(\text{spheres})} \quad \text{and} \quad \frac{\operatorname{Im} \underline{f}_{\gamma\gamma}(\text{cluster})}{\operatorname{Im} \sum \underline{f}_{\gamma\gamma}(\text{spheres})}$$

According to ref.(5) these quantities are related to the macroscopic optical constants of an assembly of clusters with low density.

TABLE I

Number of the elements of the T-matrix (EN) for a cluster of N spheres with a given L_M . The actual memory requirements for this matrix is obtained by multiplying EN by 16. The asterisk marks the entries corresponding to clusters that can be handled by PRG2. All the other entries correspond to clusters that must be handled by PRG3. The maximum capability of PRG3 is a cluster of 70 spheres with $L_M=1$. This requires to handle a T-matrix with 176400 elements. The total memory requirement of the program is of 4 Mbytes.

N	L_M	EN
* 4	3	14.400
*	4	36.864
	5	78.400
	6	147.456
* 5	3	22.500
*	4	57.600
	5	122.500
* 6	2	9.216
*	3	32.400
	4	82.944
	5	122.400
* 7	2	12.544
*	3	44.100
	4	112.896
* 8	2	16.384
*	3	57.600
	4	147.456

44 RECORDS

1. THE STATE OF TEXAS,
COUNTY OF EL PASO,

[illegible]

0.1700000000-19
K=7, IM=0, PE=0, LM=0
CONFIDENCE, NO=1.0, WS=1.5, AUCI=3

[illegible]

$\alpha = .05$, CONFIDENCE, N=1.0, AB=1.0, MODE=3

END

FILMED

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