Diagonalizar este tipo de matrices es fácil, dando como resultado los siguientes autovalores:

$$E_{\Gamma_3} = 72\ B_4$$
$$E_{\Gamma_5} = -\ 48\ B_4$$

y las correspondientes autofunciones:

$$\Gamma_3 \begin{cases} |\tilde{+}\rangle = \sqrt{1/3}\ |-2\rangle + \sqrt{2/3}\ |1\rangle \\ |\tilde{-}\rangle = \sqrt{1/3}\ |2\rangle - \sqrt{2/3}\ |-1\rangle \end{cases}$$

$$\Gamma_5 \begin{cases} |\widetilde{+1}\rangle = -\sqrt{2/3}\ |-2\rangle + \sqrt{1/3}\ |1\rangle \\ |\tilde{0}\rangle = \sqrt{0} \\ |\widetilde{-1}\rangle = -\sqrt{2/3}\ |+2\rangle - \sqrt{1/3}\ |-1\rangle \end{cases}$$

La nomenclatura aquí utilizada es la común en teoría de grupos.

APENDICE III

Programa en FORTRAN para calcular la forma de linea Mössbauer de una muestra en polvo sometida a un campo magnético externo perpendicular al haz de radiación gamma

```
DIMENSION F(3),E(10),VE(16),CT(1,400)
COMPLEX TMM(4,2),TMP(4,2),AP,AM,CAMP,CU,VEC,VFC
COMMON/UN/AMP(8),ENE(8),CN,GA,DI,GR(400),H0,N
NAMELIST/DON/N,CN,NA,NB/NAMELIST/DI,GA,H1,QS,HEXT
N=200
CN=0.1
DI=0.
```

```
      RPG=3.1415926536/180.
      R3=SQRT(3)
      ZF=-3.924/330.
      ZE=2.244/330.
    1 READ(5,DON,END=999)
      WRITE(6,DON)
      DO 2 I=1,N
    2 CT(1,I)=0.
      READ(5,NAMT)
      WRITE(6,NAMT)
      Q=QS/2.
      DO 12 IB=1,NB
      BETA=(FLOAT(IB)-0.5)*180./FLOAT(NB)*RPG
      CB=COS(BETA)
      SB=SIN(BETA)
      HX=HEXT*SB
      HZ=HEXT*CB
      DO 3 I=1,3
    3 F(I)=0.
      F(1)=0.5*HZ*ZF
      F(2)=0.5*HX*ZF
      F(3)=-F(1)
      CALL AEJAC(F,VF,2,0)
      DO 4 I=1,10
    4 E(I)=0.
      E(1)=1.5*HZ*ZE+Q
      E(2)=0.5*HX*ZE*R3
      E(3)=0.5*HZ*ZE-Q
      E(5)=HX*ZE
      E(6)=-0.5*HZ*ZE-Q
      E(9)=0.5*HX*ZE*R3
      E(10)=-1.5*HZ*ZE+Q
      CALL AEJAC(E,VE,4,0)
```

```
      DO 6 J=1,4
      DO 6 I=1,2
      TMM(J,I)=(0.,0.)
    6 TMP(J,I)=(0.,0.)
      DO 20 I=1,8
   20 AMP(I)= 0.
      TAMP=0.
      DO 5 IA=1,NA
      ALFA=(FLOAT(IA)-0.5)*360./FLOAT(NA)*RPG
      CA=COS(ALFA)
      SA=SIN(ALFA)
      CTET=CA*SB
      STET=SQRT(1-(CA*SB)**2)
      COFI=SB*SA/STET
      SEFI=CB/STET
      R1=COFI*(1+CTET)/2.
      R2=STET/R3
      R31=COFI*(1-CTET)/2.
      C1=SEFI*(1+CTET)/2.
      C3=-SEFI*(1-CTET)/2.
      TMM(1,1)=CMPLX(R1,C1)
      TMM(2,1)=CMPLX(R2,0.)
      TMM92,2)=CMPLX(R1,C1)/CMPLX(R3,0.)
      TMM(3,1)=CMPLX(R31,C3)/CMPLX(R3,0.)
      TMM(3,2)=CMPLX(R2,0.)
      TMM(4,2)=CMPLX(R31,C3)
      DO 7 I=1,2
      I1=3-I
      DO 7 J=1,4
      J1=5-J
      U=(-1)**(J+1)
      CU=CMPLX(U,0.)
    7 TMP(J,I)=CU*CONJG(TMM(J1,I1))
```

```
      L=1
      DO 9 I=1,2
      DO 9 J=1,4
      AP=(0.,0.)
      AM=(0.,0.)
      DO 8 I1=1,2
      I3=(I-1)*2+I1
      VFC=CMPLX(VF(I3),0.)
      DO 8 J1=1,4
      J3=(J-1)*4+J1
      VEC=CMPLX(VE(J3),0.)
      AM=AM+VEC*TMM(J1,I1)*VFC
    8 AP=AP+VEC*VFC*TMP(J1,I1)
      CAMP=AM*CONJG(AM)+AP*CONJG(AP)
      AMP(L)=AMP(L)+REAL(CAMP)
      TAMP=TAMP+AMP(L)
    9 L=L+1
    5 CONTINUE
      DO 10 I=1,8
   10 AMP(I)=AMP(I)*8/TAMP
      H0=H1/(FLOAT(NB)*4.)*SB*180.
      L=1
      DO 14 I=1,2
      I2=(I*I+I)/2
      DO 14 J=1,4
      J2=(J*J+J)/2
      ENE(L)=E(J2)-F(I2)
   14 L=L+1
      CALL GRAF
      DO 11 I=1,N
   11 CT(1,I)=CT(1,I)+GR(I)
   12 CONTINUE
```

```
      DO 13 I=1,N,10
   13 WRITE(6,100)(CT(1,J),J=I,I+9)
      CALL TRAZA(CT,N,1,3)
      GO TO 1
  999 CALL EXIT
  100 FORMAT(2X,10(F6.0,1x))
      END
      SUBROUTINE GRAF
      COMMON/UN/AMP(8),CN,GA,DI,GR(400),H0,N
      DO 50 I=1,N          50  GR(I)=H0
      G=GA/CN
      D0=(FLOAT(N)+1)/2.
      DO 51 L=1,8
      X0=D0+(ENE(L)+DI)/CN
      H=H0*AMP(L)/8
      DO 51 I=1,N
      X=FLOAT(I)
      FL=((G**2)*H/((X-X0)**2)+(G**2)))
      GR(I)=GR(I)-FL
   51 CONTINUE
      RETURN
      END
```

Es de hacer notar que las subrutinas AEJAC y TRAZA son simplemente para diagonalizar y graficar respectivamente.