

FORTRAN program used for calculation of the coefficients of the 1/D- expansion

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program hookeld
implicit real*16(a-h,o-z)
dimension
vef(400),vc(400),v0(400),v1(400),v2(400),rfact(0:200),
-
v3(400),en(200),vv0(120,120),vv1(120,120),t0(120,200),
- t1(120,200),enas(200),ratio(40,200)
complex*16 cone,cin1,cin3,a,c0
print*, ' 1/D-expansion for 1/8/r**2+r**2/2+rmu/r'
zero=0
pi=4*qatan(1.g0)
cone=(0.d0,1.d0)
print*, 'Type Mcoeff'
read*,nml
print*, 'number of coef. = ',nml
nm=nml-1
nmv=2*nml-1
vfact(0)=1
do 11 n=1,nm
11 rfact(n)=n*rfact(n-1)
print*, 'Type rmu'
nla=0
99 read*,rmu
if(rmu.eq.0)goto88
nla=nla+1
d=1.e9
r0=0
nst=0
1 continue
c if(rmu.gt..4)z1=1/(r0**3-rmu)/4
c if(rmu.le..4)
r1=gsqrt(qsgrt(rmu*r0+.25g0))
d1=gabs(r0-r1)
nst=nst+1
if(d.lt..0001.and.d1.ge.d)goto2
if(nst.gt.999)goto999
r0=r1
d=d1
999 print*, 'No convergency for r0'
stop
2 print20,rmu,r0,nst,d
20 format(' rmu, r0, nstexp, diff =
',f15.7,f20.12,i5,e12.4)
om=gsqrt(1/r0**4/4+3)
r1=gsqrt(r0**2-1/r0**2/4)-r0
s=qlog(4*r0**3*(r0+r1)/(1+4*r0**4+2*r0**2*om))/2+
. (1-12*r0**4)/8/r0**2*qlog((r0+r1)/r0/(2+om))
r1l=qlog((2+om)/(2-
om))/2;qlog(2*r0**2*om**2/(r0**2-r1**2))/om
ri2=2*qlog(4*r0**3*(r0+r1)/(1+4*r0**4+2*r0**2*om))
. qlog(r0*(2+om)/(r0+r1))/r0**2*pi*cone
cin1=s*cone*pi/2
cin2=r1l
cin3=r12+2*c*cone*pi
print*, '*** r0,s,11,i2',r0,s,r1l,ri2
a=1/cin1/2
c0=qsgrt(om**3/pi**3)/cdagrt(a)/2*(r0-
r1)**cdexp(cin2*om-cin3)
c write(1,100)rmu,cdabs(cin1)**2,cdabs(c0)
100 format(f8.4,2(' ',f32.16))
do 12 n=1,nm
rmv=
12 enas(n+1)=rfact(n)*rmv**(-
1.5g0)**2*dreal(a**n*c0)
do 3 n=1,nmv
v1(n)=0
3 v0(n)=0
v0(1)=r0
v0(2)=1
v1(1)=1
call divpol(v1,v0,v3,nmv)
call divpol(v3,v0,v2,nmv)
call divpol(v1,v2,v0,nmv)
do 5 n=1,nmv
vef(n)=v2(n)/8+v0(n)/2+rmu*v3(n)
5 vc(n)=v2(n)/8
c print 10,'vef',(vef(n),n=1,nml)
c print 10,'vc',(vc(n),n=1,nml)
do 6 n=1,nml
nmv=2*n-1
do 7 m=1,nml
vv0(n,m)=0
7 vvl(n,m)=0
vv0(n,m)=vef(nv)
vvl(n,m)=vef(nv+1)
if(n.gt.1)vv0(n,n-1)=4*vc(nv-2)
if(n.gt.2)vv0(n,n-2)=3*vc(nv-4)
if(n.gt.1)vvl(n,n-1)=4*vc(nv-1)
if(n.gt.2)vvl(n,n-2)=3*vc(nv-3)
6 continue
nq=0
do 8 nl=1,nml
call anhgen(vv0,vv1,t0,t1,nq,n1,nml,e)
8 en(nl)=e
print 10,'En',(en(n),n=1,nml)
print 10,'Enas',(enas(n),n=1,nml)
print 40,'E/Ea',(en(n)/enas(n),n=2,nml)
10 format(1x,a4,5(e15.8))/(5x,5e15.8))
40 format(1x,a4,5(f15.4))/(5x,5f15.4))
30 format(1x,a7,10f12.6)/(8x,10f12.6))
do 9 n=1,nm
9 ratio(nla,n)=en(n+1)/enas(n+1)
goto99
88 do 15 n=1,nm
15 write(1,200)n,(ratio(nl,n),nl=1,nla)
200 format(14,20(' ',f20.5))
c 200 format(14,20(' ',e12.5))
stop
end

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SUBROUTINE ANHGEN(V0,V1,T0,T1,MQ,NM,NMM,EN)
IMPLICIT real*16(A-H,O-Z)
DIMENSION
V0(120,120),V1(120,120),T0(120,200),T1(120,200)
. .XX(404)
LOGICAL ODD
10 FORMAT(1X,A10,I3,(10D12.5))
IF(NM.NE.1)GOTO2
EN=V0(1,1)
GOTO1
2 OM=gsqrt(V0(2,2)*2)
MQ=MQ/2+1
IF(NM.NE.2)GOTO3
EN=V0(2,1)+(MQ+.5g0)*OM
DO 13 M=1,50
13 T0(1,M)=0
T0(1,M)=1
GOTO1
3 NAH=NMM-2
NBH=NM-2
NBT=NBH+1
NA=2*NAH
MA=MQ+1
MM2=MA+3*NAH+2
MMH=(MM2-1)/2
NB2=2*NBH
NB1=NB2-1
DO 14 M=1,MMH
T0(NBT,M)=0
14 T1(NBT,M)=0
DO 4 NB=NB1,NB2
NBP3=NB+3
IN=1
IF((MA+NB)/2*.2.EQ.MA+NB)IN=2
MDB=3*MIN0(NB,NA-NB)
MINB=MAX0(IN,MA-MDB)
MAXB=MA+MDB
DO 5 MB=MINB,MAXB,2
DO 12 M=1,MM2
12 XX(M)=0
XX(MB)=1
T=0
DO 6 KX1=1,NBP3
KX=KX1-1
KV=KX/2+1
INC=3-1H
IF((KX/2)*2.EQ.KX)INC=IN
MIC=MAX0(INC,MB-KX)
MAC=MIN0(MB-KX,MM2-2)
IX=1
IF((KX/2)*2.EQ.KX)IX=2
INX=MAX0(IX,KX-2)
IF(INX.GT.NB)GOTO 15
ODD=NB-INX.NE.(NB-INX)/2*2
DO 8 NX=INX,NB,2
NC=NB-NX
NT=(NC+3)/2
MDC=3*MIN0(NC,NA-NC)
MINC=MAX0(INC,NA-MDC,MIC)
MAXC=MIN0(MA+MDC,MAC)
NV=NX/2+2
V=-V0(NV,KV)
IF(IX.EQ.1)V=-V1(NV,KV)
TX=0
DO 7 MC=MINC,MAXC,2
MT=(MC+1)/2
TC=T0(MT,MT)
IF(ODD)TC=T1(MT,MT)
7 TX=TX+XX(MC)*TC
8 T=T+TX*V
15 INC=3-INC
MIC=MAX0(INC,MB-KX-1)
MAC=MIN0(MAC+1,MM2-2)
DO 9 MB=MIC,MAC,2
XX(M)=XX(M+1)
IF(M.GT.1)XX(M)=XX(M)+XX(M-1)*(M-1)/OM/2
9 CONTINUE
6 CONTINUE
MT=(MB+1)/2
IF(MB.NE.MA)T=T/OM/(MB-MA)
IF(NB.EQ.NB2)T0(NBT,MT)=T
IF(NB.EQ.NB1)T1(NBT,MT)=T
5 CONTINUE
4 CONTINUE
EN=-T0(NBT,M0)
T0(NBT,M0)=0
1 V0(NM,1)=V0(NM,1)-EN
RETURN
END
SUBROUTINE DIVPOL(A,B,C,N)
IMPLICIT real*16(A-H,O-Z)
DIMENSION A(N),B(N),C(N)
D011=1,N
C(I)=A(I)
IF(I.EQ.1)GOTO11
D012K=2,I
IK=I-K+2
12 C(I)=C(I)-C(K-1)*B(IK)
11 C(I)=C(I)/B(1)
RETURN
END

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Input data

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61
.1
.5
1
2
5
0

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Output of the program

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1/D-expansion for 1/8/r**2+r**2/2+rmu/r
Type Mcoeff
number of coef. = 60
Type rmu
*** r0,s,11,i2 0.100000 0.705321846547879707870036855 31 0.00000-00
0.3012108157020124544642320061371
-0.3012108157020124544642320061371

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