

**《数值分析A》**

**计算实习**

**作业二**

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2014-12-1

# 一、算法设计方案：

### 1. 按照题目给出的矩阵定义对矩阵A赋初值：

### 2. 对矩阵A进行Householder变换，使其拟上三角化：

对应的函数为nishangsanjiaohua(A,n)

### 3. 输出拟上三角化后的A：

### 4. 对拟上三角化后的矩阵A使用带双步位移的QR分解法进行逐次迭代

(最大迭代次数it=500)，逐个求出其特征值，对应的函数为QR,DQR

### 5. 输出QR分解过程完毕后的A及求得的特征向量：

### 6. 对于在第三步中求得的每个实特征值，使用带原点平移的反幂法求出其所对应的特征向量

对应的函数为eigenvec()；其中包含一个解方程的程序段。这部分也用迭代完成，仍然将最大迭代次数it设置为500；

### 7. 输出矩阵A的特征向量，结束计算：

# 二、源代码：

!!!!!!!!!!!!!!!!!!!!!!!!!

!hw 2双位移法求特征值

!!!!!!!!!!!!!!!!!!!!!!!!!

program step

implicit none

integer,parameter::n=4

integer,parameter::it=500 !控制最大迭代步数

real,parameter::er=1.E-12 !控制最大迭代步数

real B(n,n),A(n,n),Q(n,n)

REAL EE(n,n) !用于检查

!A迭代过程中主对角线元素,lamb(i,0)表示复数，lamb(i,1)表示实数

real lamb(n,2)

integer i,j,k,m,iter,t

real s(3),pa,pb,pc !一元二次方程三个系数及两个根

WRITE(\*,\*)'ER',er

OPEN(1,FILE='CHECKhw.2.txt',STATUS='UNKNOWN')

do i=1,n

do j=1,n

B(i,j)=0

if(i.eq.j) then

B(i,j)=1

end if

if (i.gt.(j)) then

B(i,j)=1000

end if

end do

end do

do i=1,n

do j=1,n

if (i.NE.j) then

B(i,j)=sin(0.5\*i+0.2\*j)

else

B(i,j)=1.52\*cos(i+1.2\*j)

end if

end do

end do

do i=1,n

do j=1,n

A(i,j)=B(i,j)

end do

end do

CALL nishangsanjiaohua(A,n)

write(1,\*)'initial A'

DO i=1,n

WRITE(1,\*)(A(i,j),j=1,n)

end do

k=1

m=n

t=3

do iter=1,it

write(\*,\*) iter

if (m.eq.3) then

write(\*,\*)'kankan'

end if

!第三步

if(t.EQ.3) THEN

if (abs(A(m,m-1)).LT.er) then

lamb(m,1)=A(m,m)

lamb(m,2)=0

write(\*,\*)'three '

write(\*,\*)'m=',m

write(\*,\*)lamb(m,1),lamb(m,2)

m=m-1

t=4

else

t=5

end if

end if

!第四步

if(t.EQ.4) THEN

if (m.LT.1) then

exit

end if

if (m.EQ.1) then

lamb(m,1)=A(m,m)

lamb(m,2)=0

exit

end if

if(m.GT.1) then

t=3

end if

end if

!第五步

if(t.EQ.5) THEN

pa=1

pb=-(A(m-1,m-1)+A(m,m))

pc=A(m-1,m-1)\*A(m,m)-A(m,m-1)\*A(m-1,m)

CALL soleq(pa,pb,pc,s)

t=6

END IF

!第六步

if(t.EQ.6) THEN

if (m.EQ.2) then

if(s(3).EQ.1) then

lamb(m,1)=s(1)

lamb(m,2)=0

lamb(m-1,1)=s(2)

lamb(m-1,2)=0

else

lamb(m,1)=s(1)

lamb(m,2)=s(2)

lamb(m-1,1)=s(1)

lamb(m-1,2)=-s(2)

end if

write(\*,\*)'six '

write(\*,\*)'m=',m

write(\*,\*)lamb(m,1),lamb(m,2)

write(\*,\*)lamb(m-1,1),lamb(m-1,2)

exit

else

t=7

end if

end if

!第七步

if(t.EQ.7) THEN

if(abs(A(m-1,m-2)).LT.er) then

if(s(3).EQ.1) then

lamb(m,1)=s(1)

lamb(m,2)=0

lamb(m-1,1)=s(2)

lamb(m-1,2)=0

else

lamb(m,1)=s(1)

lamb(m,2)=s(2)

lamb(m-1,1)=s(1)

lamb(m-1,2)=-s(2)

end if

write(\*,\*)'seven '

write(\*,\*)'m=',m

write(\*,\*)lamb(m,1),lamb(m,2)

write(\*,\*)lamb(m-1,1),lamb(m-1,2)

m=m-2

t=4

else

t=9

end if

end if

!第九步

if(t.EQ.9) THEN

CALL DQR(A,m,n)

k=k+1

t=3

end if

end do

5 write(\*,\*)'end '

write(\*,\*)'end ----------'

do i=1,n

write(\*,\*)(lamb(i,j),j=1,2)

end do

if (k.eq.200) then

! write(1,\*)'k=',k

DO i=1,n

! WRITE(1,\*)(A(i,j),j=1,n)

end do

end if

! do k=1,1

! call DQR(A,m,n)

! end do

! do i=1,n

! write(\*,\*) (A(i,j),j=1,n)

! end do

! WRITE(\*,\*) S(1),S(2),S(3)

stop

end

subroutine MULT(A,Q,n)

real A(n,n),Q(n,n),R(n,n),EE(n,n)

integer i,j,k

real s

do i=1,n

do j=1,n

s=0

do k=1,n

s=s+A(i,k)\*Q(k,j)

end do

R(i,j)=s

end do

end do

do i=1,n

do j=1,n

A(i,j)=R(i,j)

end do

end do

c write(1,\*) 'neibukankankan'

c do j=1,n

c WRITE(1,\*) (A(j,k),k=1,n)

c end do

end

subroutine QR(A,Q,n)

real A(n,n),Q(n,n),B(n,n)

real EE(n,n) !EE=Q\*R to check if QR DECOMPOSITION IF RIght

real u(n),p(n),w(n),h,c

real s !for plus and

integer i,j,r,k

do i=1,n

do j=1,n

IF(i.NE.j) then

Q(i,j)=0

else

Q(i,j)=1

END IF

end do

end do

do r=1,n-1 !n-1

s=0

do i=r+1,n

s=s+A(i,r)\*\*2

end do

! WRITE(\*,\*)'S=',S

if(s.NE.0) THEN

s=0

do i=r,n !9:42

s=s+A(i,r)\*\*2

end do

d=sqrt(s)

c WRITE(\*,\*)'D=',d

if(A(r,r).EQ.0) THEN

c=d

else if(A(r,r).GT.0) THEN

c=-d

else if(A(r,r).LT.0) THEN

c=d

end if

h=c\*\*2-c\*A(r,r)

!对u(r)赋值

do i=1,r-1

u(i)=0

end do

u(r)=A(r,r)-c

do i=r+1,n

u(i)=A(i,r)

end do

!w=Q\*u

do i=1,n

s=0

do j=1,n

s=s+Q(i,j)\*u(j)

end do

w(i)=s

end do

!Q=Q-W\*u/h

do i=1,n

do j=1,n

Q(i,j)=Q(i,j)-w(i)\*u(j)/h

end do

end do

! p=At\*u/h

do i=1,n

s=0

do j=1,n

s=s+A(j,i)\*u(j)

end do

p(i)=s/h

end do

!A=A-u\*p

do i=1,n

do j=1,n

A(i,j)=A(i,j)-u(i)\*p(j)

end do

end do

end if

end do

! CHECK AND OUTPUT

! WRITE(\*,\*)'A(I,J)'

! do i=1,n

! write(\*,\*)(B(i,j),j=1,n)

! end do

c WRITE(\*,\*)'Q(I,J)'

c do i=1,n

c write(\*,\*)(Q(i,j),j=1,n)

c end do

c WRITE(\*,\*)'R(I,J)'

c do i=1,n

c write(\*,\*)(A(i,j),j=1,n)

c end do

c WRITE(\*,\*)'A=Q\*R' !NOT RIGHT

c do i=1,n

c do j=1,n

c s=0

c do k=1,n

c s=s+Q(i,k)\*A(k,j)

c end do

c EE(i,j)=s

c end do

c end do

c do i=1,n

c write(\*,\*)(EE(i,j),j=1,n)

c end do

end

subroutine soleq(a,b,c,s)

real a,b,c,s(3),d

d=b\*\*2-4\*a\*c

! WRITE(\*,\*) a,b,c,D

if(d.GE.0) then

s(1)=(-b+sqrt(d))/(2\*a)

s(2)=(-b-sqrt(d))/(2\*a)

s(3)=1

else

s(1)=-b/(2\*a)

s(2)=sqrt(-d)/(2\*a)

s(3)=0

end if

END

subroutine DQR(A,m,n)

real s,t,A(n,n),MM(n,n),Q(n,n),R(n,n)

real B(n,n),E(n,n),C(n,n)

real p !用于累加

integer i,j,k,m,n

s=A(m-1,m-1)+A(m,m)

t=A(m-1,m-1)\*A(m,m)-A(m-1,m)\*A(m,m-1)

! write(\*,\*)'s=',s,'t=',t

do i=1,n

do j=1,n

if(i.NE.j) then

E(i,j)=0

else

E(i,j)=1

end if

end do

end do

do i=1,n

do j=1,n

p=0

do k=1,n

p=p+A(i,k)\*A(k,j)

end do

MM(i,j)=p-s\*A(i,j)+t\*E(i,j)

end do

end do

! do i=1,n

! write(\*,\*) (MM(i,j),j=1,n)

! end do

!22:23全部正确

call QR(MM,Q,n)

! do i=1,n

! write(\*,\*) (MM(i,j),j=1,n)

! end do

!B=Qt\*A

do i=1,n

do j=1,n

p=0

do k=1,n

p=p+Q(k,i)\*A(k,j)

end do

B(i,j)=p

end do

end do

!C=B\*Q

do i=1,n

do j=1,n

p=0

do k=1,n

p=p+B(i,k)\*Q(k,j)

end do

C(i,j)=p

end do

end do

do i=1,n

do j=1,n

A(i,j)=C(i,j)

end do

end do

END

subroutine nishangsanjiaohua(A,n)

real A(n,n),p(n),q(n),w(n),u(n)

real d,s,c,h,t

integer i,j,r

do r=1,n-2

s=0

do i=r+2,n

s=s+A(i,r)\*\*2

end do

if(s.NE.0) THEN

d=0

do i=r+1,n

d=d+A(i,r)\*\*2

end do

d=sqrt(d)

if(A(r+1,r).EQ.0) THEN

c=d

else if(A(r+1,r).GT.0) THEN

c=-d

else if(A(r+1,r).LT.0) THEN

c=d

end if

h=c\*\*2-c\*A(r+1,r)

!对u(r)赋值

do i=1,r

u(i)=0

end do

do i=r+2,n

u(i)=A(i,r)

end do

u(r+1)=A(r+1,r)-c

!p=At\*u/h

do i=1,n

s=0

do j=1,n

s=s+A(j,i)\*u(j)

end do

p(i)=s/h

end do

!q=A\*u/h

do i=1,n

s=0

do j=1,n

s=s+A(i,j)\*u(j)

end do

q(i)=s/h

end do

!t=Pt\*u/h

s=0

do i=1,n

s=s+p(i)\*u(i)

end do

t=s/h

!w=q-t\*u

do i=1,n

w(i)=q(i)-t\*u(i)

end do

!A=A-w\*Ut-u\*Pt

do i=1,n

do j=1,n

A(i,j)=A(i,j)-w(i)\*u(j)-u(i)\*p(j)

end do

end do

! write(1,\*)'r=',r,'A='

! DO i=1,n

! write(1,\*) (A(i,j),j=1,n)

! end do

END IF

END DO

END

SUBROUTINE eighenvalue(m,c,ev)

real,parameter::er=1.e-12

real c(m,m),u(m),y(m),b(10000)

real s,a

integer i,j,k

real error

error=1

do i=1,m !initial vector

u(i)=1

end do

u(m)=0

k=2

b(1)=10000

do while (error.GT.er) !.AND.k.LT.10000)

s=0

do i=1,m

s=s+u(i)\*\*2

end do

a=sqrt(s)

do i=1,m

y(i)=u(i)/a

end do

do i=1,m

s=0.

do j=1,m

s=s+c(i,j)\*y(j)

end do

u(i)=s

end do

s=0.

do i=1,m

s=s+y(i)\*u(i)

end do

b(k)=s

error=abs(b(k)-b(k-1))

k=k+1

end do

! write(\*,\*)k

k=k-1

ev=b(k)

! write(\*,\*) ev

END

SUBROUTINE LUDOOLITTLE(m,c,lu)

real c(m,m),lu(m,m),x(m),y(m),b(m)

real s,a

integer i,j,k,t

!lu decomposition

do j=1,m

lu(1,j)=c(1,j)

end do

do i=2,m

lu(i,1)=c(i,1)/lu(1,1)

end do

c write(\*,\*) c(1,1),c(1,2)

c write(\*,\*) c(2,1),c(2,2)

c write(\*,\*) lu(1,1),lu(1,2)

c write(\*,\*) lu(2,1),lu(2,2)

do k=2,m

do j=k,m

s=0

do t=1,k-1

s=s+lu(k,t)\*lu(t,j)

end do

lu(k,j)=c(k,j)-s

end do

if(k.LT.m) then

do i=k+1,m

s=0

do t=1,k-1

s=s+lu(i,t)\*lu(t,k)

end do

lu(i,k)=(c(i,k)-s)/lu(k,k)

end do

end if

end do

c do i=1,m

c do j=1,m

c write(\*,\*)i,j,lu(i,j)

c end do

c end do

END

# 3、计算结果

### 3.1 拟上三角化后的矩阵A(n-1)：

{-8.827516758830e-001,-9.933136491826e-002,-1.103349285994e+000,-7.600443585637e-001,1.549101079914e-001,-1.946591862872e+000,-8.782436382927e-002,-9.255889387184e-001,6.032599440534e-001,1.518860956469e-001,}

{-2.347878362416e+000,2.372370104937e+000,1.819290822208e+000,3.237804101546e-001,2.205798440320e-001,2.102692662546e+000,1.816138086098e-001,1.278839089990e+000,-6.380578124405e-001,-4.154075603804e-001,}

{-1.055685482407e-016,1.728274599968e+000,-1.171467642785e+000,-1.243839262699e+000,-6.399758341743e-001,-2.002833079037e+000,2.924947206124e-001,-6.412830068395e-001,9.783997621285e-002,2.557763574160e-001,}

{-5.393383812774e-017,-3.165873865181e-017,-1.291669534130e+000,-1.111603513396e+000,1.171346824096e+000,-1.307356030021e+000,1.803699177750e-001,-4.246385358369e-001,7.988955239304e-002,1.608819928069e-001,}

{1.533464996622e-017,5.963321406181e-017,-3.273062155360e-017,1.560126298527e+000,8.125049397515e-001,4.421756832923e-001,-3.588616128137e-002,4.691742313671e-001,-2.736595050092e-001,-7.359334657750e-002,}

{1.300562737229e-016,-3.097060010889e-017,8.556127565867e-017,0.000000000000e+000,-7.707773755194e-001,-1.583051425742e+000,-3.042843176799e-001,2.528712446035e-001,-6.709925401449e-001,2.544619929082e-001,}

{1.610216724767e-016,-2.211571837369e-016,-3.925484904011e-017,0.000000000000e+000,0.000000000000e+000,-7.463453456938e-001,-2.708365157019e-002,-9.486521893682e-001,1.195871081495e-001,1.929265617952e-002,}

{1.368550186199e-016,7.151513190805e-017,-8.672615311204e-017,0.000000000000e+000,0.000000000000e+000,0.000000000000e+000,-7.701801374364e-001,-4.697623990618e-001,4.988259468008e-001,1.137691603776e-001,}

{-2.780851300718e-017,-6.708630788363e-017,8.476127173939e-017,0.000000000000e+000,0.000000000000e+000,0.000000000000e+000,0.000000000000e+000,7.013167092107e-001,1.582180688475e-001,3.862594614233e-001,}

{-2.124604440055e-017,-1.707979758930e-016,-2.798942287067e-017,0.000000000000e+000,0.000000000000e+000,0.000000000000e+000,0.000000000000e+000,0.000000000000e+000,4.843807602783e-001,3.992777995177e-001,}

### 3.2 输出矩阵Q：

{-3.519262579534e-001 4.427591982245e-001 -6.955982513607e-001 6.486200753651e-002 3.709718861896e-001 1.855847143605e-001 -1.628942319628e-002 -1.181053169648e-001 -5.255375383724e-002 -5.486582943568e-002 }

{-9.360277287361e-001 -1.664679186545e-001 2.615299548560e-001 -2.438671728934e-002 -1.394774360893e-001 -6.977585391241e-002 6.124472142963e-003 4.440505443139e-002 1.975907909728e-002 2.062836970533e-002 }

{-4.208697095111e-017 -8.810520554692e-001 -3.989762796959e-001 3.720308728479e-002 2.127794064090e-001 1.064463557221e-001 -9.343171079758e-003 -6.774200464527e-002 -3.014340698675e-002 -3.146955080444e-002 }

{-2.150178169911e-017 4.009681353156e-017 -5.371806806439e-001 -1.234945854205e-001 -7.063151608719e-001 -3.533456368496e-001 3.101438948264e-002 2.248676491598e-001 1.000601783527e-001 1.044622748702e-001 }

{6.113458775639e-018 -3.721194648197e-017 -6.543864567200e-018 9.892235468621e-001 -1.239411731211e-001 -6.200358589825e-002 5.442272839461e-003 3.945881637235e-002 1.755813350011e-002 1.833059462907e-002 }

{5.184948268593e-017 -4.198303559531e-017 6.813401279929e-017 -5.378482288047e-017 5.323610690264e-001 -6.733900344896e-001 5.910581205868e-002 4.285425323867e-001 1.906901343193e-001 1.990794495295e-001 }

{6.419444583601e-017 4.121668945107e-017 1.464430411524e-017 -3.283635382957e-017 -1.341474910453e-017 -6.059761505747e-001 -9.165783032819e-002 -6.645586508974e-001 -2.957110877580e-001 -3.087207462557e-001 }

{5.455993559780e-017 -9.724896332186e-017 3.498286856792e-018 4.094629795107e-017 -3.277415150584e-017 4.160598752399e-017 9.933396625117e-001 -9.690440311939e-002 -4.311990584470e-002 -4.501694411183e-002 }

{-1.108640877071e-017 4.655237056115e-017 2.452839917036e-017 -4.761835194658e-017 -7.077347744100e-018 -9.498452443925e-017 -3.473474944273e-017 5.410088006061e-001 -5.817540838226e-001 -6.073480580545e-001 }

{-8.470152033092e-018 9.650816729410e-017 -2.593388832073e-017 -1.529514966917e-017 4.206876599631e-017 7.223508655394e-017 -3.465913020675e-017 2.153841995946e-017 -7.221591336735e-001 6.917269588876e-001 }

### 3.3 输出矩阵R：

{2.508342744917e+000 -2.185646885493e+000 -1.314609070786e+000 -3.558787493835e-002 -2.609857850388e-001 -1.283121847090e+000 -1.390878610606e-001 -8.712897972161e-001 3.849367902971e-001 3.353802899665e-001 }

{2.100627753398e-016 -1.961603277854e+000 2.407523727633e-001 7.054714572823e-001 5.957204318279e-001 5.526978774676e-001 -3.268209924413e-001 -5.769498668364e-002 2.871129330189e-001 -8.895128754189e-002 }

{-3.300197935770e-016 3.745746820842e-016 2.404534601993e+000 1.706758096328e+000 -4.239566704091e-001 3.405332305815e+000 -1.050017655852e-001 1.462257102734e+000 -6.684487469283e-001 -4.027646209664e-001 }

{3.077314570058e-017 -3.492772703900e-017 3.251022262857e-017 1.577122080722e+000 6.399535133956e-001 3.468127872427e-001 -5.701786649768e-002 4.014788054433e-001 -2.222476176311e-001 -6.317059236442e-002 }

{1.760039865880e-016 -1.997657067996e-016 1.859390275914e-016 -1.879646195051e-016 -1.447846997770e+000 -1.415724007744e+000 -2.806139044665e-001 -2.817910521892e-001 -4.611434881851e-002 1.996629079956e-001 }

{8.804885435596e-017 -9.993604101981e-017 9.301902006232e-017 -9.403235533301e-017 8.831633340975e-017 1.231641451542e+000 1.619701003419e-001 1.962638275504e-001 5.350035621760e-001 -1.509273424767e-001 }

{-7.728357669400e-018 8.771737857515e-018 -8.164606596612e-018 8.253550597851e-018 -7.751835246841e-018 0.000000000000e+000 -7.753441914209e-001 -3.464514508821e-001 4.312226803504e-001 1.234643696237e-001 }

{-5.603391361152e-017 6.359886826628e-017 -5.919690576926e-017 5.984178799325e-017 -5.620413613517e-017 0.000000000000e+000 0.000000000000e+000 1.296312940612e+000 -4.288053318338e-001 2.737334158165e-001 }

{-2.493361499851e-017 2.829982047455e-017 -2.634106316019e-017 2.662801875647e-017 -2.500935953597e-017 0.000000000000e+000 0.000000000000e+000 0.000000000000e+000 -6.707396440648e-001 -4.842320121884e-001 }

{-2.603055667460e-017 2.954485664384e-017 -2.749992480037e-017 2.779950486177e-017 -2.610963355436e-017 0.000000000000e+000 0.000000000000e+000 0.000000000000e+000 0.000000000000e+000 7.168323926323e-002 }

### 3.4 输出矩阵RQ：

{1.163074414164e+000,2.632670934508e+000,-1.772796003272e+000,-8.668899138521e-002,3.300503471047e-001,1.455162371214e+000,-9.730650448593e-001,-4.873031174655e-001,-7.756411630489e-001,-3.249201979113e-001,}

{1.836115060851e+000,1.144286420080e-001,-9.880381403133e-001,5.589725694767e-001,4.694190067101e-002,-2.978478237007e-001,1.617130577649e-002,6.936977702522e-001,1.367670571405e-001,1.419099231519e-002,}

{-1.145324022288e-016,-2.118520153533e+000,-1.876189745783e+000,-5.407071940597e-001,1.171538359721e+000,-2.550323020223e+000,1.691577936540e+000,1.229951613262e+000,1.387947777212e+000,8.667502917242e-001,}

{3.109032122072e-017,-4.217647549576e-017,-8.471995127808e-001,4.382910468318e-001,-1.008632199185e+000,-7.959374261495e-001,4.769258865577e-001,4.072683083890e-001,4.096390493527e-001,3.363378940862e-001,}

{8.221617652840e-018,9.363387998514e-017,-2.462758518199e-016,-1.432244342447e+000,-5.742284908055e-001,1.213151477723e+000,-3.457508625575e-001,-4.749853573124e-001,-3.176158274191e-001,-4.294507015032e-002,}

{1.428690057585e-016,-8.011268039778e-017,3.002919942805e-017,2.389243616390e-017,6.556779598004e-001,-9.275250974463e-001,2.529079844053e-001,6.905949216976e-001,-2.374430675823e-002,-2.429781119781e-001,}

{-7.999241030439e-017,3.603611076732e-017,1.302668895071e-018,-2.085545352010e-017,1.320122151147e-017,4.698400884876e-001,-2.730776009527e-001,7.821296259798e-001,-9.580964936399e-002,7.846239841323e-002,}

{3.335159941997e-017,-1.028506304214e-016,3.400040464121e-017,-1.064913547032e-018,-1.054897769756e-016,7.563943275135e-017,1.287679058937e+000,-3.576058900348e-001,-4.116725408806e-003,3.914268216423e-001,}

{-6.177010223407e-018,-7.049961625974e-017,1.705628110370e-017,8.030301137687e-018,-5.013376186416e-017,1.146726839223e-017,4.159636255354e-017,-3.628760503545e-001,7.398980975354e-001,7.241608309576e-002,}

{-1.910113659202e-017,1.470334412259e-017,2.001311035312e-017,-3.378973684522e-017,-3.301239095545e-017,-1.284555565375e-017,-9.024838943191e-019,1.301408592924e-017,-5.176670596524e-002,4.958522909877e-002,}

### 3.5 全部特征值如下：

(3.383039617436e+000,0.000000000000e+000)

(-2.323496210212e+000,8.930405177200e-001)

(-2.323496210212e+000,-8.930405177200e-001)

(1.577548557113e+000,0.000000000000e+000)

(-1.484039822259e+000,0.000000000000e+000)

(-9.805309562902e-001,1.139489127430e-001)

(-9.805309562902e-001,-1.139489127430e-001)

(9.355889078188e-001,0.000000000000e+000)

(6.360627875745e-001,0.000000000000e+000)

(5.650488993501e-002,0.000000000000e+000)

#### 3.5.1 属于特征值(3.383039617436e+000,0.000000000000e+000)的特征向量为：

-2.067168224156e-001

-4.289952290841e-001

-9.292842660158e-001

-5.125358695842e-001

-6.007814276243e-001

-5.076092860026e-001

1.715828807567e-001

7.965492890534e-001

1.000000000000e+000

4.733179520686e-001

#### 3.5.2 属于特征值(1.577548557113e+000,0.000000000000e+000)的特征向量为：

6.217350824598e-001

-1.115111815236e-001

-2.483773580814e+000

-1.306860840426e+000

-3.815605442546e+000

8.117305509423e+000

-1.239170883679e+000

-6.800309586188e-001

2.691900144851e+000

1.000000000000e+000

#### 3.5.3属于特征值(-1.484039822259e+000,0.000000000000e+000)的特征向量为：

-1.863596657004e+002

2.592985634361e+002

4.451064290620e+000

-9.229821461401e+001

1.000000000000e+000

-8.433771723742e-001

-6.863405121540e+000

-3.664350307334e+000

-4.075297756300e+000

1.076735184888e+001

#### 3.5.5属于特征值(9.355889078188e-001,0.000000000000e+000)的特征向量为：

2.792418944573e+000

1.598236841537e+000

-5.207507041030e-001

-1.667886451729e+000

-1.225708535879e+001

7.241214790893e+000

-5.398214501519e+000

2.841008913020e+001

-1.216518754434e+001

1.000000000000e+000

#### 3.5.6属于特征值(6.360627875745e-001,0.000000000000e+000)的特征向量为：

3.620712743827e-001

2.409622321906e-001

1.320041870259e+000

-1.510883371006e-001

-2.432249473791e+000

5.947245513463e-001

-7.663007137633e-001

1.274877394363e+000

1.000000000000e+000

7.630533982224e-002

#### 3.5.7属于特征值(5.650488993501e-002,0.000000000000e+000)的特征向量为：

-3.241531831404e-001

-3.102673735994e-001

6.035506501855e-001

-4.310397073871e-002

-6.098478232642e-001

-1.933959294137e-001

1.000000000000e+000

-4.695637659552e-001

-4.514428113045e-001

6.349714787599e-002

# 思考与体会

4.1.本程序用Fortran 77语言，在win XP系统下用Compaq Visual Fortran 编译器运行。

编程过程中遇到的关于设置变量及调试程序中遇到的困难及解决问题的方法

数组定义必须从a【1】开始

设置双精度 project ，setting，fortran，fortran data ,default real kind 8

倒序循环必须指明步长，否则编译通过，能运行但不能进入循环

do i=1,m

write(\*,\*) (cre(i,j),j=1,m)

end do

来打印出矩阵，很强

数组未定义就直接使用连接时报错

【新人】走走停停 2014-11-24 15:02:17

为啥显示\_B@8？

【宗师】臭石头雪球

2014-11-24 15:03:23

这是因为你的 B 没有定义，编译器误以为 B 是函数，找不到函数。

\_B@8 表示 B 这个函数有 8 字节的输入，一个integer是4字节，即有 2 个数的输入，二维数组没有定义，写成 B(i,j)，编译器就认为是 2 个数的输入。

链接错误，无法通过双击确定位置。

只有编译错误可以通过双击确定位置。

计算A=A\*Q时，

直接A(i,j)=A(i,k)\*Q(k,j)是错误的，一定要先B=A\*Q,然后A(i,j)=B(i,j)即矩阵乘法过程中，不能改变矩阵A的值

4.2关于本次大作业，仍沿用大作业1的解决思路，即由简单到复杂，先求解一个简单矩阵的特征值及对应特征向量，求解成功后推广到本次大作业指定的问题。

写函数块的时候同理，先对矩阵实现QR分解，然后修改QR分解程序，完成拟上三角化模块，最后添加双步位移QR分解法，求出所有特征值，最后调用大作业1的反幂法程序，求出对应特征向量。