数值扰动添加方法

readptrbx

数值扰动函数说明

```
      subroutine readptrbx
      IMPLICIT NONE
      include 'orbcom'
      REAL*8 dpx,dum,dum2,dbsmax,dnmax,omrat,ampdum,alimit
      REAL*8 thetd,zetd,sdum,agg,snmd,xx2,dp2,rdum,qmn
      REAL*8 qfun,qdum,pdum,rpol,giac,dum3
      INTEGER md,ndum,mdum,j,jm,jp,jpp,m,lptm,ldum,mload,k,jd,l,n
      INTEGER jdum,idum,kdum,mmin,mmax,nmd
C============
ccc-modified for file from Nikolai, 3/2012, read xi
      nval = 0
      modes = 0
cc      plabel = "Xin08w.1267E+01"
ccc add file for TAEs of east, 10/2017
      plabel = "file.txt" ! 读取的文件
      open(61,file=plabel,status='unknown')  ! 61是随便给的一个数字，来标识打开的文档，下面的read(61,*)就是读取标号为61的文档
      write(6,801) plabel
 801  format('  subroutine readptrbx, perturbation read=   ',A30)
      read(61,*)
      read(61,*)
      read(61,*)  ! 前三行，只读取，什么都不做
      read(61,*) lpt,nmd,mmin,mmax,dum,ndum ! 第四行的数字赋给一下变量，lpt=201
cc      write(6,*)  lpt,nmd,mmin,mmax,dum,ndum
      lptm = lpt - 1
      dpx = pw/lptm
      read (61,*) jdum,idum ! 第五行
ccc      write(6,*) jdum,idum
      do kdum = 1,2*idum ! 循环，idum控制循环次数，应该是读取扰动信息
      read(61,*) ! 读取第六行第七行
      enddo
      read (61,*) jdum,idum ! 第八行
      read (61,*) jdum,idum ! 第九行，jdum=201，idum=9，行数列数
      write(6,*) jdum,idum
ccccccccccccccccccccccccccc
      read(61,*) ((xi1(j,md),j=1,lpt),md = 1,idum) ! 第十行是真正读的内容，赋给xi1这个数组，lpt行，idum列。idum列每一列都是一个扰动。第一行到最后一行对应磁面划分，行数应当等于格点数。数值大小对应扰动大小，最大值为1。扰动幅度可以由amp控制。转化成xi1数组的时候，先转化行，再转化列，和matlab函数reshape的工作模式是一致的。
ccccccccccccccccccccccccccc
      modes = modes + mmax - mmin + 1
      nval = 1
      harm(nval) = mmax - mmin + 1
      do md = 1,harm(nval)
         alfv(md) = 1
         amp(md) = 0.1D-4
```

```
cc        omegv(md) = 1.e-4
          omegv(md) = 207*2.0D3*pi/omeg0
cc        omegv(md) = 7.5e-3
          nmod(md) = nmd
          mmod(md) = mmin - 1 + md
          enddo
 81    continue
       nvalx = nval
ccccccccccccccccccccccc
ccccc-  The perturbation harmonics are used only from md1 to md2
       md1 = 1
       md2 = modes
ccccccccccccccccccc  Select one mode
       if(nplot.eq.9.or.nplot.eq.8) then
       nvalx = 1
       nval = 1
       md1 = 1
       md2 = 1
       modes = md2 - md1 + 1
       endif
ccccccccccc-renormalize
       dum =  1.  ! amplitude renormalization
       dum2 = 1.  ! frequency renormalization
       write(6,57) dum,dum2,nval
 57    format('  change amp,freq, nval',1p2e12.4,i6)
             do 50 md = md1,md2
                amp(md) = amp(md)*dum   !   modify mode amplitude
                omegv(md) = omegv(md)*dum2     !  modify frequency
                 dum3 = omegv(md)*omeg0/(2.D3*pi)
ccc                write(6,52) md,mmod(md),nmod(md),amp(md),dum3
 52                format(i4,' mode- m,n,amp, freq ',2i4,1p2e12.4)
ccc              write(6,121)(xi1(j,md),j=1,lpt)
 50             continue
                call splnx
                return
                end
```

所以这个函数可以修改为这样

```
       subroutine readptrbx
       IMPLICIT NONE
       include 'orbcom'
       REAL*8 dpx,dum,dum2,dbsmax,dnmax,omrat,ampdum,alimit
       REAL*8 thetd,zetd,sdum,agg,snmd,xx2,dp2,rdum,qmn
       REAL*8 qfun,qdum,pdum,rpol,giac,dum3
       INTEGER md,ndum,mdum,j,jm,jp,jpp,m,lptm,ldum,mload,k,jd,l,n
       INTEGER jdum,idum,kdum,mmin,mmax,nmd,mmd
C============
       plabel = "Xin08w.1267E+01"
       open(61,file=plabel,status='unknown')
       write(6,801) plabel
 801   format('  subroutine readptrbx, perturbation read=   ',A30)
       read(61,*) jdum,idum
       lpt = jdum
       lptm = lpt - 1
       dpx = pw/lptm
       write(6,*) jdum,idum
```

```
      read(61,*) ((xi1(j,md),j=1,lpt),md = 1,idum)
ccccccccccccccccccccccccccc
      modes = idum
      nval = 1
      harm(nval) = mmax - mmin + 1

c         alfv(md) = 1
c         amp(md) = 1.D-4
c         omegv(md) = 207*2.0D3*pi/omeg0
c         nmod(md) = nmd
c         mmod(md) = mmd
 81   continue
      nvalx = nval
ccccccccccccccccccccccc
ccccc-  The perturbation harmonics are used only from md1 to md2
      md1 = 1
      md2 = modes
ccccccccccccccccccc  Select one mode
      if(nplot.eq.9.or.nplot.eq.8) then
      nvalx = 1
      nval = 1
      md1 = 1
      md2 = 1
      modes = md2 - md1 + 1
      endif
ccccccccc-renormalize
      dum =  1.  ! amplitude renormalization
      dum2 = 1.  ! frequency renormalization
      write(6,57) dum,dum2,nval
 57   format('  change amp,freq, nval',1p2e12.4,i6)
           do 50 md = md1,md2
               dum3 = omegv(md)*omeg0/(2.D3*pi)
 52              format(i4,' mode- m,n,amp, freq ',2i4,1p2e12.4)
 50          continue
             call splnx
             return
             end
```

扰动文件

扰动文件的格式为

```
 81   8 ; 第一行为: 行数, 列数
  0.000 ; 第二行: 整个扰动数据都要放在第三行. 所以第三行的数字个数为 行数x列数
```

扰动数据的生成方法:

- 假设数组a是扰动数据, 则a的每一列对应一个扰动, 一列的每一行对应一个扰动的大小
- 然后将a展开 `b = a(:)'`;
- 把b存进文件 `save('perturb.dat','b','-ascii')`
- 把文件里面的数据粘贴到扰动文件下

最终的文件应该只有两行, 像这样:

```
81 9
    0.0000000e+00   2.4596200e-05   4.7438100e-05   6.9478900e-05   9.0052400e-05
    1.0914200e-04   1.2668300e-04   1.4259500e-04   1.5679300e-04   1.6919200e-04
    1.7967500e-04   1.8812100e-04   1.9442600e-04   1.9842200e-04   1.9997800e-04
    1.9893300e-04   1.9506800e-04   1.8819800e-04   1.7811300e-04   1.6451200e-04
    1.4712800e-04   1.2565100e-04   9.9687100e-05   6.8764800e-05   3.2403100e-05
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   2.0503700e-06   2.7400400e-05   5.0272400e-05   7.2126000e-05
    9.2518300e-05   1.1142000e-04   1.2875900e-04   1.4446400e-04   1.5844900e-04
    1.7061100e-04   1.8084500e-04   1.8903000e-04   1.9505600e-04   1.9875500e-04
    1.9999900e-04   1.9860700e-04   1.9438100e-04   1.8711900e-04   1.7660700e-04
    1.6254900e-04   1.4468000e-04   1.2266300e-04   9.6104700e-05   6.4527800e-05
    2.7448000e-05   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   5.9632300e-06   3.0233100e-05   5.3082700e-05
    7.4757100e-05   9.4962300e-05   1.1367200e-04   1.3080900e-04   1.4631100e-04
    1.6007100e-04   1.7199600e-04   1.8198400e-04   1.8990500e-04   1.9564700e-04
    1.9905100e-04   1.9997800e-04   1.9823600e-04   1.9364000e-04   1.8598900e-04
    1.7504900e-04   1.6052700e-04   1.4216300e-04   1.1960700e-04   9.2444200e-05
    6.0206100e-05   2.2392000e-05   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
    0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
```

不要有很多行.

perturbylm.f | Xin08w.1267E+01 | filea1.txt | filea.txt | c.txt

```
81 2 1 1 1.3 2
81   8
    0.0000000e+00   2.4596200e-05   4.7438100e-05   6.9478900e-05   9.0052400e-05   1.0914200e-04   1.2668300e-04
    1.4259500e-04   1.5679300e-04   1.6919200e-04   1.7967500e-04   1.8812100e-04   1.9442600e-04   1.9842200e-04
    1.9997800e-04   1.9893300e-04   1.9506800e-04   1.8819800e-04   1.7811300e-04   1.6451200e-04   1.4712800e-04
    1.2565100e-04   9.9687100e-05   6.8764800e-05   3.2403100e-05   0.0000000e+00   0.0000000e+00   0.0000000e+00
```

修改orbit文件并提交任务

- 在perturb.f中指定扰动文件文件名
- 在orbit.F中设置`npert=4`并写下`call readptrbx`

readptrba

数值扰动函数说明

```
      subroutine readptrba
      IMPLICIT NONE
      include 'orbcom'
      REAL*8 dpx,dum,dum2,dbsmax,dnmax,omrat,ampdum,alimit
      REAL*8 thetd,zetd,sdum,agg,snmd,xx2,dp2,rdum,qmn
      REAL*8 qfun,qdum,pdum,rpol,giac
      INTEGER md,ndum,mdum,j,jm,jp,jpp,m,lptm,ldum,mload,k,jd,l,n
C============
ccc-modified for file from Nikolai, read alpha
```

```
      plabel = "ptr1_sm_141711.dat"
      open(61,file=plabel,status='unknown')
      write(6,801) plabel
 801  format('  subroutine readptrba, perturbation read=   ',A30)
      nval = 0
      read(61,*)
      read(61,*)
      read(61,*) lpt,mload ! 行数和列数, 列数也是扰动文件中数值的行数
      lptm = lpt - 1
      dpx = pw/lptm
      nval = nval+1
      do  md=1,mload
         alfv(md) = nval
         read(61,*)  !  空行
         read(61,*) mmod(md),nmod(md),omrat,amp(md)
         omegv(md) = 13.69*omrat*2.0D3*pi/omeg0
         read(61,111) (a1(j,md),j=1,lpt) ! 一行数据保存为数组中的一列
      enddo ! 说明如果有n个扰动, 就要写n行
      modes = modes + mload
      harm(nval) = mload
      open(62,file='ptr2_sm_141711.dat',status='unknown') ! 读取多个扰动文件, 可以删
除. 如需要读取, 复制粘贴这一段即可
      read(62,*)
      read(62,*)
      read(62,*) lpt,mload
      lptm = lpt - 1
      dpx = pw/lptm
      nval = nval+1
      do  md = modes + 1,modes + mload
         alfv(md) = nval
      read(62,*)
      read(62,*) mmod(md),nmod(md),omrat,amp(md)
      omegv(md) = 13.69*omrat*6280/omeg0
      read(62,111) (a1(j,md),j=1,lpt)
      enddo
      modes = modes + mload
      harm(nval) = mload
 111  format(8e12.5)
      open(63,file='ptr3_sm_141711.dat',status='unknown')
      read(63,*)
      read(63,*)
      read(63,*) lpt,mload
      lptm = lpt - 1
      dpx = pw/lptm
      nval = nval+1
      do  md = modes + 1,modes + mload
         alfv(md) = nval
      read(63,*)
      read(63,*) mmod(md),nmod(md),omrat,amp(md)
      omegv(md) = 13.69*omrat*6280/omeg0
      read(63,111) (a1(j,md),j=1,lpt)
      enddo
      modes = modes + mload
      harm(nval) = mload
      open(64,file='ptr4_sm_141711.dat',status='unknown')
      read(64,*)
      read(64,*)
      read(64,*) lpt,mload
```

```
      lptm = lpt - 1
      dpx = pw/lptm
      nval = nval+1
      do  md = modes + 1,modes + mload
         alfv(md) = nval
      read(64,*)
      read(64,*) mmod(md),nmod(md),omrat,amp(md)
      omegv(md) = 13.69*omrat*6280/omeg0
      read(64,111) (a1(j,md),j=1,lpt)
      enddo
      modes = modes + mload
      harm(nval) = mload
      nvalx = nval
ccccccccccccccccccccccc
ccccc-  The perturbation harmonics are used only from md1 to md2
      md1 = 1
      md2 = modes
ccccccccccccccccccc  Select one mode
      if(nplot.eq.9.or.nplot.eq.8) then
      nvalx = 1
      nval = 1
      md1 = 1
      md2 = 14
      modes = md2 - md1 + 1
      endif
ccccccccccc-renormalize
      dum =  1.    ! mode renormalization
      dum2 = 1.
      write(6,57) dum,dum2,nval
 57   format('  change amp,freq, nval',1p3e12.4,i6)
            do 50 md = md1,md2
               amp(md) = amp(k)*dum    !   modify mode amplitude
               omegv(md) = omegv(k)*dum2          !  modify frequency
ccc               write(6,52) md,nmod(md),mmod(md),amp(md)
 52               format(' mode- n,m,amp ',3i4,1pe12.4)
 50            continue
ccccccccccccccc- now spline
               call splna
      return
      end
```

因此, 程序修改为

```
      subroutine readptrba
      IMPLICIT NONE
      include 'orbcom'
      REAL*8 dpx,dum,dum2,dbsmax,dnmax,omrat,ampdum,alimit
      REAL*8 thetd,zetd,sdum,agg,snmd,xx2,dp2,rdum,qmn
      REAL*8 qfun,qdum,pdum,rpol,giac
      INTEGER md,ndum,mdum,j,jm,jp,jpp,m,lptm,ldum,mload,k,jd,l,n
C============
ccc-modified for file from Nikolai, read alpha
      nval = 0
      plabel = "ptr1_sm_141711.dat"
      open(61,file=plabel,status='unknown')
      write(6,801) plabel
      read(61,*)
```

```
      read(61,*)
      read(61,*) lpt,mload
      lptm = lpt - 1
      dpx = pw/lptm
      nval = nval+1
      do  md=1,mload
         alfv(md) = nval
         read(61,*)
         read(61,*) mmod(md),nmod(md),omrat,amp(md)
         omegv(md) = 13.69*omrat*2.0D3*pi/omeg0
         read(61,111) (a1(j,md),j=1,lpt)
      enddo
      modes = modes + mload
      harm(nval) = mload
 111  format(8e12.5)
 801  format('  subroutine readptrba, perturbation read=   ',A30)
      nvalx = nval
ccccccccccccccccccccccc
ccccc-  The perturbation harmonics are used only from md1 to md2
      md1 = 1
      md2 = modes
ccccccccccccccccccc  Select one mode
      if(nplot.eq.9.or.nplot.eq.8) then
      nvalx = 1
      nval = 1
      md1 = 1
      md2 = 14
      modes = md2 - md1 + 1
      endif
ccccccccccc-renormalize
      dum =  1.   ! mode renormalization
      dum2 = 1.
      write(6,57) dum,dum2,nval
 57   format('  change amp,freq, nval',1p3e12.4,i6)
           do 50 md = md1,md2
              amp(md) = amp(k)*dum   !   modify mode amplitude
              omegv(md) = omegv(k)*dum2          !  modify frequency
 52              format(' mode- n,m,amp ',3i4,1pe12.4)
 50           continue
ccccccccccccccc- now spline
              call splna
      return
      end
```

扰动文件

```
; 第一行，随便写，可以写一些关于文件的说明信息
; 第二行，随便写
lpt mload; 第三行，格点数 模数，比如说81个格点，8个模，接下来开始进入模的读取循环，一共循环
mload次
; 第四行，空行
m n omrat amp; 第五行，m值，n值，omrat是频率，单位是kHz，amp是幅度
; 第六行，把这一支模的信息写在这一行里，一共有lpt个数据
; 仿照第四行到第六行写入数据
```

最后的文件应该像这样

```
alfv mode
2020/4/6
81 8

10 8 2 5e-4
   1.2565100e-04   9.9687100e-05   6.8764800e-05   3.2403100e-05   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00

7 6 3 2e-4
   1.2565100e-04   9.9687100e-05   6.8764800e-05   3.2403100e-05   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
   0.0000000e+00   0.0000000e+00   0.0000000e+00   0.0000000e+00
```