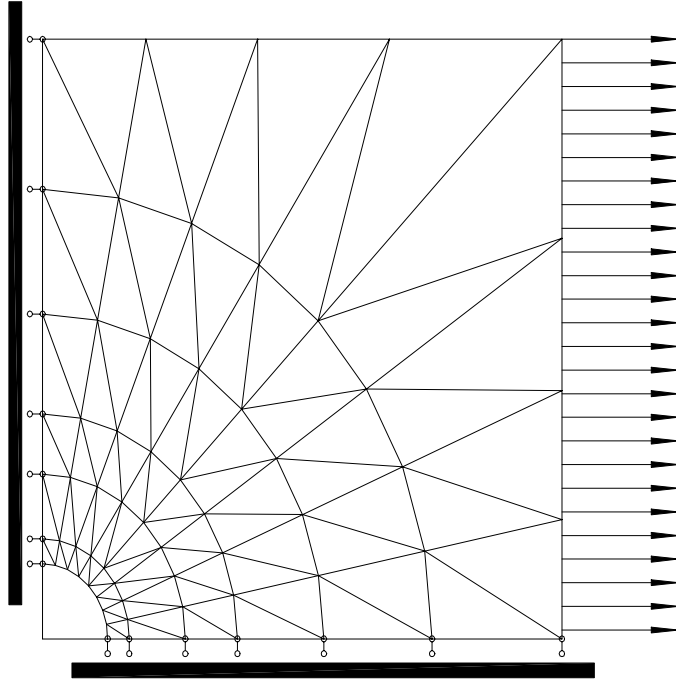


# 弹性力学大作业

班级 结六(2) 姓名 陆新征 学号 960133

## 一：命题



## 二：源程序清单

```
include 'Lxz_Tools.f90'
```

```
module Joint
```

```
  use Lxz_Tools
```

```
  implicit none
```

```
  type::typ_Joint
```

```
    real(rkind)::x,y
```

```
    integer(ikind)::GDOF(2)
```

```
  end type typ_Joint
```

```
end module Joint
```

```
module Support
```

```

use Lxz_Tools
use Joint
implicit none

type::typ_Support
    type(typ_Joint) :: SJoint
    integer(ikind) :: DOF
end type typ_Support

contains

subroutine SetSupport(GK,Support,GLoad)
    real(rkind),intent(inout)::GK(:,,:),GLoad(:)
    type(typ_Support),intent(in)::Support(:)
    integer(ikind)::i,j,k
    do i=1,size(Support)
        k=Support(i)%DOF
        j=Support(i)%SJoint%GDOF(k)
        do k=1,size(GK,dim=2)
            GK(j,k)=0.0D0
            GK(k,j)=0.0D0
        end do
        GK(j,j)=1D0;GLoad(j)=0D0
    end do
end subroutine SetSupport
end module Support

```

```

module Force
    use Lxz_Tools
    use Joint
    implicit none
    type::typ_Force
        type(typ_Joint) :: FJoint
        integer(ikind) :: DOF
        real(rkind) :: Val
    end type typ_Force
contains

subroutine SetGLoad(Force,GLoad)
    real(rkind),intent(inout)::GLoad(:)
    type(typ_Force),intent(in)::Force(:)
    integer(ikind)::i,j,k
    GLoad=0D0
    do i=1,size(Force)
        k=Force(i)%DOF

```

```

        j=Force(i)%FJoint%GDOF(k)
        GLoad(j)=GLoad(j)+Force(i)%Val
    end do
end subroutine SetGLoad
end module Force

module Elem_Triangle3 //常应变三角元
    use Lxz_Tools
    use Joint
    implicit none

    type::typ_Triangle3
        type(typ_Joint):: EJoint(3)
        real(rkind)::EK(6,6),B(3,6),D(3,3)
        real(rkind)::A,E,u,t
        real(rkind)::Stress(3)
    end type typ_Triangle3

contains
    subroutine Triangle3_GetProp(Triangle3)
        type(typ_Triangle3),intent(inout)::Triangle3(:)
        integer(ikind)::i,j
        real(rkind)::b(3),c(3),Temp(3,3)
        do i=1,size(Triangle3)
            b(1)=Triangle3(i)%EJoint(2)%y-Triangle3(i)%EJoint(3)%y
            b(2)=Triangle3(i)%EJoint(3)%y-Triangle3(i)%EJoint(1)%y
            b(3)=Triangle3(i)%EJoint(1)%y-Triangle3(i)%EJoint(2)%y

            c(1)=Triangle3(i)%EJoint(3)%x-Triangle3(i)%EJoint(2)%x
            c(2)=Triangle3(i)%EJoint(1)%x-Triangle3(i)%EJoint(3)%x
            c(3)=Triangle3(i)%EJoint(2)%x-Triangle3(i)%EJoint(1)%x
            Triangle3(i)%D(1,1)=1D0
            Triangle3(i)%D(2,2)=1d0
            Triangle3(i)%D(1,2)=Triangle3(i)%u
            Triangle3(i)%D(2,1)=Triangle3(i)%u
            Triangle3(i)%D(3,1)=0d0
            Triangle3(i)%D(3,2)=0d0
            Triangle3(i)%D(2,3)=0d0
            Triangle3(i)%D(1,3)=0d0;
            Triangle3(i)%D(3,3)=(1-Triangle3(i)%u)/2;

            Triangle3(i)%D=(Triangle3(i)%E/(1-Triangle3(i)%u*Triangle3(i)%u))*Triangle3(i)%D;
            Temp(:,1)=1D0
            Temp(1,2)=Triangle3(i)%EJoint(1)%x

```

```

Temp(2,2)=Triangle3(i)%EJoint(2)%x
Temp(3,2)=Triangle3(i)%EJoint(3)%x
Temp(1,3)=Triangle3(i)%EJoint(1)%y
Temp(2,3)=Triangle3(i)%EJoint(2)%y
Temp(3,3)=Triangle3(i)%EJoint(3)%y
Triangle3(i)%A=abs(0.5D0*matdet(Temp))
do j=1,3
    Triangle3(i)%B(1,2*j-1)=b(j);Triangle3(i)%B(1,2*j)=0D0
    Triangle3(i)%B(2,2*j-1)=0D0;Triangle3(i)%B(2,2*j)=c(j)
    Triangle3(i)%B(3,2*j-1)=c(j);Triangle3(i)%B(3,2*j)=b(j)
end do
Triangle3(i)%B=Triangle3(i)%B/(2*Triangle3(i)%A)
Triangle3(i)%EK=matmul(matmul(transpose(&
Triangle3(i)%B),Triangle3(i)%D),Triangle3(i)%B)&
*Triangle3(i)%t*Triangle3(i)%A
end do
end subroutine Triangle3_GetProp

subroutine Triangle3_GetGK(GK, Triangle3)
real(rkind),intent(inout):: GK(:, :)
type(typ_Triangle3),intent(in):: Triangle3(:)
integer(ikind):: i,j,k,b1,b2,a1,a2
do i=1,size(Triangle3)
    do j=1,3
        do k=1,3
            a1=Triangle3(i)%EJoint(j)%GDOF(1)
            a2=Triangle3(i)%EJoint(j)%GDOF(2)
            b1=Triangle3(i)%EJoint(k)%GDOF(1)
            b2=Triangle3(i)%EJoint(k)%GDOF(2)
            GK(a1,b1)=GK(a1,b1)+&
                Triangle3(i)%EK(2*j-1,2*k-1)
            GK(a1,b2)=GK(a1,b2)+&
                Triangle3(i)%EK(2*j-1,2*k)
            GK(a2,b1)=GK(a2,b1)+&
                Triangle3(i)%EK(2*j,2*k-1)
            GK(a2,b2)=GK(a2,b2)+&
                Triangle3(i)%EK(2*j,2*k)
        end do
    end do
end do
end subroutine Triangle3_GetGK

subroutine Triangle3_GetStress(GDisp, Triangle3)
real(rkind),intent(in) :: GDisp(:)

```

```

type(typ_Triangle3),intent(inout)::Triangle3(:)
integer(ikind):: i,j
real(rkind):: EDisp(6)
do i=1,size(Triangle3)
    do j=1,3
        EDisp(2*j-1)=GDisp(Triangle3(i)%EJoint(j)%GDOF(1))
        EDisp(2*j)=GDisp(Triangle3(i)%EJoint(j)%GDOF(2))
    end do
    Triangle3(i)%Stress=matmul(Triangle3(i)%D,matmul(Triangle3(i)%B,EDisp))
end do
end subroutine Triangle3_GetStress
end module Elem_Triangle3

```

```

module Elem_Rect4//四节点等参元

```

```

    use Lxz_Tools

```

```

    use Joint

```

```

    implicit none

```

```

type::typ_Rect4

```

```

    type(typ_Joint) :: EJoint(4)

```

```

    real(rkind)::EK(8,8),B(3,8),D(3,3),J(2,2)

```

```

    real(rkind)::E,u,t

```

```

end type typ_Rect4

```

```

contains

```

```

subroutine Rect4_GetProp(Rect4)

```

```

    type(typ_Rect4),intent(in out)::Rect4(:)

```

```

    real(rkind)::J1(2,4),J2(4,2),Temp(2,1),InvJ(2,2)

```

```

    integer(ikind)::i,j,k

```

```

    real(rkind)::r,s

```

```

    do k=1,size(Rect4)

```

```

        Rect4(k)%EK=0d0

```

```

        Rect4(k)%B=0d0

```

```

        Rect4(k)%D(1,1)=1d0

```

```

        Rect4(k)%D(2,2)=1d0

```

```

        Rect4(k)%D(1,2)=Rect4(k)%u

```

```

        Rect4(k)%D(2,1)=Rect4(k)%u

```

```

        Rect4(k)%D(3,1)=0d0

```

```

        Rect4(k)%D(3,2)=0d0

```

```

        Rect4(k)%D(2,3)=0d0

```

```

        Rect4(k)%D(1,3)=0d0;

```

```

        Rect4(k)%D(3,3)=(1-Rect4(k)%u)/2;

```

```

        Rect4(k)%D=(Rect4(k)%E/(1-Rect4(k)%u*Rect4(k)%u))*Rect4(k)%D;
    end do
end subroutine Rect4_GetProp

```

```

do i=1,2
  do j=1,2
    r=0.577350269189626D0*(-1D0)**i
    s=0.577350269189626D0*(-1D0)**j
    J1(1,:)=/(-1-s),(1-s),(1+s),-(1+s)/
    J1(2,:)=/(-1-r),-(1+r),(1+r),(1-r)/
    J2(1,:)=/Rect4(k)%EJoint(1)%x,Rect4(k)%EJoint(1)%y/
    J2(2,:)=/Rect4(k)%EJoint(2)%x,Rect4(k)%EJoint(2)%y/
    J2(3,:)=/Rect4(k)%EJoint(3)%x,Rect4(k)%EJoint(3)%y/
    J2(4,:)=/Rect4(k)%EJoint(4)%x,Rect4(k)%EJoint(4)%y/
    Rect4(k)%J=(0.25D0)*(matmul(J1,J2))
    Temp(1,1)=-0.25D0*(1-s);    Temp(2,1)=-0.25D0*(1-r);
    InvJ=matinv(Rect4(k)%J)
    Temp=matmul(InvJ,Temp);
    Rect4(k)%B(1,1)=Temp(1,1); Rect4(k)%B(2,2)=Temp(2,1);
    Rect4(k)%B(3,1)=Temp(2,1); Rect4(k)%B(3,2)=Temp(1,1);
    Temp(1,1)=0.25D0*(1-s);    Temp(2,1)=-0.25D0*(1+r);
    Temp=matmul(InvJ,Temp);
    Rect4(k)%B(1,3)=Temp(1,1); Rect4(k)%B(2,4)=Temp(2,1);
    Rect4(k)%B(3,3)=Temp(2,1); Rect4(k)%B(3,4)=Temp(1,1);
    Temp(1,1)=0.25D0*(1+s);    Temp(2,1)=0.25D0*(1+r);
    Temp=matmul(InvJ,Temp);
    Rect4(k)%B(1,5)=Temp(1,1); Rect4(k)%B(2,6)=Temp(2,1);
    Rect4(k)%B(3,5)=Temp(2,1); Rect4(k)%B(3,6)=Temp(1,1);
    Temp(1,1)=-0.25D0*(1+s);    Temp(2,1)=0.25D0*(1-r);
    Temp=matmul(InvJ,Temp);
    Rect4(k)%B(1,7)=Temp(1,1); Rect4(k)%B(2,8)=Temp(2,1);
    Rect4(k)%B(3,7)=Temp(2,1); Rect4(k)%B(3,8)=Temp(1,1);
    Rect4(k)%EK=Rect4(k)%EK+&
      (&
        matmul(matmul(transpose(Rect4(k)%B),&
          Rect4(k)%D),Rect4(k)%B)&
        )*matdet(Rect4(k)%J)*Rect4(k)%t
  end do
end do
end subroutine Rect4_GetProp

```

```

subroutine Rect4_GetGK(GK,Rect4)
  real(rkind),intent(inout):: GK(:,)
  type(typ_Rect4),intent(in):: Rect4(:)
  integer(ikind):: i,j,k,b1,b2,a1,a2
  do i=1,size(Rect4)
    do j=1,4

```

```

        do k=1,4
            a1=Rect4(i)%EJoint(j)%GDOF(1)
            a2=Rect4(i)%EJoint(j)%GDOF(2)
            b1=Rect4(i)%EJoint(k)%GDOF(1)
            b2=Rect4(i)%EJoint(k)%GDOF(2)
            GK(a1,b1)=GK(a1,b1)+&
                Rect4(i)%EK(2*j-1,2*k-1)
            GK(a1,b2)=GK(a1,b2)+&
                Rect4(i)%EK(2*j-1,2*k)
            GK(a2,b1)=GK(a2,b1)+&
                Rect4(i)%EK(2*j,2*k-1)
            GK(a2,b2)=GK(a2,b2)+&
                Rect4(i)%EK(2*j,2*k)
        end do
    end do
end subroutine Rect4_GetGK
end module Elem_Rect4

include 'Elem.f90'
program main
    use Lxz_Tools
    use Joint
    use Support
    use Force
    use Elem_Triangle3
    use Elem_Rect4
    implicit none

    type(typ_Joint),allocatable:: GJoint(:)
    type(typ_Triangle3),allocatable:: Triangle3(:)
    type(typ_Rect4),allocatable:: Rect(:)
    type(typ_Support),allocatable:: GSupport(:)
    type(typ_Force),allocatable:: GForce(:)
    integer(ikind):: NJoint,NTriangle,NElem,NSupport,NLoad;
    real(rkind),allocatable:: GK(:,,:),GLoad(:),GDisp(:)
    integer(ikind):: i

    call Input('4.ipt')
    call Triangle3_GetProp(Triangle3)
    call matprint(Triangle3(3)%EK,8)
    call Triangle3_GetGK(GK,Triangle3)
    call matprint(GK,8)

```

```

call Rect4_GetProp(Rect)
call Rect4_GetGK(GK,Rect)
call SetGLoad(GForce,GLoad)
call SetSupport(GK,GSupport,GLoad)
write(*,*)
call matprint(GK,8)
call Gauss(GK,GLoad ,GDisp)
do i=1,NJoint
    write(*,*) GDisp(i*2-1),GDisp(i*2)
end do
call Triangle3_GetStress(GDisp,Triangle3)
write(*,*)
do i=1,NTriangle
    write(*,*) Triangle3(i)%Stress
end do

stop

contains

subroutine Input(filename)
    character (len=*)::filename
    integer(ikind)::i,j,k(8)

    open(5,file='5.ipt',status='OLD',position='REWIND')
    read(5,*) NJoint,NTriangle,NElem,NSupport,NLoad;
    allocate(GK(2*NJoint,2*NJoint));GK=0D0
    allocate(GLoad(2*NJoint));GLoad=0D0
    allocate(GDisp(2*NJoint))
    allocate(GJoint(NJoint))
    allocate(Rect(NElem))
    allocate(GSupport(NSupport))
    allocate(GForce(NLoad))
    allocate(Triangle3(NTriangle))
    do i=1,NJoint
        read(5,*) GJoint(i)%x,GJoint(i)%y
        GJoint(i)%GDOF(1)=2*i-1;GJoint(i)%GDOF(2)=2*i
    end do
    do i=1,NElem
        read(5,*) k(1),k(2),k(3),k(4),&
        Rect(i)%E,Rect(i)%u,Rect(i)%t
        do j=1,4
            Rect(i)%EJoint(j)=GJoint(k(j))
        end do
    end do

```



```

end do
do i=1,NTriangle
    read(5,*) k(1),k(2),k(3),&
    Triangle3(i)%E,Triangle3(i)%u,Triangle3(i)%t
    do j=1,4
        Triangle3(i)%EJoint(j)=GJoint(k(j))
    end do
end do
do i=1,NSupport
    read(5,*) k(1),k(2)
    GSupport(i)%SJoint=GJoint(k(1))
    GSupport(i)%DOF=k(2)
end do
do i=1,NLoad
    read(5,*) k(1),k(2),GForce(i)%Val
    GForce(i)%FJoint=GJoint(k(1))
    GForce(i)%DOF=k(2)
end do
end subroutine Input

```

end program main

### 三：输出结果

	$\sigma_x$	$\sigma_y$	$\tau_{xy}$
单元 1	53604156.9693031	4445322.01947467	-2462537.04425200
单元 2	31273523.3249669	2131433.92658100	-4027733.35988360
单元 3	33855375.5830158	6802624.15086688	729787.339524726
单元 4	24169200.4371930	4030459.83167562	-414137.958140732
单元 5	24578262.4886557	4300838.86472495	872115.377174725
单元 6	21997550.3159925	3182255.68193054	195169.784059072
单元 7	21870911.9605896	2483022.99372643	494754.866840923
单元 8	21501172.3339921	2199484.24985229	290937.487353979
单元 9	21256179.4810108	1343502.33584873	307382.461747867

单元	10		
	21969667.7356397	1506624.96003756	390359.297578143
单元	11		
	21620675.4022370	448743.782879099	230742.124167828
单元	12		
	24278967.1992597	698131.284882345	399811.620284354
单元	13		
	49037439.0703889	7734756.08895382	-5788242.49733598
单元	14		
	27697476.2288959	3455643.65743943	-5702175.75448603
单元	15		
	33437786.6674267	5870092.61669299	738393.430588456
单元	16		
	23518938.5256916	2618524.40065935	-472412.146391839
单元	17		
	25275537.2998112	3365154.31760016	1496421.54573693
单元	18		
	21853139.5900102	1923680.82200164	338536.717088807
单元	19		
	22406048.0714493	2077510.92661034	979655.559726547
单元	20		
	21334640.2267326	1502325.78568111	432385.555174280
单元	21		
	21514764.6645329	1207861.37395289	732112.312169265
单元	22		
	21773324.9428698	1200005.99762975	631471.526999948
单元	23		
	21756990.7192088	-281785.675751461	1002081.88169464
单元	24		
	24908040.0560181	264162.217476525	796511.992591854
单元	25		
	40185920.9906867	7679397.80006273	-7932996.92312899
单元	26		
	22936369.0330139	3205285.18393636	-6257273.37696105
单元	27		
	32505692.1021101	3256037.57137232	37770.3667752476
单元	28		
	22393983.6980525	342290.200774476	-1239791.27519257
单元	29		
	26036334.4372568	1575792.82920235	1143785.79919048
单元	30		
	21407701.1808006	309074.633327599	-217701.360553114
单元	31		
	22991026.8114276	1293509.01579168	813825.307387283

单元	32		
	20745610.6221485	609168.157484740	86962.6149067444
单元	33		
	21768304.8390950	1058894.90712258	755156.444130578
单元	34		
	20792676.3951774	749557.374011941	624263.879615011
单元	35		
	22089135.7086378	-909730.818824975	1494263.16330916
单元	36		
	25598361.0263153	130307.864134667	760488.931113671
单元	37		
	29218095.5411389	5589225.07563461	-7975305.64671674
单元	38		
	17653477.1289647	1802738.59104712	-6177890.23351853
单元	39		
	30138653.5116430	152031.961458378	-1797869.75799872
单元	40		
	20384530.4979957	-1711502.12813522	-2722881.98670301
单元	41		
	25944780.1238838	-151671.054562805	-370515.651700875
单元	42		
	20426638.9004275	-937348.309505469	-1328252.10717970
单元	43		
	23090191.0557399	536078.468294241	-74264.0869711404
单元	44		
	19595045.1787832	-82246.1265590213	-686007.390896710
单元	45		
	21672941.3265961	1214839.31720565	318099.436112775
单元	46		
	18241176.6880653	289758.787786514	200394.141740895
单元	47		
	22336986.7766350	-862483.489522487	1530370.40176470
单元	48		
	26410603.4152069	380245.737944307	1085602.73721446
单元	49		
	16569058.1496016	137121.016692633	-8959634.95490076
单元	50		
	16351748.7314522	1728484.34386756	-5807433.36763993
单元	51		
	22227498.4284718	-3801764.87499522	-6846988.77449169
单元	52		
	20772176.6266984	-500035.915160577	-3153412.23253923
单元	53		
	21734781.2523242	-2504356.05540434	-3734447.68922093

单元	54		
	21136664.4406938	-27285.0251729227	-1764429.86764862
单元	55		
	20672831.4957972	-1088642.06601217	-2242530.08652104
单元	56		
	20612412.1649656	720564.477731599	-1176055.20371635
单元	57		
	19355562.7178857	-51869.4051015705	-1684926.13363612
单元	58		
	19397624.2309220	1659424.53677960	-479713.282987903
单元	59		
	20686009.4714365	-444551.183763029	-1040988.47691486
单元	60		
	17122443.4159821	100522.967232572	3661571.17527429
单元	61		
	7173000.98972498	-5009401.48557462	-5891185.63638626
单元	62		
	8941429.62892492	393323.813516127	-5178708.64424894
单元	63		
	15987038.7349822	-3090803.61157209	-7543369.48989117
单元	64		
	16407639.6509106	-725232.186469409	-4205044.10718213
单元	65		
	18861909.6877699	-1324546.72398838	-4624577.47993397
单元	66		
	19025180.3300240	-189265.802291850	-2578834.42346987
单元	67		
	19600349.3914823	-476484.238044975	-2773710.14776925
单元	68		
	19897855.1499995	476450.863160407	-1988136.34008094
单元	69		
	19044060.7591366	56699.2786575356	-2255502.85326943
单元	70		
	19365503.2736605	894232.025755285	-1769644.20375488
单元	71		
	19038195.9774643	363938.694894246	-2115151.69020298
单元	72		
	17770602.0138141	-4023768.19309714	714151.912279746
单元	73		
	2063386.10666652	-9905473.27119529	-3192849.33970908
单元	74		
	4268740.65765795	-676401.038751784	-2816547.76739361
单元	75		
	10663552.6319847	-1667104.94322646	-5724305.85725362

单元	76		
	11940543.6894597	-289808.492277277	-3645400.55312708
单元	77		
	16149225.7085838	498031.708885013	-3783898.77467500
单元	78		
	16551755.1954306	-135306.367154647	-2448092.21654696
单元	79		
	18895437.4774982	502475.336344211	-2279797.39013934
单元	80		
	18840308.4946994	-150865.893473827	-2065474.22493958
单元	81		
	20514025.2681398	289268.719921203	-1964189.47029523
单元	82		
	19872647.3916957	421685.823655959	-2941755.65196155
单元	83		
	19220313.0458327	963832.752785203	-2101318.97880563
单元	84		
	18212246.5406695	-4153056.49181656	-1926349.44027673
单元	85		
	1600861.75945636	-12876095.8111749	-886815.706065201
单元	86		
	2618618.05971142	-1840864.14665875	-192579.680099856
单元	87		
	8102509.20569349	-781125.138130006	-2283022.00990973
单元	88		
	8952533.07915104	57738.8715612301	-1586577.72395227
单元	89		
	14800944.4447135	1790637.75969918	-1469170.76312874
单元	90		
	14677593.9077579	-114756.448892455	-1280722.67777834
单元	91		
	18868301.6139784	1211637.33278653	-866888.670766185
单元	92		
	18013538.2921647	-1011015.99912976	-1356958.11241647
单元	93		
	22477632.4708923	409724.809661979	-885686.368198222
单元	94		
	20124649.3943323	-2227750.31225245	-2487734.59945620
单元	95		
	28557410.7242318	394007.731587695	-1839093.96218776
单元	96		
	21362214.0642776	596382.583934890	-6378760.14733099

## 四：结果分析

采用二单元平均法

1: AB 边

2: CD 边

单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$
74	-6.76E+05	76	-2.90E+05	78	-1.35E+05	80	-1.51E+05	82	421685.82	84	-4153056
73	-9.91E+06	75	-1.67E+06	77	4.98E+05	79	5.03E+05	81	289268.72	83	963832.75
平均	-5.29E+06	平均	-9.78E+05	平均	1.81E+05	平均	1.76E+05	平均	3.55E+05	平均	-1.59E+06
86	-1.84E+06	88	5.77E+04	90	1.22E+05	92	-1.01E+05	93	409724.81	95	394007.73
85	-1.29E+07	87	-7.81E+05	89	-1.15E+05	91	1.21E+05	94	-2227750	96	596382.58
平均	-7.36E+06	平均	-3.62E+05	平均	3.44E+03	平均	1.01E+04		-9.09E+05		4.95E+05
	-1.05E+07		5.63E+05		-2.63E+05		-2.38E+05		-2.81E+06		3.63E+06
单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$	单元号	$\sigma_y$
13	4.90E+07	15	3.34E+07	17	2.53E+07	19	2.24E+07	21	21514765	23	21756991
14	2.77E+07	16	2.35E+07	18	4.37E+07	20	2.13E+07	22	21773325	24	24908040
平均	3.84E+07	平均	2.85E+07	平均	3.45E+07	平均	2.19E+07	平均	2.16E+07	平均	2.33E+07
1	5.36E+07	3	3.39E+07	5	2.46E+07	7	2.19E+07	9	21256179	11	21620675
2	3.13E+07	4	2.42E+07	6	2.20E+07	8	2.15E+07	10	21969668	12	24278967
平均	4.24E+07	平均	2.90E+07	平均	2.33E+07	平均	2.17E+07		2.16E+07		2.29E+07
	4.85E+07		2.98E+07		6.48E+06		2.14E+07		2.16E+07		2.24E+07

由此推导出最大应力