Table 83 (3pp) abridged allen.OPM (for "STAGSworthy" design

Abridged allen2.OPM file for optimum design with ICONSV = 0 and IQUICK = 0. This is the "STAGSworthy" configuration.

```
 *********** LOAD SET NO. 1  **************
 ICASE =  1  (ICASE=1 MEANS PANEL MIDLENGTH)
             (ICASE=2 MEANS AT RINGS                        )

   APPLIED LOADS IN LOAD SET A ("eigenvalue" loads):
         Applied     axial       stress resultant, Nx= -8.0250E+03
         Applied circumferential stress resultant, Ny= -8.0250E-03
         Applied    in-plane     shear  resultant,Nxy=  4.0125E+01
         Applied     axial       moment resultant, Mx=  0.0000E+00
         Applied circumferential moment resultant, My=  0.0000E+00
         Applied pressure (positive for upward),    p =  4.0530E-05

   APPLIED LOADS IN LOAD SET B ( fixed uniform loads):
         Applied     axial       stress resultant,Nx0=  0.0000E+00
         Applied circumferential stress resultant,Ny0=  0.0000E+00
         Applied    in-plane    shear  resultant,Nxy0=  0.0000E+00

 NOTE: "F.S." means "Factor of Safety";
 "DONL" means "Donnell shell theory used.";
 "SAND" means "Sanders shell theory used." panda2.news ITEM 128
 "Dseg" means "Segment numbering used in discretized model"
 "Iseg" means "Segment numbering used for input data." ITEM 272
0
 MARGINS FOR CURRENT DESIGN: LOAD CASE NO. 1, SUBCASE NO. 1
 MAR. MARGIN
 NO.  VALUE                 DEFINITION
 1  2.36E-03 Local buckling from discrete model-1.,M=4   axial halfwaves;FS=1.55
 2  1.57E-03 Bending-torsion buckling; M=4  ;FS=1.5556
 3  2.09E-03 Bending-torsion buckling: Koiter theory,M=4   axial halfwav;FS=1.55
 4  1.72E+00 eff.stress:matl=1,STR,Dseg=3,node=11,layer=1,z=0.0788; MID.;FS=1.
 5  4.26E+04 stringer popoff margin:(allowable/actual)-1, web 1  MID.;FS=1.
 6  1.47E-02 (m=4   lateral-torsional buckling load factor)/(FS)-1;FS=1.5556
 7  2.99E-01 Inter-ring bucklng, discrete model, n=24  circ.halfwaves;FS=1.5556
 8  1.72E+00 eff.stress:matl=1,STR,Iseg=3,at:TIP,layer=1,z=0.;-MID.;FS=1.
 9 -1.51E-02 buck.(DONL);simp-support general buck;M=3;N=8;slope=0.;FS=2.1538
10  8.95E+00 buck.(DONL);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556
11  4.72E+02 (Max.allowable ave.axial strain)/(ave.axial strain) -1; FS=1.
12 -1.83E-02 buck.(SAND);simp-support general buck;M=3;N=8;slope=0.;FS=2.1538
13  8.95E+00 buck.(SAND);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556


 *********** LOAD SET NO. 1  **************
 ICASE =  2  (ICASE=1 MEANS PANEL MIDLENGTH)
             (ICASE=2 MEANS AT RINGS                        )

   APPLIED LOADS IN LOAD SET A ("eigenvalue" loads):
         Applied     axial       stress resultant, Nx= -8.0250E+03
         Applied circumferential stress resultant, Ny= -8.0250E-03
         Applied    in-plane     shear  resultant,Nxy=  4.0125E+01
         Applied     axial       moment resultant, Mx=  0.0000E+00
         Applied circumferential moment resultant, My=  0.0000E+00
         Applied pressure (positive for upward),    p =  4.0530E-05

   APPLIED LOADS IN LOAD SET B ( fixed uniform loads):
         Applied     axial       stress resultant,Nx0=  0.0000E+00
         Applied circumferential stress resultant,Ny0=  0.0000E+00
         Applied    in-plane    shear  resultant,Nxy0=  0.0000E+00

 NOTE: "F.S." means "Factor of Safety";
 "DONL" means "Donnell shell theory used.";
 "SAND" means "Sanders shell theory used." panda2.news ITEM 128
 "Dseg" means "Segment numbering used in discretized model"
 "Iseg" means "Segment numbering used for input data." ITEM 272
0
 MARGINS FOR CURRENT DESIGN: LOAD CASE NO. 1, SUBCASE NO. 2
 MAR. MARGIN
 NO.  VALUE                 DEFINITION
 1  2.72E-02 Local buckling from discrete model-1.,M=4   axial halfwaves;FS=1.55
 2  2.69E-02 Bending-torsion buckling; M=4  ;FS=1.5556
 3  2.31E-02 Bending-torsion buckling: Koiter theory,M=4   axial halfwav;FS=1.55
 4  1.78E+00 eff.stress:matl=1,STR,Dseg=4,node=11,layer=1,z=0.1427; RNGS;FS=1.
 5  5.30E+04 stringer popoff margin:(allowable/actual)-1, web 1  RNGS;FS=1.
 6  3.72E-02 (m=4   lateral-torsional buckling load factor)/(FS)-1;FS=1.5556
```

Table 83 (p. 2 of 3)

```
 7  2.99E-01 Inter-ring bucklng, discrete model, n=24  circ.halfwaves;FS=1.5556
 8  1.79E+00 eff.stress:matl=1,SKN,Iseg=2,at:n=6,layer=1,z=0.1427;-RNGS;FS=1.
 9  8.91E+00 buck.(DONL);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556
10  4.69E+02 (Max.allowable ave.axial strain)/(ave.axial strain) -1; FS=1.
11  8.91E+00 buck.(SAND);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556


 *********** LOAD SET NO. 2  **************
 ICASE =  1  (ICASE=1 MEANS PANEL MIDLENGTH)
             (ICASE=2 MEANS AT RINGS                          )

   APPLIED LOADS IN LOAD SET A ("eigenvalue" loads):
         Applied     axial       stress resultant, Nx= -8.0250E+03
         Applied circumferential stress resultant, Ny= -8.0250E-03
         Applied    in-plane     shear  resultant,Nxy=  4.0125E+01
         Applied     axial       moment resultant, Mx=  0.0000E+00
         Applied circumferential moment resultant, My=  0.0000E+00

   APPLIED LOADS IN LOAD SET B ( fixed uniform loads):
         Applied     axial       stress resultant,Nx0=  0.0000E+00
         Applied circumferential stress resultant,Ny0=  1.1266E+04
         Applied    in-plane    shear  resultant,Nxy0=  0.0000E+00
         Applied pressure (positive for upward),   p = -5.6900E+01

 NOTE: "F.S." means "Factor of Safety";
 "DONL" means "Donnell shell theory used.";
 "SAND" means "Sanders shell theory used." panda2.news ITEM 128
 "Dseg" means "Segment numbering used in discretized model"
 "Iseg" means "Segment numbering used for input data." ITEM 272
0
 MARGINS FOR CURRENT DESIGN: LOAD CASE NO. 2, SUBCASE NO. 1
 MAR. MARGIN
 NO.  VALUE                  DEFINITION
 1   3.92E-02 Local buckling from discrete model-1.,M=6   axial halfwaves;FS=1.1
 2   3.17E-02 Bending-torsion buckling; M=6  ;FS=1.1
 3   1.57E-02 Bending-torsion buckling: Koiter theory,M=6   axial halfwav;FS=1.1
 4   1.41E-02 eff.stress:matl=1,SKN,Dseg=2,node=6,layer=1,z=-0.1427; MID.;FS=1.26
 5   3.02E+03 stringer popoff margin:(allowable/actual)-1, web 1  MID.;FS=1.2658
 6   4.91E-02 (m=6   lateral-torsional buckling load factor)/(FS)-1;FS=1.1
 7   1.54E+00 Inter-ring bucklng, discrete model, n=12  circ.halfwaves;FS=1.1
 8   1.45E-02 eff.stress:matl=1,SKN,Iseg=2,at:n=6,layer=1,z=-0.1427;-MID.;FS=1.26
 9   1.22E+00 buck.(DONL);simp-support general buck;M=3;N=7;slope=0.;FS=1.1
10   2.00E+00 buck.(DONL);simp-support general buck;(0.85*altsol);FS=1.
11   1.32E+01 buck.(DONL);rolling with smear rings; M=61;N=1;slope=0.;FS=1.1
12   3.40E+02 (Max.allowable ave.axial strain)/(ave.axial strain) -1; FS=1.
13   1.21E+00 buck.(SAND);simp-support general buck;M=3;N=7;slope=0.;FS=1.1
14   2.00E+00 buck.(SAND);simp-support general buck;(0.85*altsol);FS=1.
15   1.32E+01 buck.(SAND);rolling with smear rings; M=61;N=1;slope=0.;FS=1.1


 *********** LOAD SET NO. 2  **************
 ICASE =  2  (ICASE=1 MEANS PANEL MIDLENGTH)
             (ICASE=2 MEANS AT RINGS                          )

   APPLIED LOADS IN LOAD SET A ("eigenvalue" loads):
         Applied     axial       stress resultant, Nx= -8.0250E+03
         Applied circumferential stress resultant, Ny= -8.0250E-03
         Applied    in-plane     shear  resultant,Nxy=  4.0125E+01
         Applied     axial       moment resultant, Mx=  0.0000E+00
         Applied circumferential moment resultant, My=  0.0000E+00

   APPLIED LOADS IN LOAD SET B ( fixed uniform loads):
         Applied     axial       stress resultant,Nx0=  0.0000E+00
         Applied circumferential stress resultant,Ny0=  1.1266E+04
         Applied    in-plane    shear  resultant,Nxy0=  0.0000E+00
         Applied pressure (positive for upward),   p = -5.6900E+01

 NOTE: "F.S." means "Factor of Safety";
 "DONL" means "Donnell shell theory used.";
 "SAND" means "Sanders shell theory used." panda2.news ITEM 128
 "Dseg" means "Segment numbering used in discretized model"
 "Iseg" means "Segment numbering used for input data." ITEM 272
0
 MARGINS FOR CURRENT DESIGN: LOAD CASE NO. 2, SUBCASE NO. 2
 MAR. MARGIN
 NO.  VALUE                  DEFINITION
 1   3.66E-01 Local buckling from discrete model-1.,M=6   axial halfwaves;FS=1.1
 2   4.96E-01 Bending-torsion buckling; M=6  ;FS=1.
```

Table 83 (p. 3 of 3)

```
  3  3.07E-01 Bending-torsion buckling: Koiter theory,M=6   axial halfwav;FS=1.1
  4  5.79E-03 eff.stress:matl=1,STR,Dseg=4,node=11,layer=1,z=0.1427; RNGS;FS=1.26
  5  1.45E+04 stringer popoff margin:(allowable/actual)-1, web 1  RNGS;FS=1.2658
  6  3.47E-01 (m=6   lateral-torsional buckling load factor)/(FS)-1;FS=1.1
  7  1.54E+00 Inter-ring bucklng, discrete model, n=12  circ.halfwaves;FS=1.1
  8  1.46E-02 eff.stress:matl=1,SKN,Iseg=2,at:n=6,layer=1,z=0.1427;-RNGS;FS=1.265
  9  1.28E+01 buck.(DONL);rolling with smear rings; M=61;N=1;slope=0.;FS=1.1
 10  3.32E+02 (Max.allowable ave.axial strain)/(ave.axial strain) -1; FS=1.
 11  1.28E+01 buck.(SAND);rolling with smear rings; M=61;N=1;slope=0.;FS=1.1
 ***********  ALL 2 LOAD SETS PROCESSED  ***********
 *****************************************************


          SUMMARY OF INFORMATION FROM OPTIMIZATION ANALYSIS
 VAR. DEC. ESCAPE LINK. LINKED  LINKING    LOWER    CURRENT     UPPER         DEFINITION
  NO. VAR.  VAR.  VAR.    TO   CONSTANT    BOUND     VALUE      BOUND
   1   Y     N     N      0    0.00E+00  2.00E+00 8.5210E+00  5.00E+01        B(STR):stiffener s»
pacing, b: STR seg=NA, layer=NA
   2   N     N     Y      1    3.33E-01  0.00E+00 2.8375E+00  0.00E+00       B2(STR):width of st»
ringer base, b2 (must be > 0, see
   3   Y     N     N      0    0.00E+00  6.50E-02 2.7722E+00  1.05E+01        H(STR):height of s»
tiffener (type H for sketch), h:
   4   Y     Y     N      0    0.00E+00  6.50E-02 2.8549E-01  2.00E+00    T(1 )(SKN):thickness f»
or layer index no.(1 ): SKN seg=1
   5   Y     Y     N      0    0.00E+00  6.50E-02 1.5755E-01  3.00E+00    T(2 )(STR):thickness f»
or layer index no.(2 ): STR seg=3
   6   Y     N     N      0    0.00E+00  2.00E+00 3.1000E+01  5.00E+01        B(RNG):stiffener s»
pacing, b: RNG seg=NA, layer=NA
   7   N     N     N      0    0.00E+00  0.00E+00 0.0000E+00  0.00E+00       B2(RNG):width of ri»
ng base, b2 (zero is allowed): RN
   8   Y     N     N      0    0.00E+00  6.50E-02 9.8591E+00  1.05E+01        H(RNG):height of s»
tiffener (type H for sketch), h:
   9   Y     Y     N      0    0.00E+00  6.50E-02 6.5000E-02  3.00E+00    T(3 )(RNG):thickness f»
or layer index no.(3 ): RNG seg=3

 ****************************************************
 ******************* DESIGN OBJECTIVE ******************
 *************                          ***********
0
   CURRENT VALUE OF THE OBJECTIVE FUNCTION:
 VAR. STR/ SEG. LAYER   CURRENT
 NO.  RNG  NO.   NO.     VALUE               DEFINITION
            0     0   2.702E+03    WEIGHT OF THE ENTIRE PANEL

  TOTAL WEIGHT OF SKIN                                 =    2.1580E+03
  TOTAL WEIGHT OF SUBSTIFFENERS                        =    0.0000E+00
  TOTAL WEIGHT OF STRINGERS                            =    3.8745E+02
  TOTAL WEIGHT OF RINGS                                =    1.5626E+02
  SPECIFIC WEIGHT (WEIGHT/AREA) OF STIFFENED PANEL=    3.5027E-02

 *************                       ************
 ******************* DESIGN OBJECTIVE ******************
 *****************************************************
```

"STAGS worthy" optimum design.

Table 84 allen.OPT (1st load set only)

```
n          $ Do you want a tutorial session and tutorial output?
-8025      $ Resultant (e.g. lb/in) normal to the plane of screen, Nx( 1)
0          $ Resultant (e.g. lb/in) in the plane of the screen,    Ny( 1)
0          $ In-plane shear in load set A,                      Nxy( 1)
n          $ Does the axial load vary in the L2 direction?
0          $ Applied axial moment resultant (e.g. in-lb/in), Mx( 1)
0          $ Applied hoop moment resultant (e.g. in-lb/in), My( 1)
y          $ Want to include effect of transverse shear deformation?
0          $ IQUICK = quick analysis indicator (0 or 1)
y          $ Do you want to vary M for minimum local buckling load?
n          $ Do you want to choose a starting M for local buckling?
y          $ Do you want to perform a "low-axial-wavenumber" search?
2.153846   $ Factor of safety for general instability, FSGEN( 1)
1.555556   $ Factor of safety for panel (between rings) instability, FSPAN( 1)
1.555556   $ Minimum load factor for local buckling (Type H for HELP), FSLOC( 1)
1.555556   $ Minimum load factor for stiffener buckling (Type H), FSBSTR( 1)
1          $ Factor of safety for stress, FSSTR( 1)
y          $ Do you want "flat skin" discretized module for local buckling?
n          $ Do you want wide-column buckling to constrain the design?
0          $ Resultant (e.g. lb/in) normal to the plane of screen, Nx0( 1)
0          $ Resultant (e.g. lb/in) in the plane of the screen,    Ny0( 1)
1          $ Axial load applied along the (0=neutral plane), (1=panel skin)
0          $ Uniform applied pressure [positive upward. See H(elp)], p( 1)
0          $ Out-of-roundness, Wimpg1=(Max.diameter-Min.diam)/4, Wimpg1( 1)
0          $ Initial buckling modal general imperfection amplitude, Wimpg2( 1)
0          $ Initial buckling modal inter-ring imperfection amplitude,Wpan( 1)
0          $ Initial local imperfection amplitude (must be positive), Wloc( 1)
n          $ Do you want PANDA2 to change imperfection amplitudes (see H(elp))?( 1)
y          $ Do you want PANDA2 to find the general imperfection shape?( 1)
0          $ Maximum allowable average axial strain (type H for HELP)( 1)
n          $ Is there any thermal "loading" in this load set (Y/N)?
y          $ Do you want a "complete" analysis (type H for "Help")?
n          $ Want to provide another load set ?
n          $ Do you want to impose minimum TOTAL thickness of any segment?
n          $ Do you want to impose maximum TOTAL thickness of any segment?
n          $ Do you want to impose minimum TOTAL thickness of any segment?
n          $ Do you want to impose maximum TOTAL thickness of any segment?
n          $ Use reduced effective stiffness in panel skin (H(elp), Y or N)?
2          $ NPRINT= output index (-1=min. 0=good, 1=ok, 2=more, 3=too much)
0          $ Index for type of shell theory (0 or 1 or 2), ISAND
n          $ Does the postbuckling axial wavelength of local buckles change?
n          $ Want to suppress general buckling mode with many axial waves?
n          $ Do you want to double-check PANDA-type eigenvalues [type (H)elp]?
1          $ Choose (0=transverse inextensional; 1=transverse extensional)
0          $ Choose ICONSV = -1 or 0 or 1 or H(elp), ICONSV
2          $ Choose type of analysis (ITYPE = 1 or 2 or 3 or 4 or 5)
Y          $ Do you want to prevent secondary buckling (mode jumping)?
y          $ Do you want to use the "alternative" buckling solution?
1.000000   $ Factor of safety for "alternative" model of general buckling
```

Table 85 allen.OPM for "STAGSworthy" design

```
Abridged allen2.OPM file for optimum design
with ICONSV = 0 and IQUICK = 0. This is the
"STAGSworthy" configuration.

Only the first load set is processed here
because that is the load step for which we
wish to compare results with STAGS.

 *********** LOAD SET NO. 1  **************
 ICASE =  1  (ICASE=1 MEANS PANEL MIDLENGTH)
             (ICASE=2 MEANS AT RINGS                         )

   APPLIED LOADS IN LOAD SET A ("eigenvalue" loads):
         Applied     axial        stress resultant, Nx= -8.0250E+03
         Applied circumferential stress resultant, Ny= -8.0250E-03
         Applied    in-plane      shear  resultant,Nxy=  4.0125E+01
         Applied     axial        moment resultant, Mx=  0.0000E+00
         Applied circumferential moment resultant, My=  0.0000E+00
         Applied pressure (positive for upward),   p =  4.0530E-05

   APPLIED LOADS IN LOAD SET B ( fixed uniform loads):
         Applied     axial        stress resultant,Nx0=  0.0000E+00
         Applied circumferential stress resultant,Ny0=  0.0000E+00
         Applied    in-plane    shear  resultant,Nxy0=  0.0000E+00

 NOTE: "F.S." means "Factor of Safety";
 "DONL" means "Donnell shell theory used.";
 "SAND" means "Sanders shell theory used." panda2.news ITEM 128
 "Dseg" means "Segment numbering used in discretized model"
 "Iseg" means "Segment numbering used for input data." ITEM 272
0
 MARGINS FOR CURRENT DESIGN: LOAD CASE NO. 1, SUBCASE NO. 1
 MAR. MARGIN
 NO.  VALUE              DEFINITION
 1   2.36E-03 Local buckling from discrete model-1.,M=4   axial halfwaves;FS=1.55     1.55927
 2   1.57E-03 Bending-torsion buckling; M=4  ;FS=1.5556                              1.55804
 3   2.09E-03 Bending-torsion buckling: Koiter theory,M=4   axial halfwav;FS=1.55    1.55885
 4   1.72E+00 eff.stress:matl=1,STR,Dseg=3,node=11,layer=1,z=0.0788; MID.;FS=1.
 5   4.26E+04 stringer popoff margin:(allowable/actual)-1, web 1  MID.;FS=1.
 6   1.47E-02 (m=4   lateral-torsional buckling load factor)/(FS)-1;FS=1.5556        1.57847
 7   2.99E-01 Inter-ring bucklng, discrete model, n=24  circ.halfwaves;FS=1.5556     2.0207
 8   1.72E+00 eff.stress:matl=1,STR,Iseg=3,at:TIP,layer=1,z=0.;-MID.;FS=1.
 9  -1.51E-02 buck.(DONL);simp-support general buck;M=3;N=8;slope=0.;FS=2.1538       2.12128
10   8.95E+00 buck.(DONL);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556
11   4.72E+02 (Max.allowable ave.axial strain)/(ave.axial strain) -1; FS=1.
12  -1.83E-02 buck.(SAND);simp-support general buck;M=3;N=8;slope=0.;FS=2.1538
13   8.95E+00 buck.(SAND);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556


 *********** LOAD SET NO. 1  **************
 ICASE =  2  (ICASE=1 MEANS PANEL MIDLENGTH)
             (ICASE=2 MEANS AT RINGS                         )

   APPLIED LOADS IN LOAD SET A ("eigenvalue" loads):
         Applied     axial        stress resultant, Nx= -8.0250E+03
         Applied circumferential stress resultant, Ny= -8.0250E-03
         Applied    in-plane      shear  resultant,Nxy=  4.0125E+01
         Applied     axial        moment resultant, Mx=  0.0000E+00
         Applied circumferential moment resultant, My=  0.0000E+00
         Applied pressure (positive for upward),   p =  4.0530E-05

   APPLIED LOADS IN LOAD SET B ( fixed uniform loads):
         Applied     axial        stress resultant,Nx0=  0.0000E+00
         Applied circumferential stress resultant,Ny0=  0.0000E+00
         Applied    in-plane    shear  resultant,Nxy0=  0.0000E+00

 NOTE: "F.S." means "Factor of Safety";
 "DONL" means "Donnell shell theory used.";
 "SAND" means "Sanders shell theory used." panda2.news ITEM 128
 "Dseg" means "Segment numbering used in discretized model"
 "Iseg" means "Segment numbering used for input data." ITEM 272
0
 MARGINS FOR CURRENT DESIGN: LOAD CASE NO. 1, SUBCASE NO. 2
 MAR. MARGIN
 NO.  VALUE              DEFINITION
 1   2.72E-02 Local buckling from discrete model-1.,M=4   axial halfwaves;FS=1.55
 2   2.69E-02 Bending-torsion buckling; M=4  ;FS=1.5556
```

Table 85 (p. 2 of 2)

```
  3  2.31E-02 Bending-torsion buckling: Koiter theory,M=4   axial halfwav;FS=1.55
  4  1.78E+00 eff.stress:matl=1,STR,Dseg=4,node=11,layer=1,z=0.1427; RNGS;FS=1.
  5  5.30E+04 stringer popoff margin:(allowable/actual)-1, web 1  RNGS;FS=1.
  6  3.72E-02 (m=4   lateral-torsional buckling load factor)/(FS)-1;FS=1.5556
  7  2.99E-01 Inter-ring bucklng, discrete model, n=24  circ.halfwaves;FS=1.5556
  8  1.79E+00 eff.stress:matl=1,SKN,Iseg=2,at:n=6,layer=1,z=0.1427;-RNGS;FS=1.
  9  8.91E+00 buck.(DONL);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556
 10  4.69E+02 (Max.allowable ave.axial strain)/(ave.axial strain) -1; FS=1.
 11  8.91E+00 buck.(SAND);rolling with smear rings; M=61;N=1;slope=0.;FS=1.5556
 ***********  ALL 1 LOAD SETS PROCESSED  ***********
 ****************************************************

         SUMMARY OF INFORMATION FROM OPTIMIZATION ANALYSIS
 VAR. DEC. ESCAPE LINK. LINKED  LINKING    LOWER    CURRENT     UPPER       DEFINITION
  NO. VAR.  VAR.  VAR.    TO   CONSTANT    BOUND     VALUE      BOUND
   1   Y     N     N      0    0.00E+00  2.00E+00 8.5210E+00  5.00E+01       B(STR):stiffener s»
pacing, b: STR seg=NA, layer=NA
   2   N     N     Y      1    3.33E-01  0.00E+00 2.8375E+00  0.00E+00      B2(STR):width of st»
ringer base, b2 (must be > 0, see
   3   Y     N     N      0    0.00E+00  6.50E-02 2.7722E+00  1.05E+01       H(STR):height of s»
tiffener (type H for sketch), h:
   4   Y     Y     N      0    0.00E+00  6.50E-02 2.8549E-01  2.00E+00    T(1 )(SKN):thickness f»
or layer index no.(1 ): SKN seg=1
   5   Y     Y     N      0    0.00E+00  6.50E-02 1.5755E-01  3.00E+00    T(2 )(STR):thickness f»
or layer index no.(2 ): STR seg=3
   6   Y     N     N      0    0.00E+00  2.00E+00 3.1000E+01  5.00E+01       B(RNG):stiffener s»
pacing, b: RNG seg=NA, layer=NA
   7   N     N     N      0    0.00E+00  0.00E+00 0.0000E+00  0.00E+00      B2(RNG):width of ri»
ng base, b2 (zero is allowed): RN
   8   Y     N     N      0    0.00E+00  6.50E-02 9.8591E+00  1.05E+01       H(RNG):height of s»
tiffener (type H for sketch), h:
   9   Y     Y     N      0    0.00E+00  6.50E-02 6.5000E-02  3.00E+00    T(3 )(RNG):thickness f»
or layer index no.(3 ): RNG seg=3

 ***************************************************
 ******************* DESIGN OBJECTIVE ******************
 *************                          ***********
0
   CURRENT VALUE OF THE OBJECTIVE FUNCTION:
 VAR. STR/ SEG. LAYER    CURRENT
 NO.  RNG  NO.   NO.      VALUE            DEFINITION
            0     0    2.702E+03   WEIGHT OF THE ENTIRE PANEL

  TOTAL WEIGHT OF SKIN                                =   2.1580E+03
  TOTAL WEIGHT OF SUBSTIFFENERS                       =   0.0000E+00
  TOTAL WEIGHT OF STRINGERS                           =   3.8745E+02
  TOTAL WEIGHT OF RINGS                               =   1.5626E+02
  SPECIFIC WEIGHT (WEIGHT/AREA) OF STIFFENED PANEL=   3.5027E-02

 *************                       ************
 ******************* DESIGN OBJECTIVE ******************
```

"STAGSworthy" optimum design

Table 86 allen.STG

```
   n         $ Do you want a tutorial session and tutorial output?
      1      $ Choose type of STAGS analysis (1,3,4,5,6),INDIC
      0      $ Restart from ISTARTth load step (0=1st nonlinear soln), ISTART
1.700000     $ Local buckling load factor from PANDA2, EIGLOC
   y         $ Are the dimensions in this case in inches?
      0      $ Nonlinear (0) or linear (1) kinematic relations?, ILIN
      0      $ Type 1 for closed (360-deg) cyl. shell, 0 otherwise, ITOTAL
93.0         $ X-direction length of the STAGS model of the panel: XSTAGS
85.2103      $ Panel length in the plane of the screen, L2
   y         $ Is the nodal point spacing uniform along the stringer axis?
    101      $ Number of nodes in the X-direction: NODEX
  -8025      $ Resultant (e.g. lb/in) normal to the plane of screen, Nx
      0      $ Resultant (e.g. lb/in) in the plane of the screen,    Ny
      0      $ In-plane shear in load set A,                        Nxy
      0      $ Normal pressure in STAGS model in Load Set A, p
      0      $ Resultant (e.g. lb/in) normal to the plane of screen, Nx0
      0      $ Resultant (e.g. lb/in) in the plane of the screen,    Ny0
      0      $ Normal pressure in STAGS model in Load Set B, p0
      1      $ Starting load factor for Load System A, STLD(1)
      0      $ Load factor increment for Load System A, STEP(1)
      1      $ Maximum load factor for Load System A, FACM(1)
      0      $ Starting load factor for Load System B, STLD(2)
      0      $ Load factor increment for Load System B, STEP(2)
      0      $ Maximum load factor for Load System B, FACM(2)
      5      $ How many eigenvalues do you want? NEIGS
    480      $ Choose element type (410 or 411 or 480) for panel skin
   n         $ Have you obtained buckling modes from STAGS for this case?
    146      $ Number of stringers in STAGS model of 360-deg. cylinder
      4      $ Number of rings in the STAGS model of the panel
   y         $ Are there rings at the ends of the panel?
      4      $ Number of finite elements between adjacent stringers
     11      $ Number of finite elements between adjacent rings
      3      $ Stringer model: 1 or 2 or 3 or 4 or 5(Type H(elp))
      3      $ Ring model: 1 or 2 or 3 or 4 or 5 (Type H(elp))
     -1      $ Reference surface of cyl: 1=outer, 0=middle, -1=inner
   n         $ Do you want to use fasteners (they are like rigid links)?
   n         $ Are the stringers to be "smeared out"?
   n         $ Are the rings to be "smeared out"?
      7      $ Number of nodes over height of stiffener webs, NODWEB
      7      $ Number of nodes over width of stringer flange, NDFLGS
      7      $ Number of nodes over width of ring flange, NDFLGR
   n         $ Do you want stringer(s) with a high nodal point density?
   n         $ Do you want ring(s) with a high nodal point density?
   n         $ Is there plasticity in this STAGS model?
   n         $ Do you want to use the "least-squares" model for torque?
   n         $ Is stiffener sidesway permitted at the panel edges?
   y         $ Do you want symmetry conditions along the straight edges?
```

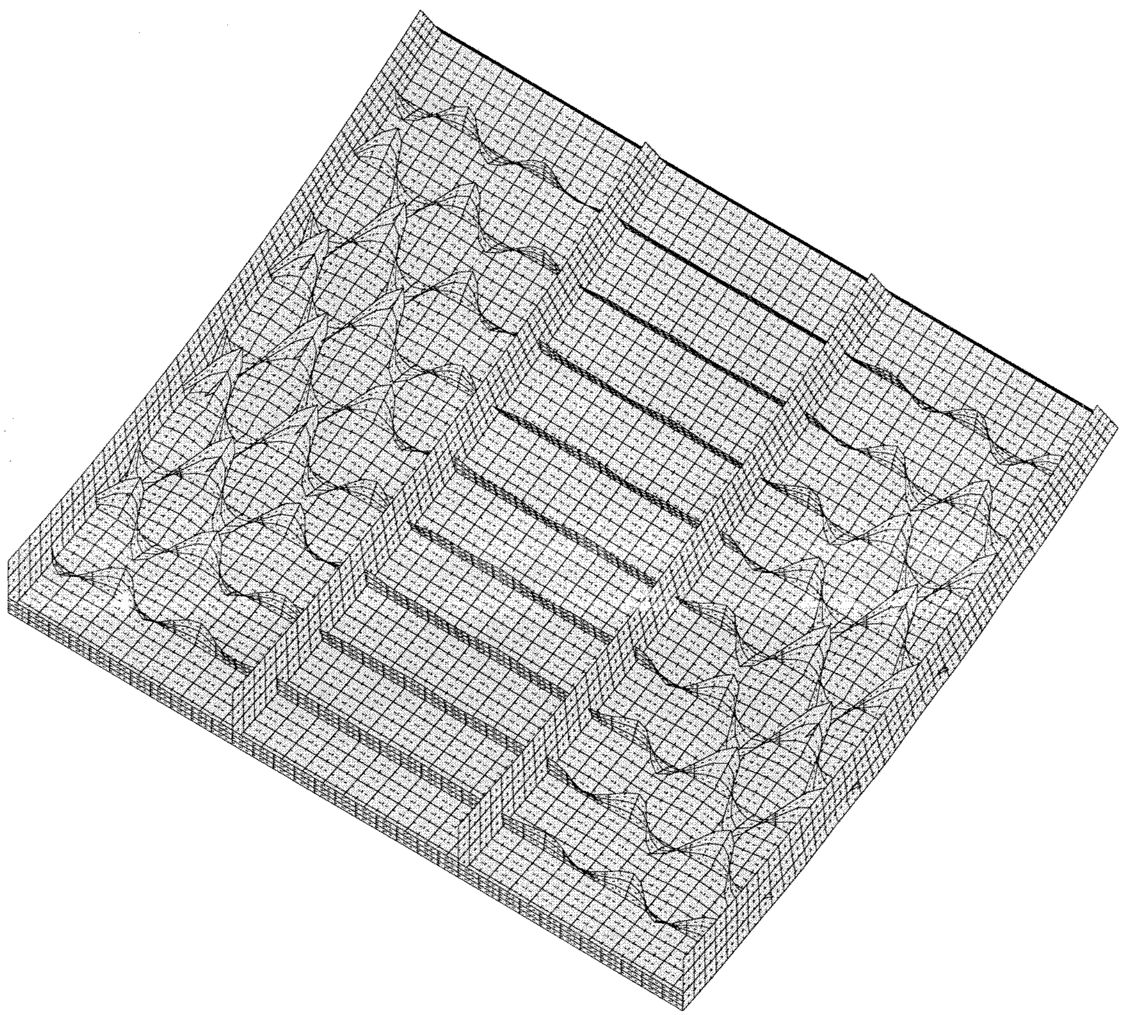
note

10 stringer bays: 10x 8.52103 inches

3 ring bays: 3 x 31 = 93 inches

Table 87 allen.pin

```
linear buckling of perfect shell from STAGS
  1  0  1  0   $PL-2  NPLOT,IPREP,IPRS,KDEV
     1      0      4      0      1  $PL-3  KPLOT,NUNIT,ITEM,STEP,MODE
    0.0    3  $PL-5  DSCALE,NROTS
  1    -35.84    $PL-6  IROT,ROT
  2    180.14    $PL-6  IROT,ROT
  3     35.63    $PL-6  IROT,ROT
```



solution scale = 0.8056E+01
mode 1, pcr = 0.15631E+01
step 0 eigenvector deformed geometry
linear buckling of perfect shell from STAGS

Θ x -35.84
Θ y -179.86
Θ z 35.63

2.062E+01

x y z

205

Fig. 45

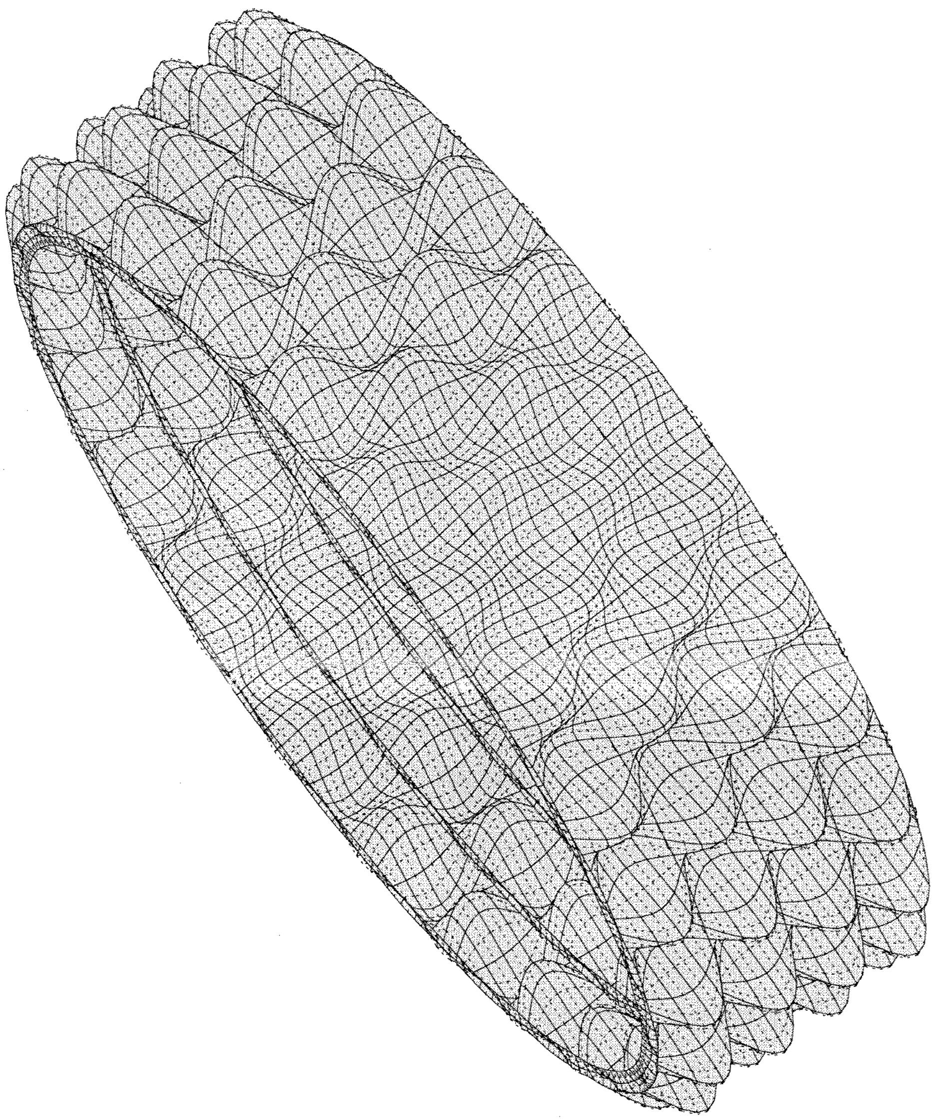
Table 88 allen. STG

```
      n         $ Do you want a tutorial session and tutorial output?
         1      $ Choose type of STAGS analysis (1,3,4,5,6),INDIC
         0      $ Restart from ISTARTth load step (0=1st nonlinear soln), ISTART
  1.700000      $ Local buckling load factor from PANDA2, EIGLOC
      y         $ Are the dimensions in this case in inches?
         0      $ Nonlinear (0) or linear (1) kinematic relations?, ILIN
         0      $ Type 1 for closed (360-deg) cyl. shell, 0 otherwise, ITOTAL
  124.          $ X-direction length of the STAGS model of the panel: XSTAGS
  1244.0710     $ Panel length in the plane of the screen, L2
      y         $ Is the nodal point spacing uniform along the stringer axis?
       101      $ Number of nodes in the X-direction: NODEX
     -8025      $ Resultant (e.g. lb/in) normal to the plane of screen, Nx
         0      $ Resultant (e.g. lb/in) in the plane of the screen,    Ny
         0      $ In-plane shear in load set A,                       Nxy
         0      $ Normal pressure in STAGS model in Load Set A, p
         0      $ Resultant (e.g. lb/in) normal to the plane of screen, Nx0
         0      $ Resultant (e.g. lb/in) in the plane of the screen,    Ny0
         0      $ Normal pressure in STAGS model in Load Set B, p0
         1      $ Starting load factor for Load System A, STLD(1)
         0      $ Load factor increment for Load System A, STEP(1)
         1      $ Maximum load factor for Load System A, FACM(1)
         0      $ Starting load factor for Load System B, STLD(2)
         0      $ Load factor increment for Load System B, STEP(2)
         0      $ Maximum load factor for Load System B, FACM(2)
         2      $ How many eigenvalues do you want? NEIGS
       480      $ Choose element type (410 or 411 or 480) for panel skin
      n         $ Have you obtained buckling modes from STAGS for this case?
       146      $ Number of stringers in STAGS model of 360-deg. cylinder
         5      $ Number of rings in the STAGS model of the panel
      y         $ Are there rings at the ends of the panel?
         1      $ Number of finite elements between adjacent stringers
         4      $ Number of finite elements between adjacent rings
         3      $ Stringer model: 1 or 2 or 3 or 4 or 5(Type H(elp))
         3      $ Ring model: 1 or 2 or 3 or 4 or 5 (Type H(elp))
        -1      $ Reference surface of cyl: 1=outer, 0=middle, -1=inner
      n         $ Do you want to use fasteners (they are like rigid links)?
note  y         $ Are the stringers to be "smeared out"?
      n         $ Are the rings to be "smeared out"?
         5      $ Number of nodes over height of stiffener webs, NODWEB
         5      $ Number of nodes over width of stringer flange, NDFLGS
         5      $ Number of nodes over width of ring flange, NDFLGR
      n         $ Do you want stringer(s) with a high nodal point density?
      n         $ Do you want ring(s) with a high nodal point density?
      n         $ Is there plasticity in this STAGS model?
      n         $ Do you want to use the "least-squares" model for torque?
      n         $ Is stiffener sidesway permitted at the panel edges?
      n         $ Do you want symmetry conditions along the straight edges?
         0      $ Edges normal to screen (0) in-plane deformable; (1) rigid
```

complete shell

Table 89 allen.pin

```
linear buckling of perfect shell from STAGS
  1  0  1  0   $PL-2  NPLOT,IPREP,IPRS,KDEV
     1      0      4      0      1  $PL-3   KPLOT,NUNIT,ITEM,STEP,MODE
    0.0    3  $PL-5  DSCALE,NROTS
  1    -35.84    $PL-6  IROT,ROT
  2    -13.14    $PL-6  IROT,ROT
  3     35.63    $PL-6  IROT,ROT
```



solution scale = 0.2046E+02
mode 1, pcr = 0.20615E+01
step 0 eigenvector deformed geometry
linear buckling of perfect shell from STAGS

Θ x -35.84
Θ y -13.14
Θ z 35.63

y z x

|— 6.869E+01 —|

208

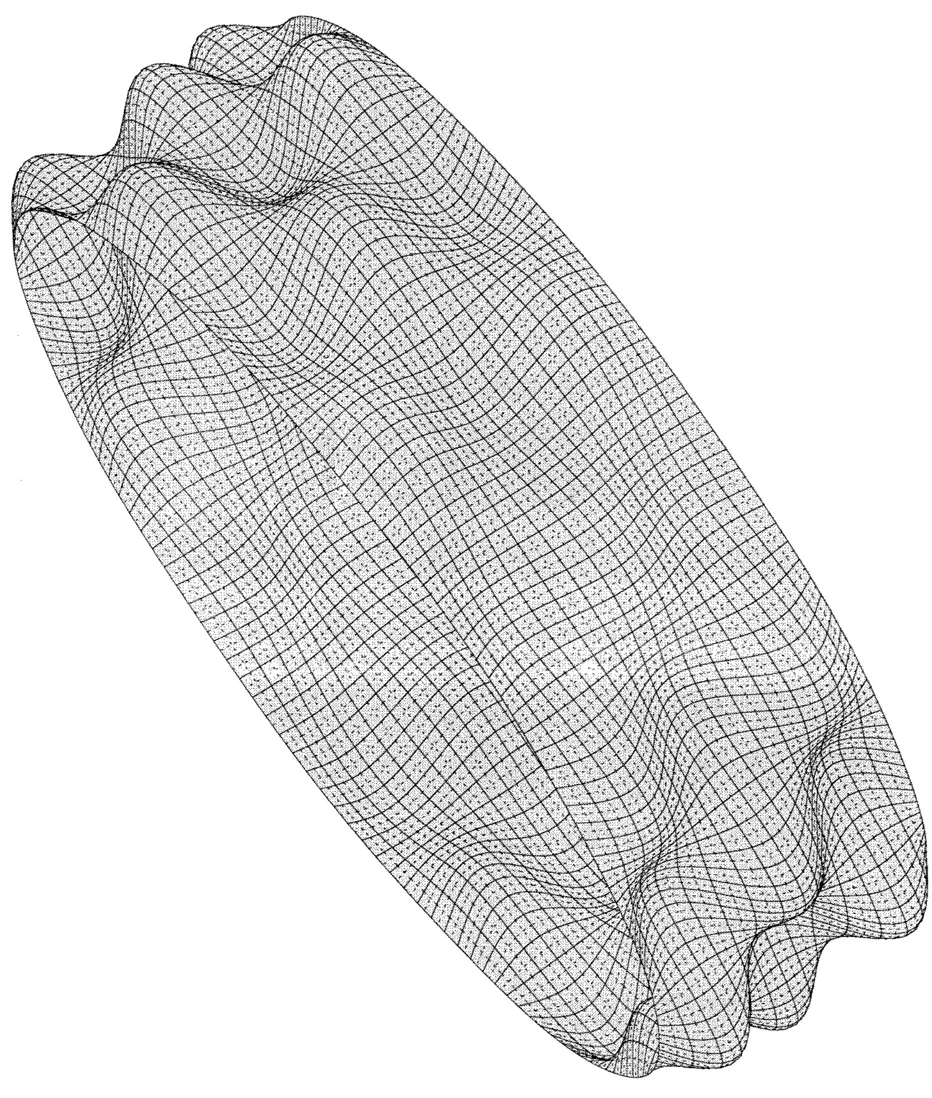
Fig. 46

Table 90 allen, STG

```
   n          $ Do you want a tutorial session and tutorial output?
     1        $ Choose type of STAGS analysis (1,3,4,5,6),INDIC
     0        $ Restart from ISTARTth load step (0=1st nonlinear soln), ISTART
1.700000      $ Local buckling load factor from PANDA2, EIGLOC
   y          $ Are the dimensions in this case in inches?
     0        $ Nonlinear (0) or linear (1) kinematic relations?, ILIN
     0        $ Type 1 for closed (360-deg) cyl. shell, 0 otherwise, ITOTAL
124.          $ X-direction length of the STAGS model of the panel: XSTAGS
1244.0710     $ Panel length in the plane of the screen, L2
   y          $ Is the nodal point spacing uniform along the stringer axis?
   101        $ Number of nodes in the X-direction: NODEX
  -8025       $ Resultant (e.g. lb/in) normal to the plane of screen, Nx
     0        $ Resultant (e.g. lb/in) in the plane of the screen,    Ny
     0        $ In-plane shear in load set A,                        Nxy
     0        $ Normal pressure in STAGS model in Load Set A, p
     0        $ Resultant (e.g. lb/in) normal to the plane of screen, Nx0
     0        $ Resultant (e.g. lb/in) in the plane of the screen,    Ny0
     0        $ Normal pressure in STAGS model in Load Set B, p0
     1        $ Starting load factor for Load System A, STLD(1)
     0        $ Load factor increment for Load System A, STEP(1)
     1        $ Maximum load factor for Load System A, FACM(1)
     0        $ Starting load factor for Load System B, STLD(2)
     0        $ Load factor increment for Load System B, STEP(2)
     0        $ Maximum load factor for Load System B, FACM(2)
     2        $ How many eigenvalues do you want? NEIGS
   480        $ Choose element type (410 or 411 or 480) for panel skin
   n          $ Have you obtained buckling modes from STAGS for this case?
   146        $ Number of stringers in STAGS model of 360-deg. cylinder
     5        $ Number of rings in the STAGS model of the panel
   y          $ Are there rings at the ends of the panel?
     1        $ Number of finite elements between adjacent stringers
     4        $ Number of finite elements between adjacent rings
     3        $ Stringer model: 1 or 2 or 3 or 4 or 5(Type H(elp))
     3        $ Ring model: 1 or 2 or 3 or 4 or 5 (Type H(elp))
    -1        $ Reference surface of cyl: 1=outer, 0=middle, -1=inner
   n          $ Do you want to use fasteners (they are like rigid links)?
   y          $ Are the stringers to be "smeared out"?
   y          $ Are the rings to be "smeared out"?
     5        $ Number of nodes over height of stiffener webs, NODWEB
     5        $ Number of nodes over width of stringer flange, NDFLGS
     5        $ Number of nodes over width of ring flange, NDFLGR
   n          $ Do you want stringer(s) with a high nodal point density?
   n          $ Do you want ring(s) with a high nodal point density?
   n          $ Is there plasticity in this STAGS model?
   n          $ Do you want to use the "least-squares" model for torque?
   n          $ Is stiffener sidesway permitted at the panel edges?
   n          $ Do you want symmetry conditions along the straight edges?
     0        $ Edges normal to screen (0) in-plane deformable; (1) rigid
```

note

entire shell: stringers & rings smeared out.



solution scale = 0.2046E+02
mode 1, pcr = 0.24383E+01
step 0 eigenvector deformed geometry
linear buckling of perfect shell from STAGS

Θ x -35.84
Θ y -13.14
Θ z 35.63

y z x

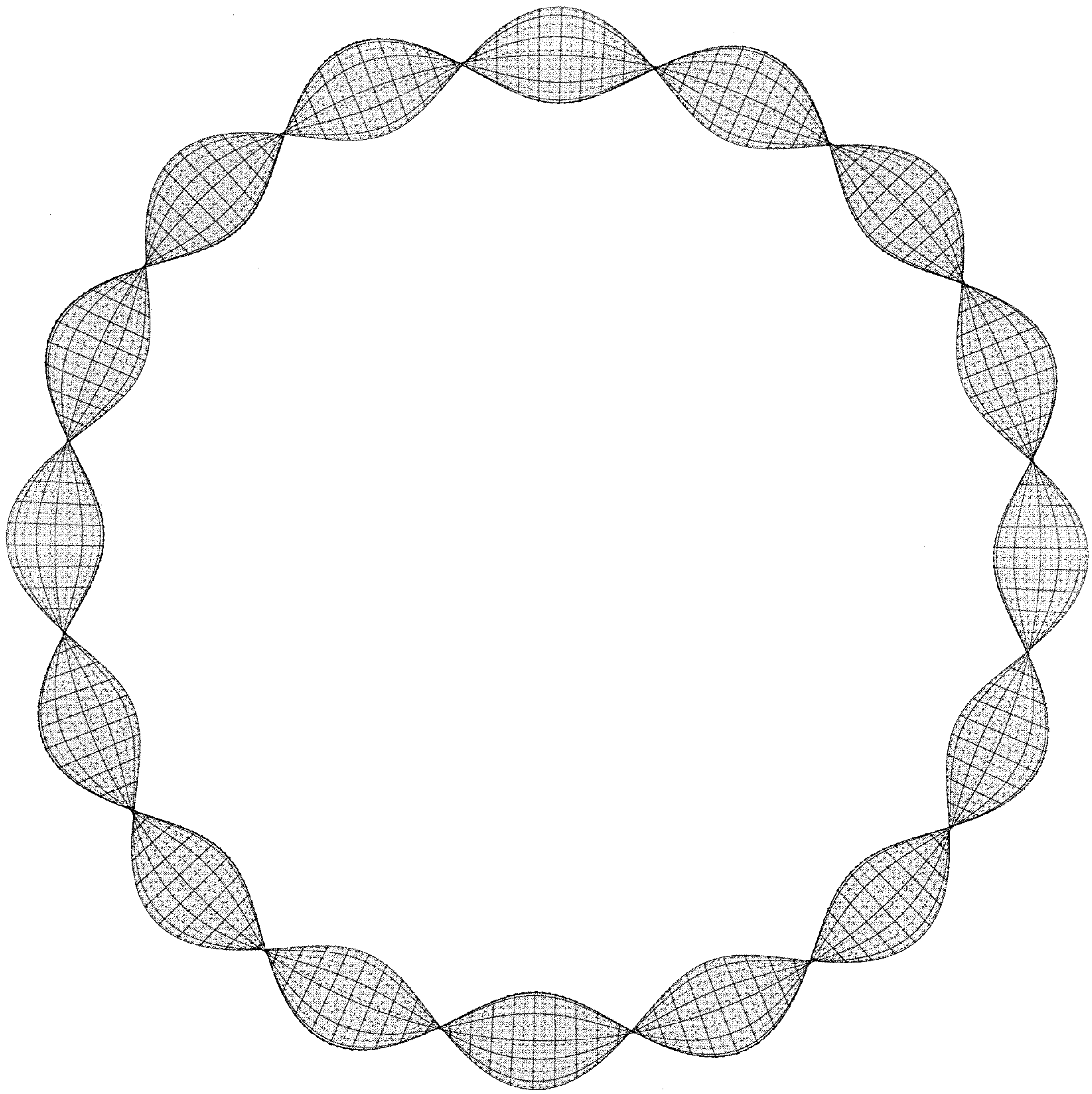
6.873E+01

210

Fig. 47

Table 91 allen.pin

```
linear buckling of perfect shell from STAGS
  1  0  1  0  $PL-2  NPLOT,IPREP,IPRS,KDEV
     1     0     4     0     1  $PL-3  KPLOT,NUNIT,ITEM,STEP,MODE
    0.0   3  $PL-5  DSCALE,NROTS
  1      0.0   $PL-6  IROT,ROT
  2     90.0   $PL-6  IROT,ROT
  3      0.0   $PL-6  IROT,ROT
```



solution scale = 0.1992E+02
mode 1, pcr = 0.24383E+01
step 0 eigenvector deformed geometry
linear buckling of perfect shell from STAGS

212

Fig. 48