APDL code 0 90 90 0

FINISH

/CLEAR, NO START

/prep7

!Variables (Input lengths in millimeters.)

y = .25

x = 15

z = 7.5

supportX = 10

unitmesh = .4

!Geometry for laminate (Generation of Keypoints)

k,1,x,0,0

k,2,-x,0,0

k,3,-x,0,z

k,4, x,0,z

k,5,x,-y,0

k,6,-x,-y,0

k,7,-x,-y,z

k,8, x,-y,z

k,9,x,-2\*y,0

k,10,-x,-2\*y, 0

k,11,-x,-2\*y, z

k,12,x,-2\*y,z

k,13,x,-3\*y,0

k,14,-x,-3\*y,0

k,15,-x,-3\*y, z

k,16,x,-3\*y,z

k,17,x, -4\*y,0

k,18,-x, -4\*y,0

k,19,-x, -4\*y,z

k,20,x, -4\*y,z

!Creates 1st laminate volume layer

v,8,7,6,5,4,3,2,1

cm,lam\_1,volu

aatt,1,,1,0

!/COLOR,VOLU,4,1 !(Blue) Colors Before meshing.

!Creates the 2nd laminate volume layer

!v,12,11,10,9,8,7,6,5

!vsel,none

!cm,lam\_2,volu

!aatt,2,,1,0

!/COLOR,VOLU,4,1 !(Blue) Colors Before meshing.

!Creates the 2nd laminate volume layer

v,16,15,14,13,8,7,6,5

vsel,none

cm,lam\_2,volu

aatt,2,,1,0

!/COLOR,VOLU,8,2 !(Blue) Colors Before meshing.

!Creates the 3nd laminate volume layer

!v,16,15,14,13,12,11,10,9

!vsel,none

!cm,lam\_3,volu

!aatt,3,,1,0

!/COLOR,VOLU,12,3 !(Blue) Colors Before meshing.

!Creates 4th laminate volume layer

v,20,19,18,17,16,15,14,13

cm,lam\_4,volu

aatt,4,,1,0

vsel, all

ET,1,solid186

Vsel,none

!Assigns material properties (MP) to: top Laminate (0 Degree) based on MATLAB CODE

MP,EX,1, 3123

MP,EY,1, 2785

MP,EZ,1, 2785

MP,PRXY,1,0.256

MP,PRYZ,1,0.256

MP,PRXZ,1,0.256

MP,GXY,1,1028

MP,GYZ,1,1028

MP,GXZ,1,1028

!Assigns material properties (MP) to: 2nd laminate (90 Degrees)

MP,EX,2,2785

MP,EY,2,3123

MP,EZ,2, 2785

MP,PRXY,2,0.256

MP,PRYZ,2,0.256

MP,PRXZ,2,0.256

MP,GXY,2,1028

MP,GYZ,2,1028

MP,GXZ,2,1028

!Assigns material properties (MP) to: 3rd Laminate (90 Degree) based on MATLAB CODE

!MP,EX,3,2785

!MP,EY,3,3123

!MP,EZ,3, 2785

!MP,PRXY,3,0.256

!MP,PRYZ,3,0.256

!MP,PRXZ,3,0.256

!MP,GXY,3,1028

!MP,GYZ,3,1028

!MP,GXZ,3,1028

!Assigns material properties (MP) to: 4th laminate (0 Degrees)

MP,EX,4, 3123

MP,EY,4, 2785

MP,EZ,4, 2785

MP,PRXY,4,0.256

MP,PRYZ,4,0.256

MP,PRXZ,4,0.256

MP,GXY,4,1028

MP,GYZ,4,1028

MP,GXZ,4,1028

vsel,s,volu,,1,4

esize,unitmesh,

vmesh,all

MCHECK

/SOL

!\*

ANTYPE,0

NLGEOM,1

**!apply displacement**

Nsel,s,loc,y,0,0

Nsel,r,loc,z,0,7.5

Nsel,r,loc,x,-.2,.2

**!D,all,UX,0,,,,UZ**

!SF,all,PRES,-100

**!D,all,UY,-.254,,,, ! Next several lines are different displacements to apply**

**D,all,UY,-.508,,,,**

**!D,all,UY,-.762,,,,**

**!D,all,UY,-5,,,,**

**!D,all,UY,-10,,,,**

**!apply constraint**

Nsel,s,loc,y,-1,-1

Nsel,r,loc,z,0,7.5

Nsel,r,loc,x,9.8,10.2

**D,all,all,0,,,,**

**!D,all,uy,0,,,,ux**

Nsel,none

Nsel,s,loc,y,-1,-1

Nsel,r,loc,z,0,7.5

Nsel,r,loc,x,-9.8,-10.2

**D,all,all,0,,,,**

**!D,all,uy,0,,,,ux**

!Lswrite,1

allsel,all

solve

!Enter Postprocessing

/POST1

!Creates a path through thickness that we are going to plot stresses/strains on.

PATH,thicknessCen,2,30,20

PPATH,1,,0,0,0

PPATH,2,,0,-1,0

!Creates a path at free edge for interface between laminate 1&2

!PATH,lay1int,2,30,20

!PPATH,1,,-15,-.25,0

!PPATH,2,,15,-.25,0

!Creates a path at free edge for interface between laminate 2&3

!PATH,lay2int,2,30,20

!PPATH,1,,-15,-.5,0

!PPATH,2,,15,-.5,0

!Creates a path at free edge for interface between laminate 3&4

!PATH,lay3int,2,30,20

!PPATH,1,,-15,-.75,0

!PPATH,2,,15,-.75,0

PDEF,StressY,S,Y,AVG ! Calculate transverse stress on the defined path

PLPATH,StressY

/show,jpeg,,0

/GFILE,800

/RGB,INDEX,100,100,100, 0

/RGB,INDEX, 80, 80, 80,13

/RGB,INDEX, 60, 60, 60,14

/RGB,INDEX,  0,  0,  0,15

/REPLOT

/SHOW,CLOSE

!\*

!\*GET, NoNodes, NODE, 0, COUNT !Get number of nodes  
!\*DIM, StressY, array, NoNodes, 6 !Declare table to save coordinates and σyy

!\*GET, Par, Entity, ENTNUM, Item1, IT1NUM, Item2, IT2NUM

!\*get, StressY,PATH, ,last,Y

PDEF,StressXY,S,XY,AVG ! Calculate in-plane shear stress on the defined path

PLPATH,StressXY

/show,jpeg,,0

/GFILE,800

/RGB,INDEX,100,100,100, 0

/RGB,INDEX, 80, 80, 80,13

/RGB,INDEX, 60, 60, 60,14

/RGB,INDEX,  0,  0,  0,15

/REPLOT

/SHOW,CLOSE

!\*

!\*GET, NoNodes, NODE, 0, COUNT !Get number of nodes  
!\*DIM, StressXY, array, NoNodes, 6 !Declare table to save coordinates and displacements

PDEF,StressYZ,S,YZ,AVG ! Calculate out-of-plane shear stress on the defined path

PLPATH,StressYZ

/show,jpeg,,0

/GFILE,800

/RGB,INDEX,100,100,100, 0

/RGB,INDEX, 80, 80, 80,13

/RGB,INDEX, 60, 60, 60,14

/RGB,INDEX,  0,  0,  0,15

/REPLOT

/SHOW,CLOSE

!\*

!\*GET, NoNodes, NODE, 0, COUNT !Get number of nodes  
!\*DIM, StressYZ, array, NoNodes, 6 !Declare table to save coordinates and displacements