In [1]:
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run -i MECH530_main.py
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PLYBOOK (READ FROM EXCEL FILE AND SUMMARIZED HERE)

The laminate is given by the following plybook where the highest ply number '4'
 indicates the top layer, while the first ply number '1' indicates the bottom l
ayer.

Unique Ply #, Fiber/Matrix, Orientation, Thickness
                             (degrees)      (mm)
     4        Kev49/Epoxy        52         0.125
     3        Kev49/Epoxy       -52         0.125
     2        Kev49/Epoxy       -52         0.125
     1        Kev49/Epoxy        52         0.125

PLIES AND THICKNESSES
-Total number of plies in the laminate: 4
-Total thickness of laminate is: 0.500 mm
-There is no core in the laminate (Zc = 0 mm)
-Laminate contains 1 Fiber/Matrix combination. The material properties for this
 combination shall be listed below.

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MATERIALS AND MATERIAL PROPERTIES

RESIN/MATRIX 1 of 1: For Kev49/Epoxy, the given material properties are:

-Stiffness and Strength:

Ex =  76.0000 GPa, Ey =   5.5000 GPa, Es =   2.3000 GPa and nu_x =   0.3400

Xt = 1400.0000 MPa, Xc = 235.0000 MPa, Yt =  12.0000f MPa, Yc =  53.0000 MPa an
d Sc =  34.0000 MPa.

-The 'on-axis' matrices are given by the following:
S_on =
[[      0.0   -0.0045       0.0]
 [  -0.0045    0.1818       0.0]
 [      0.0       0.0    0.4348]] [1/GPa]

Q_on =
[[  76.6412    1.8858       0.0]
 [   1.8858    5.5464       0.0]
 [      0.0       0.0    2.3000]] [GPa]

-The linear combinations of the modulus, independent of ply angle are the follo
wing:
Us_1 =    0.1214 [1/GPa]
Us_2 =   -0.0909 [1/GPa]
Us_3 =   -0.0305 [1/GPa]
Us_4 =   -0.0350 [1/GPa]
Us_5 =    0.3128 [1/GPa]

-The linear combinations of the modulus, dependent on ply angle are the followi
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ng:
Uq_1 =   32.4418 GPa
Uq_2 =   35.5474 GPa
Uq_3 =    8.6520 GPa
Uq_4 =   10.5378 GPa
Uq_5 =   10.9520 GPa

-The 'Stiffness' [A] and 'Compliance' [a] matrices are given by the following:
A =
[[   0.0081    0.0091       0.0]
 [   0.0091    0.0167       0.0]
 [      0.0       0.0    0.0093]] [GN/m]

a =
[[ 316.9010 -172.4533      -0.0]
 [-172.4533  153.7231       0.0]
 [      0.0       0.0  107.5774]] [m/GN]

-The 'In-Plane Flexural Modulus' [D] and 'In-Plane Flexural Compliance' [d] mat
rices are given by the following:
D =
[[   0.0002    0.0002    0.0001]
 [   0.0002    0.0003    0.0002]
 [   0.0001    0.0002    0.0002]] [kNm]

d =
[[15530371.6619 -7642652.2161 -1690461.2187]
 [-7642652.2161 8642673.4179 -3364279.7092]
 [-1690461.2187 -3364279.7092 8954671.2946]] [1/MNm]

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INPUTS:

Would you like to input a resultant applied stress? ON/OFF/NO
OFF
Enter the applied stress resultant vector [N1, N2, N6] [N/m].
N1 = 25000
N2 = 50000
N6 = 0
Would you like to input a resultant applied moment? ON/OFF/NO
NO

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Curvature K =
[[      0.0       0.0       0.0]] [1/m]

OFF-AXIS APPLIED RESULTANTS:

(INPUT) Off-axis Applied stress resultant N =
[[25000.0000 50000.0000       0.0]] [N/m]

(INPUT) Off-axis Applied moment resultant M =
[[      0.0       0.0       0.0]] [N]

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FAILURE CRITERION AND ANALYSIS
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MAXIMUM STRESS:
-Minimum R = 1.475 and laminate fails in Matrix Tension at TOP of ply 4
-The load vectors which cause the failure are:
R*N =
[[  36.8778   73.7555       0.0]] [kN/m]
R*M =
[[      0.0       0.0       0.0]] [kN]

QUADRATIC POLYNOMIAL:
-Minimum R = 2.455 and laminate fails at TOP of ply 4
-The load vectors which cause the failure are:
R*N =
[[  61.3641  122.7282       0.0]] [kN/m]
R*M =
[[      0.0       0.0       0.0]] [kN]

HASHIN CRITERION:
-Minimum R = 1.372 and laminate fails in Matrix Tension at TOP of ply 4
-The load vectors which cause the failure are:
R*N =
[[  34.3042   68.6085       0.0]] [kN/m]
R*M =
[[      0.0       0.0       0.0]] [kN]
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