Planar Gem Mechanical Analysi

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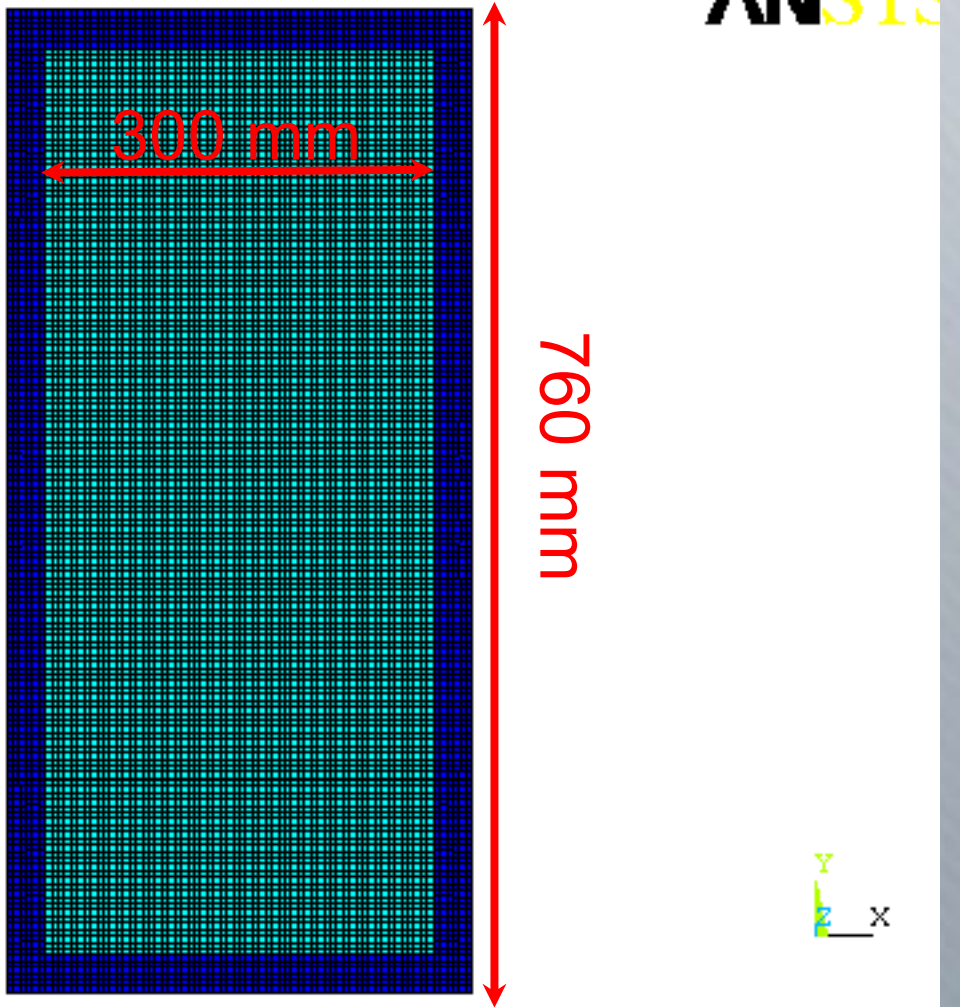
nalysis

FEA Model (element type, material, geometry)

Stress and Strain Calculations (several configurations of boundary conditions and loading)

Results for static analysis

(Instability analysis in progress)



FEA model

Thin Shell:10944 elementi

Non linear problems due to:

1.deformations >> thickness

•material behaviour

- Shell63
- Shell181(keyopt0=0)
- Solid45+Shell181(keyopt1=1)

aterial data

Permaglass

- densità=1850 Kg/m”
- Young Modulus=2.4E+10
- Poisson Coeff=0.17 [Ref1]

- Gem (kapton+copper
  - densità= 2221.63 kg/m3
  - Young Modulus=3.26E+9 (well-accordance expermental-calculated srtess-strain)
  - Poisson Coeff=0.335**

**Ref:articolo

Proceeding xxi ICTAM, 15-24 August 2004
Warsaw Polland

<<Three-dimensional Thremoelastic Analysis of plain/epoxy composite>>

Poisson's ratio=0.17

Table 2 Elastic properties of two-layer G-11 woven glass/epoxy laminates

			293 K	77 K	4 K
Young's moduli					
E_1^l (GPa)	3-D FEA		26.75	33.10	36.04
	Micromechanics model		26.66	32.98	35.94
	Experimental		27.9	32.7	36.9
E_3 (GPa)	3-D FEA	Case 1	25.88	31.85	34.69
		Case 2	25.51	31.23	33.89
Poisson's ratios			293 K	77 K	4 K
ν_{13}^l	3-D FEA		0.140	0.193	0.214
	Micromechanics model		0.13	0.19	0.21
	Experimental		0.17	0.19	0.23
ν_{13}	3-D FEA	Case 1	0.137	0.188	0.209
		Case 2	0.132	0.182	0.202

Boundary conditions

Shell Only

Externally Simple supported
(UZ not allowed)

Frame +Shell

Rigidly clamped
ALL degree
of freedom suppressed

Loads

Shell Only

Only gravity

gravity+traction
on external side (sf=load
per unit length)

Frame +Shell

uniform compression
on the lower surface of
the frame nodes
(f=load)

Model

Shell Only

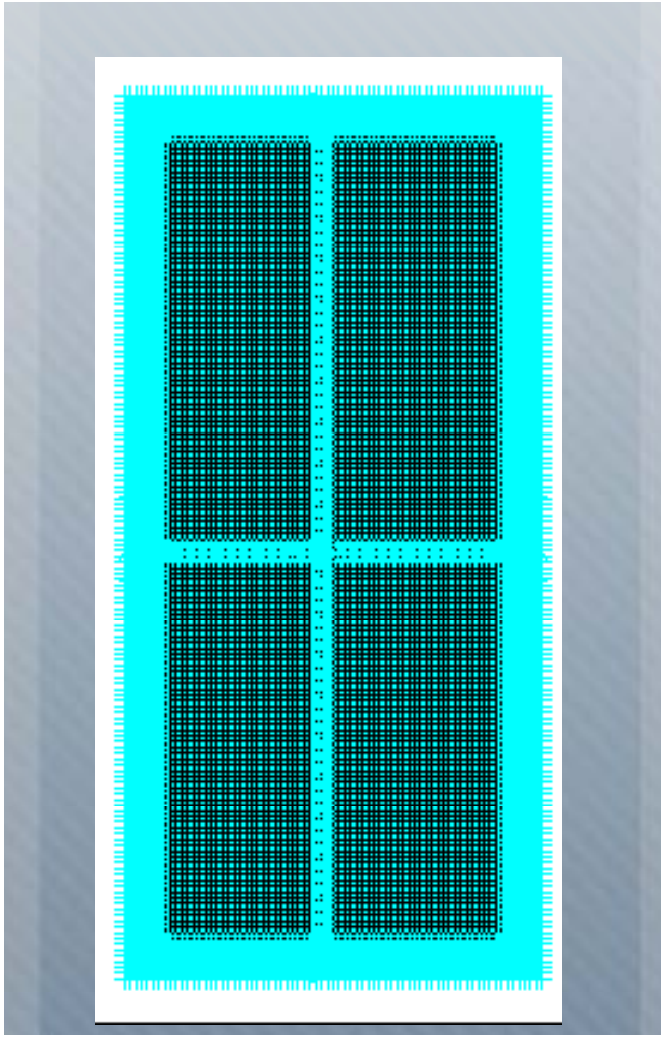
Shell63
Shell181

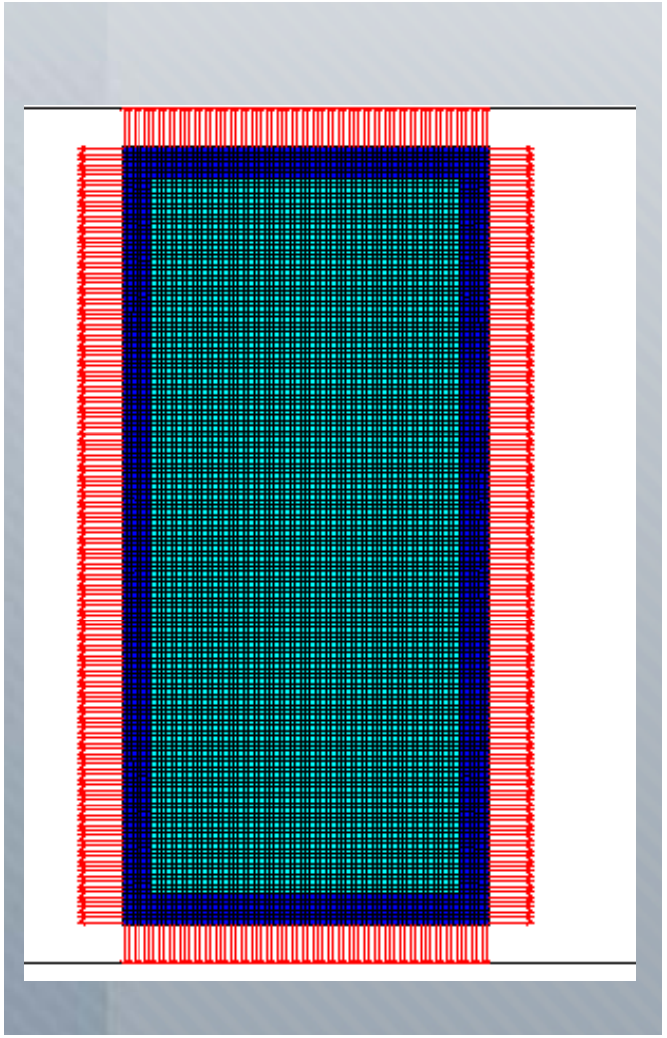
Frame +Shell

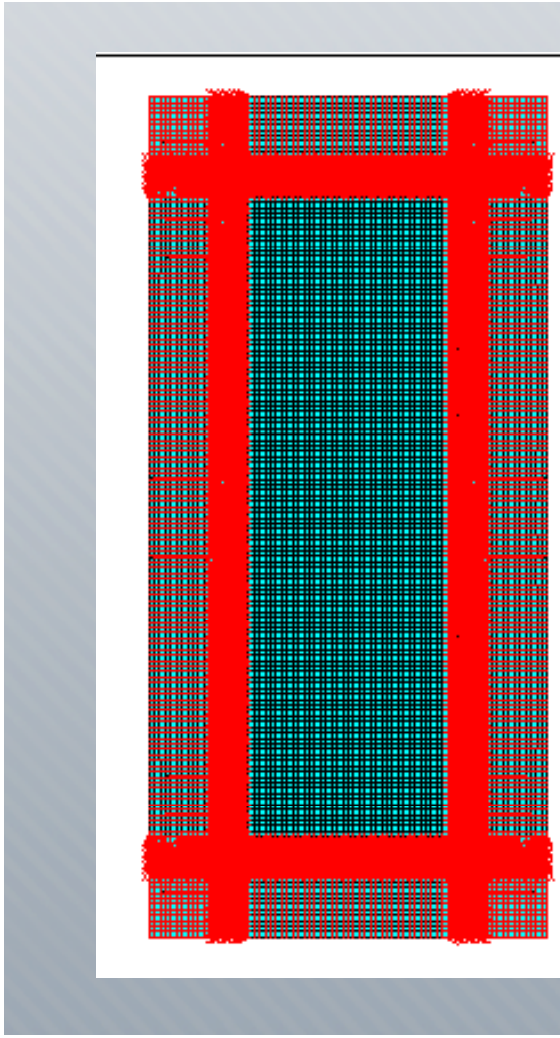
Shell63+Shell63
Shell181+Shell18
Shell181+solid4

Calculations Descriptions

nodes of the frame







only shell
with gravity

only shell
with tesile load +gravity

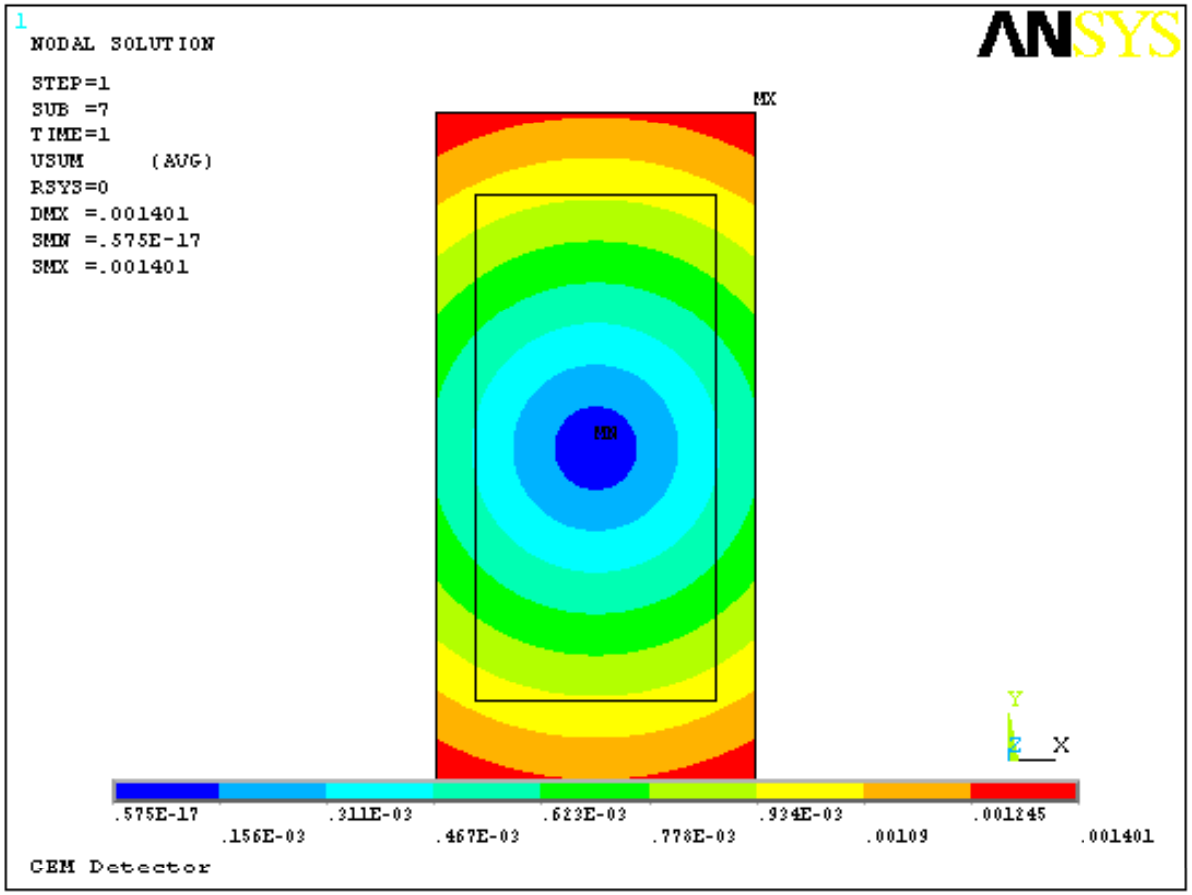
shell+frame wi
compression lo

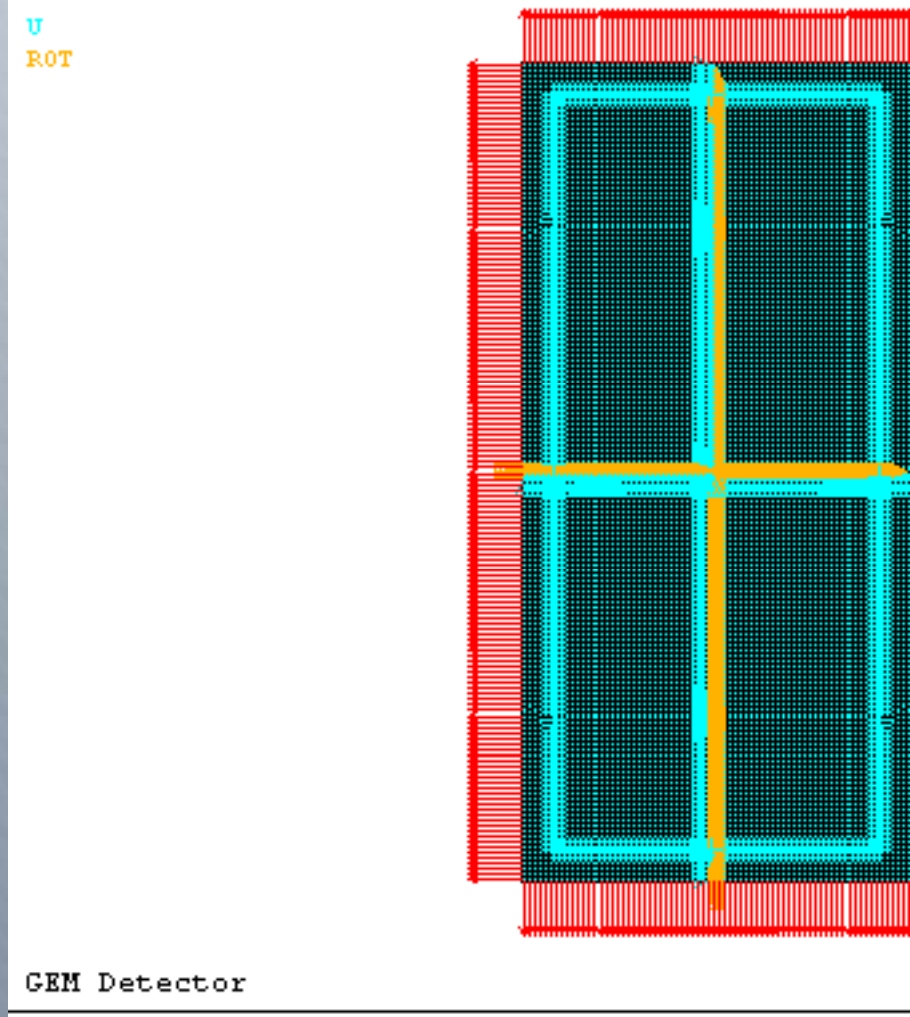
Boundary condition and load configuratior

Case(

Simply supported shell with tensile loa

Umax=0.001407 m
hydrostatic stress with value
σ=0.163E+8 Pa



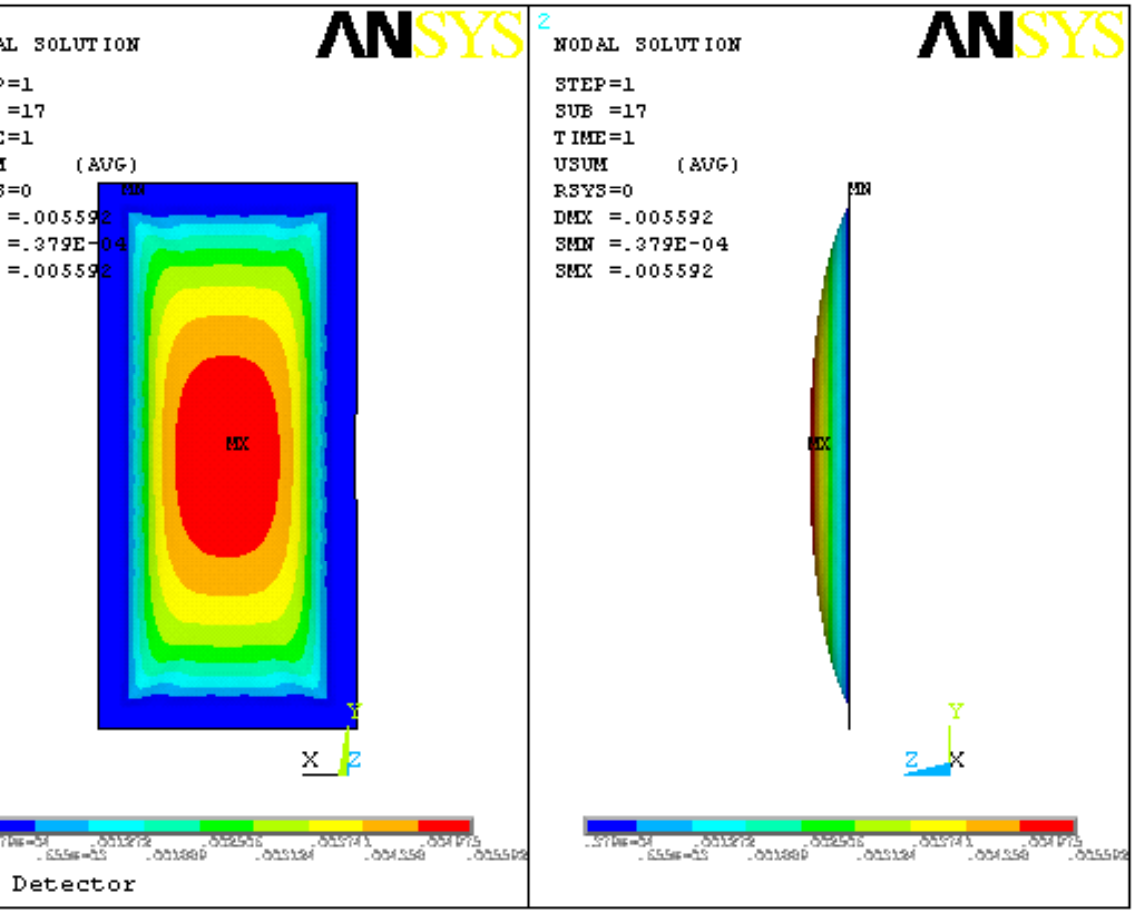


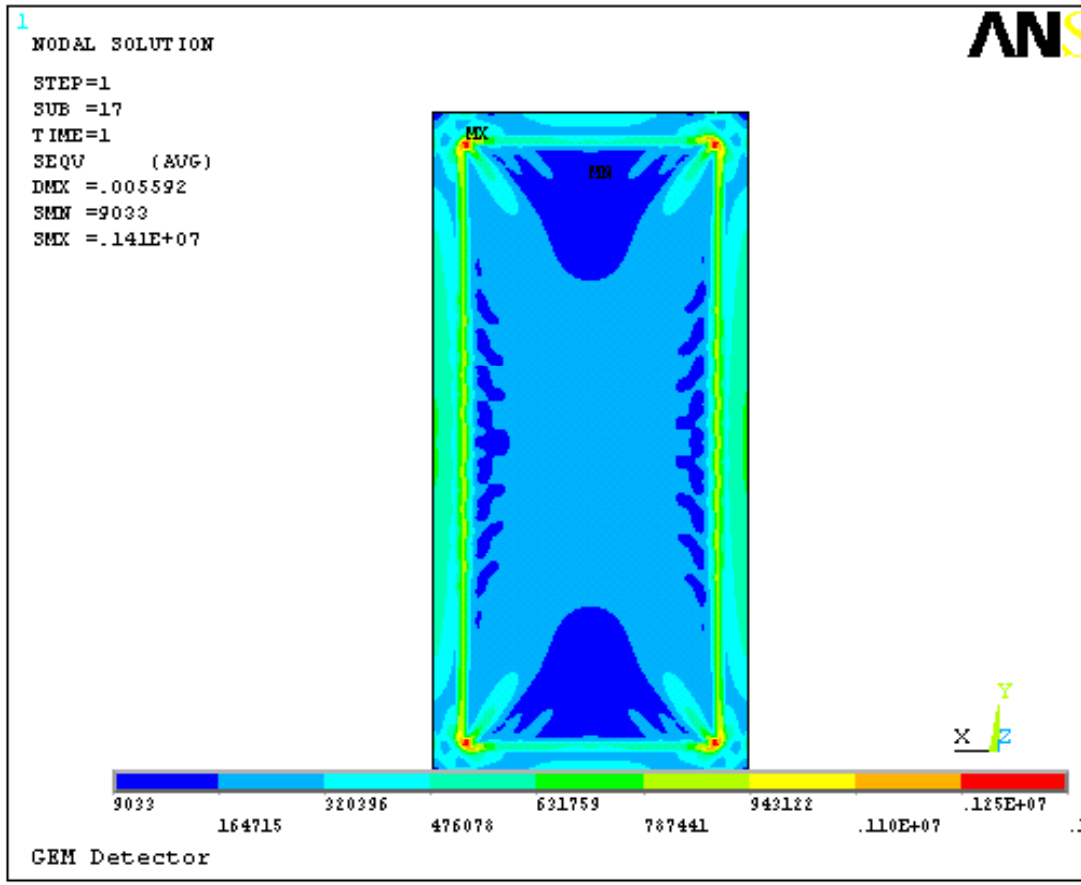
CASE1

SIMPLY SUPPORTED SHELL (WITHOUT FRAM

WITH GRAVIT

maximum equivalent sigma =0.147E+71 a





+ Displacement scale=10

BC:simply supported Sh

LOAD:only grav

+

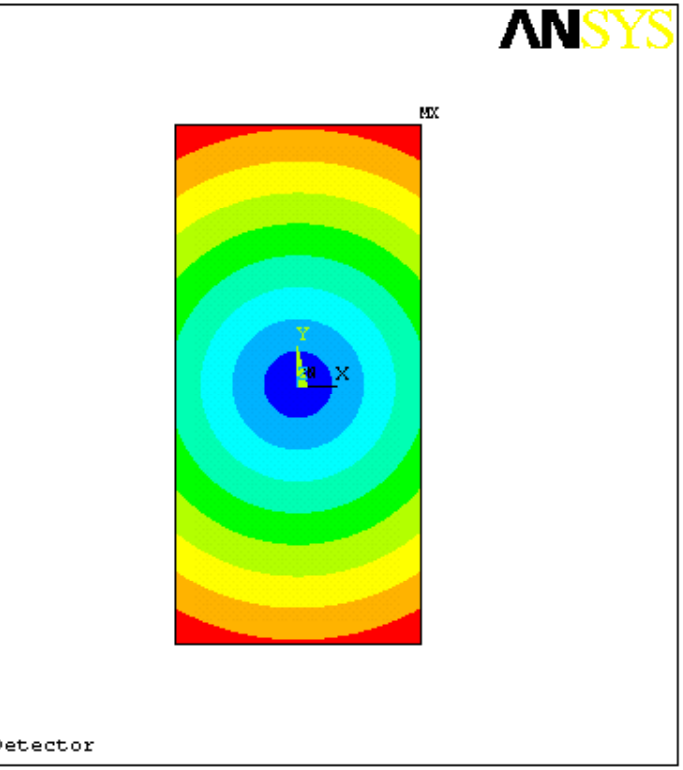
>>>

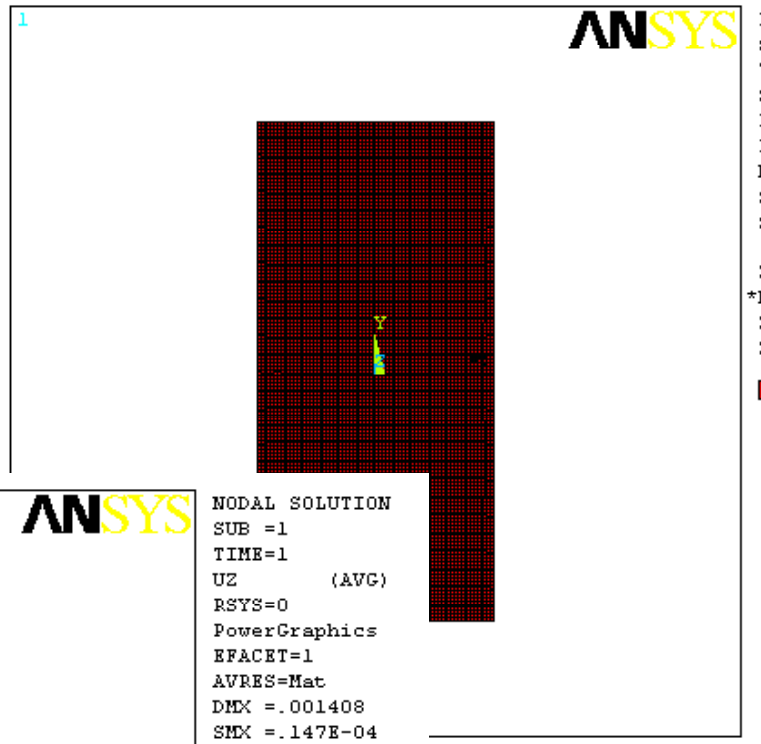
CASE2

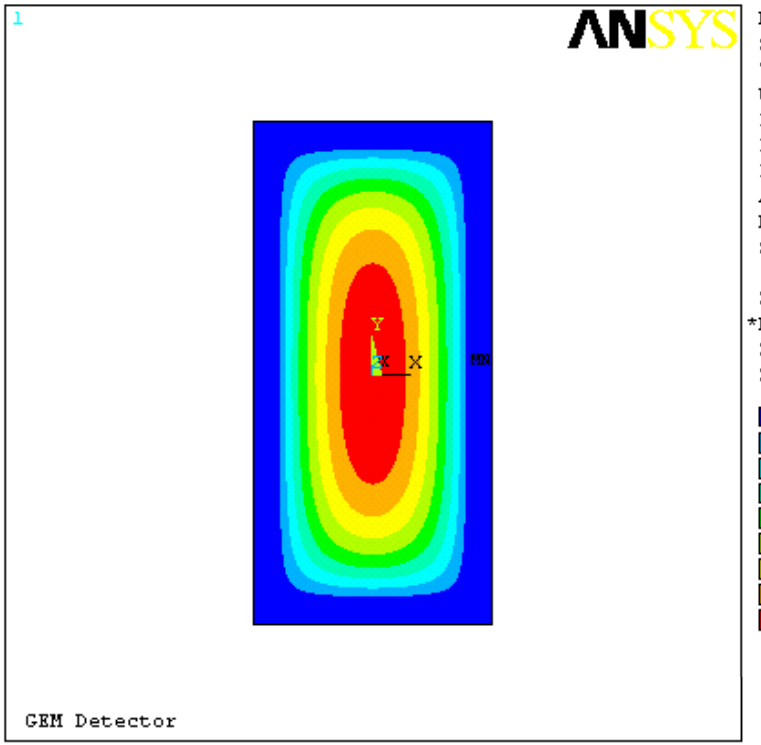
SIMPLY SUPPORTED SHELL (WITHOUT FRAME

WITH GRAVITY AND TENSILE LOA

maximum equivalent sigma =0.1e4+8 Pa (<< sigma_ultimate)







BC:simply supported shell

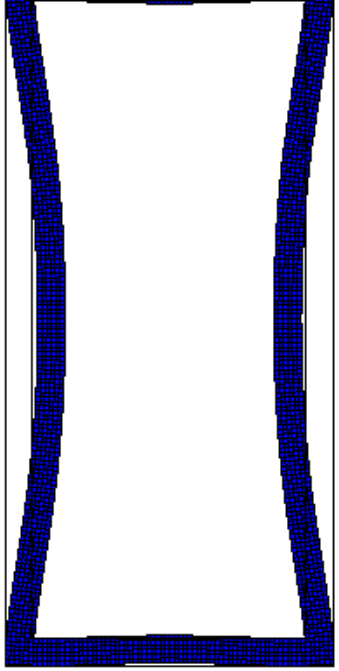
LOAD:gravity+ traction load (1kgf/cm)

CASE

SIMPLY SUPPORTED SHELL WITH FRAM

FRAME WITH COMPRESSION LOA

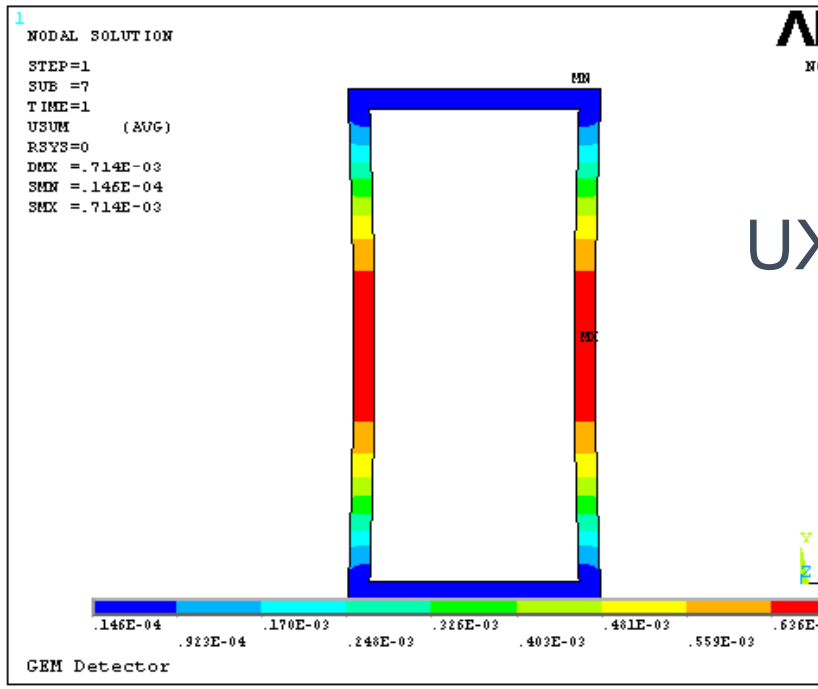
σ =0.163E+8 Pa from CASE0 Fx=σ ·(760*60E-6) Fy=σ ·(360*60E



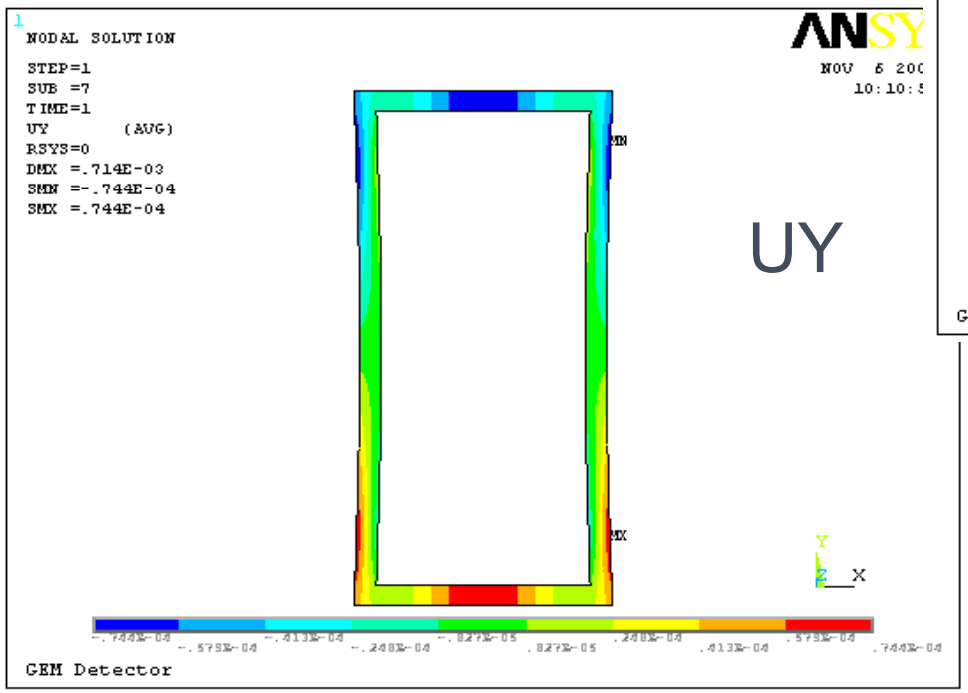
STEP=1
SUB =7
TIME=1
PowerGraphics
EFACET=1
AVRES=Mat
DMX =.714E-03

*DSCA=50
ZV =1
DIST=.41738
Z-BUFFER

sigma_eq (max)=0.152E+8 Pa



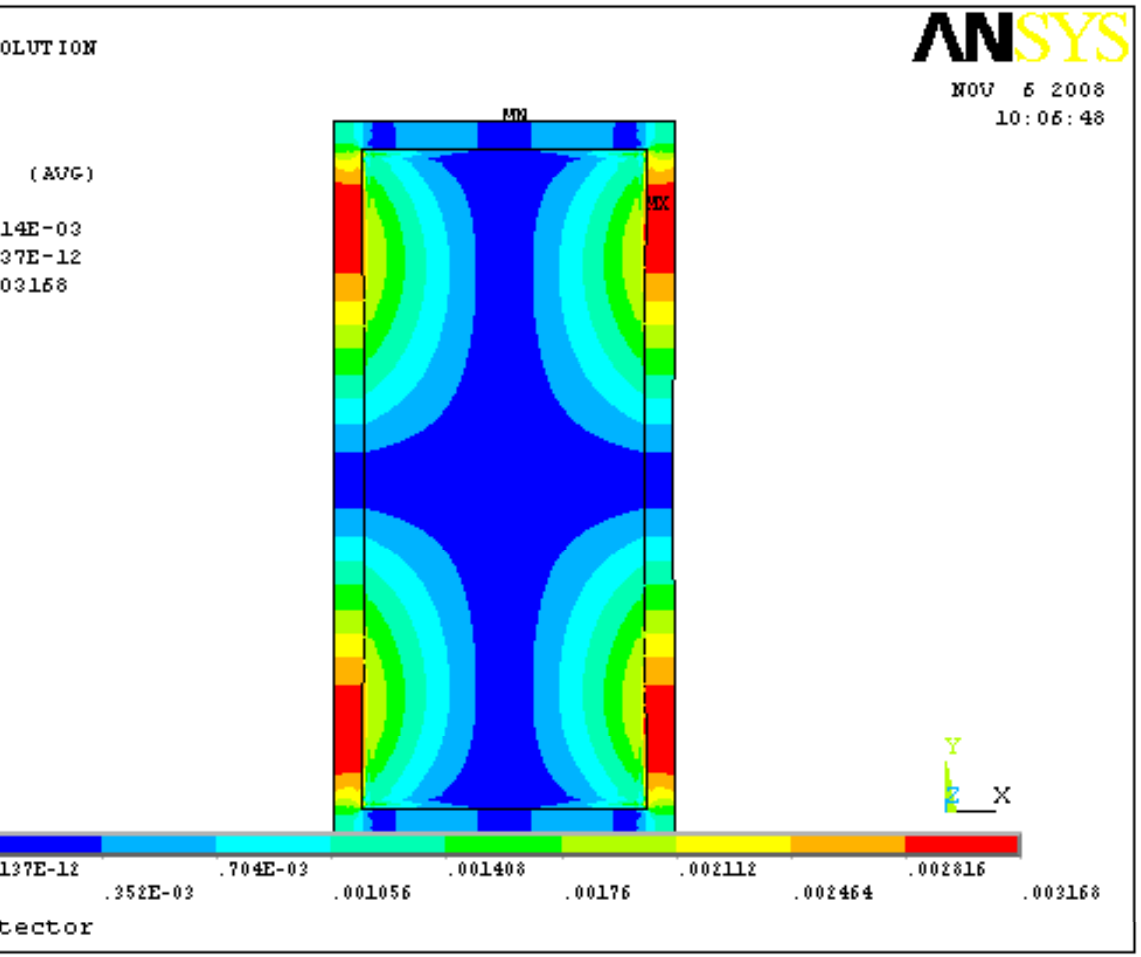
UX

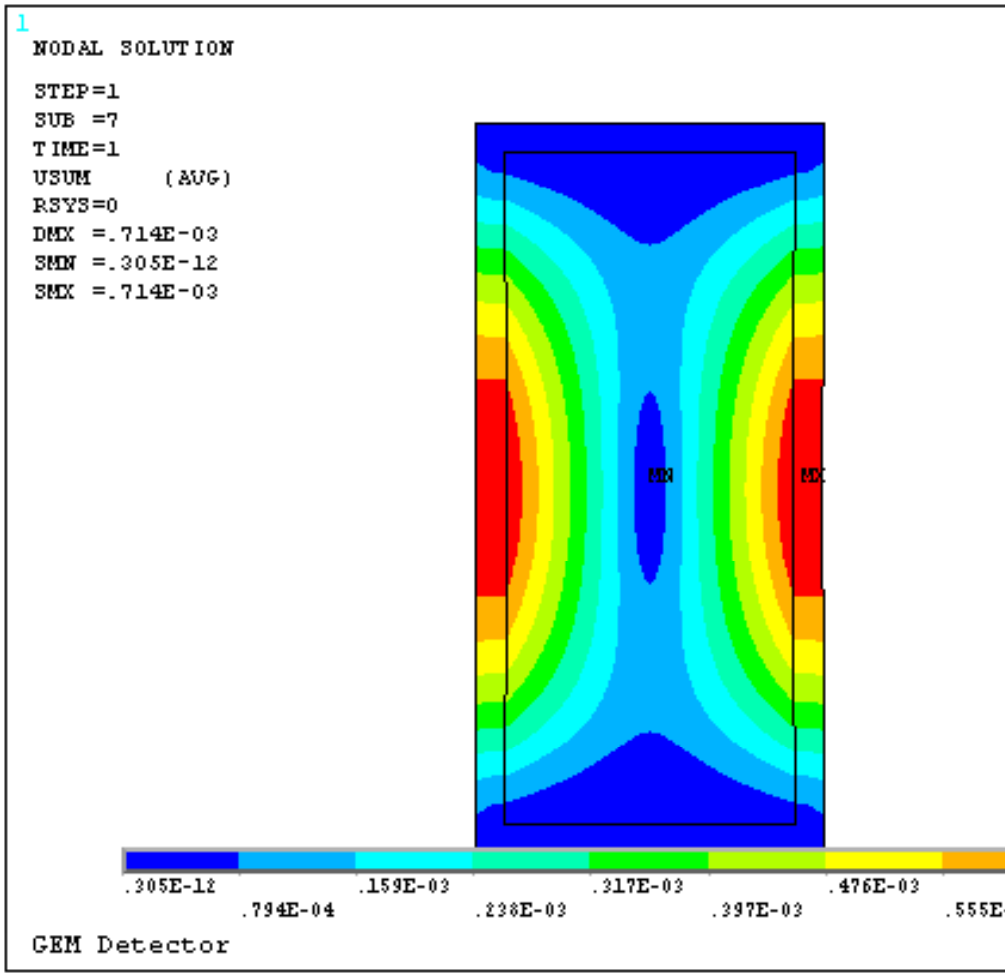


UY

Model: Simply supported shell+frame

LOAD:only uniform compression on frame





Shell+frame=some commer

Conservative calculations (shell prestress not yet taken into accou

transient analysis with initial stress in the shell could be do

ne with different thickness: 2-4-6-8 mm

nm-->umax=0.714E-3 m

nm-->umax=0.696E-3 m

nm-->umax=0.668E-3 m

nm-->umax=0.639E-3 m