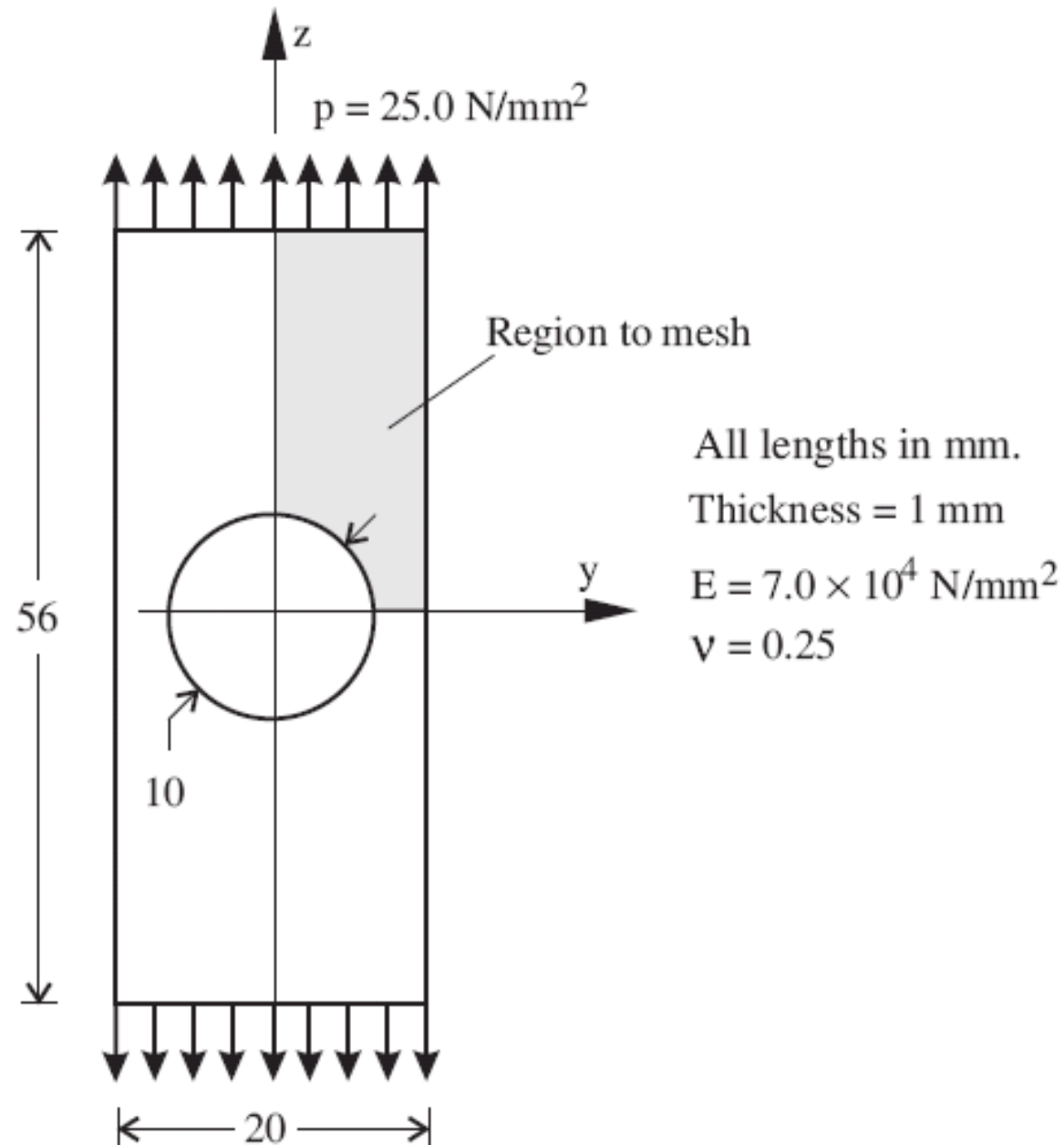


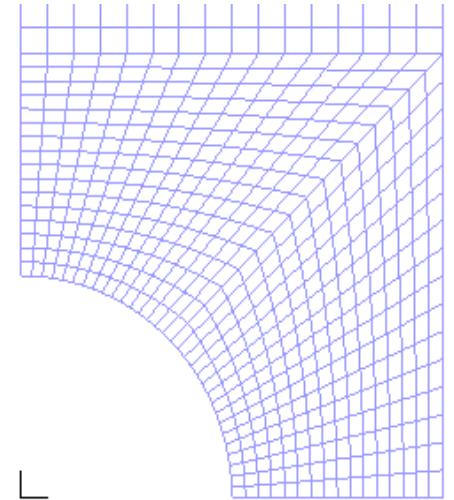
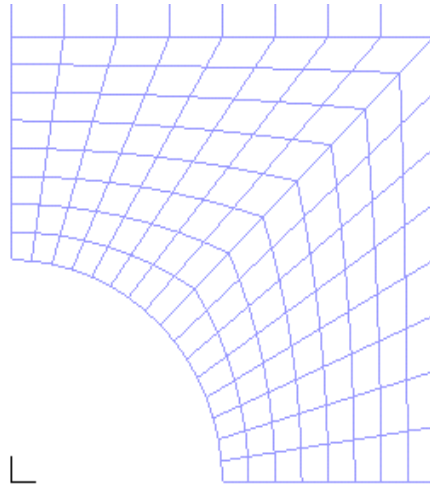
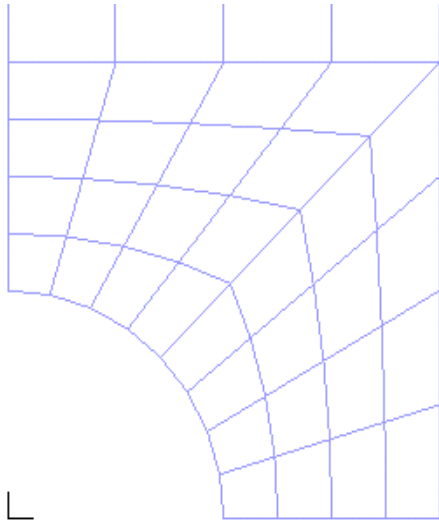
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2.094 Finite Element Analysis of Solids and Fluids
Spring 2008

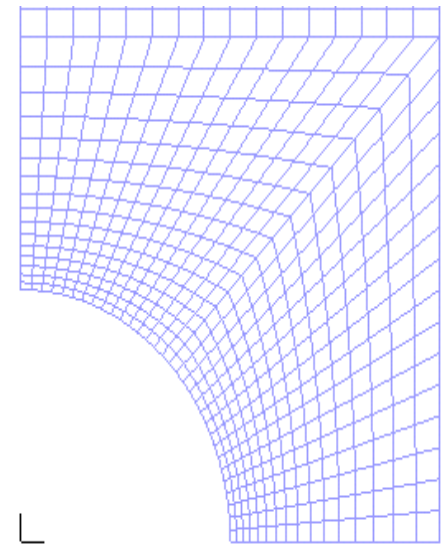
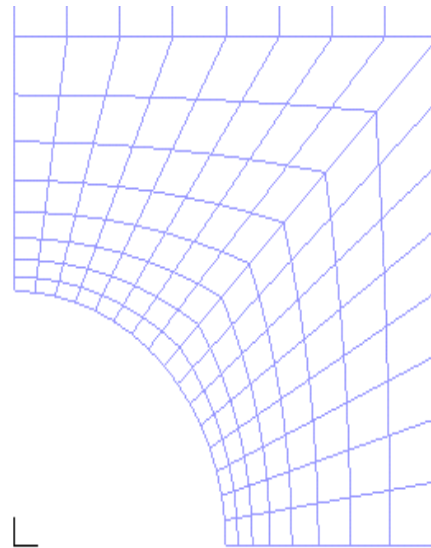
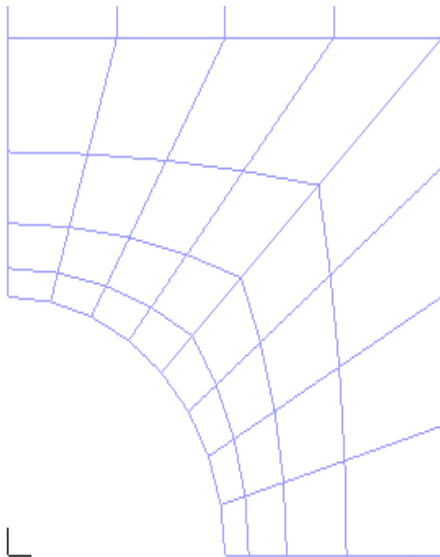
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Convergence demo – plate with a hole





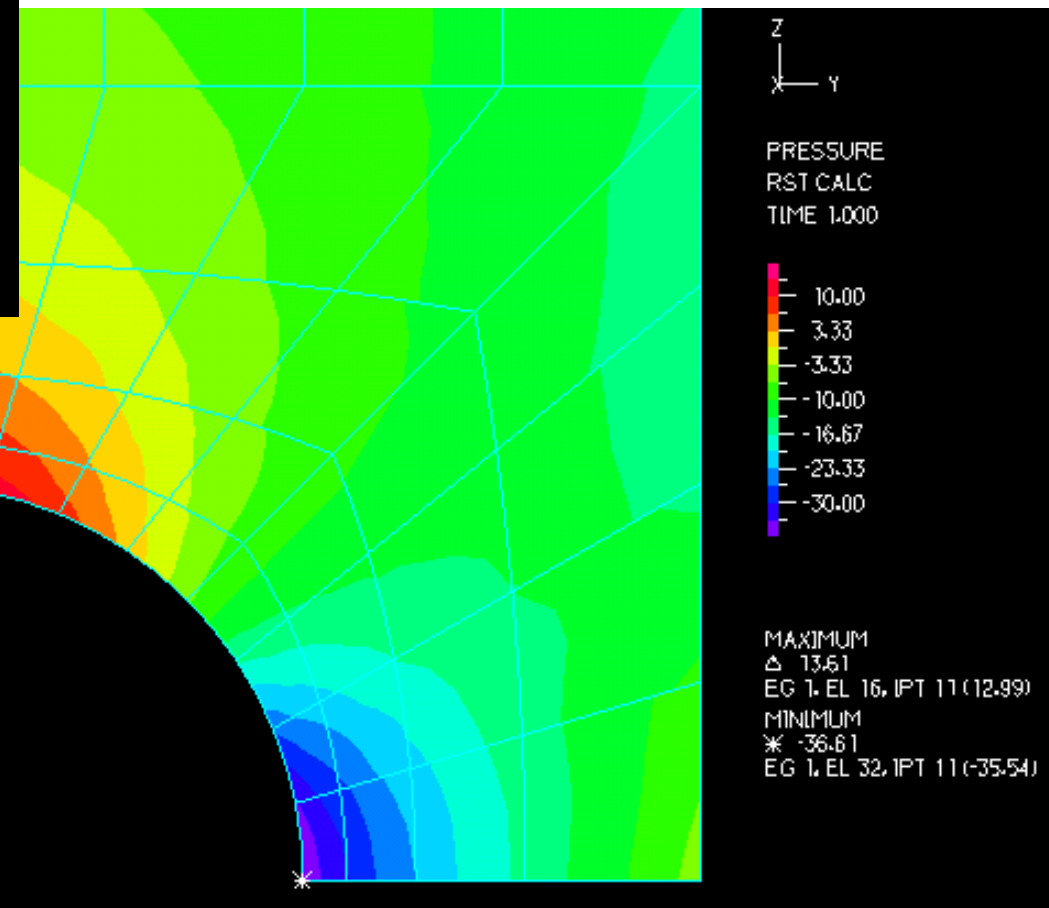
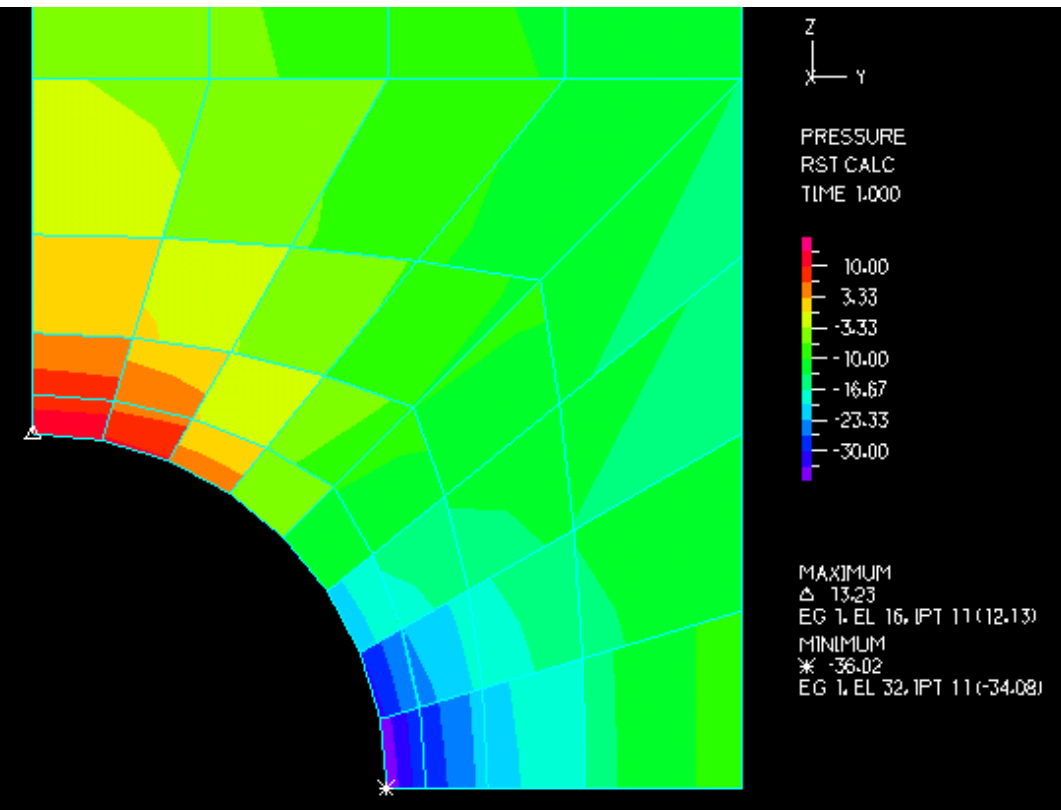
Uniform mesh refinement



Graded mesh refinement

Plane stress, Compressible material ($\nu = 0.25$)

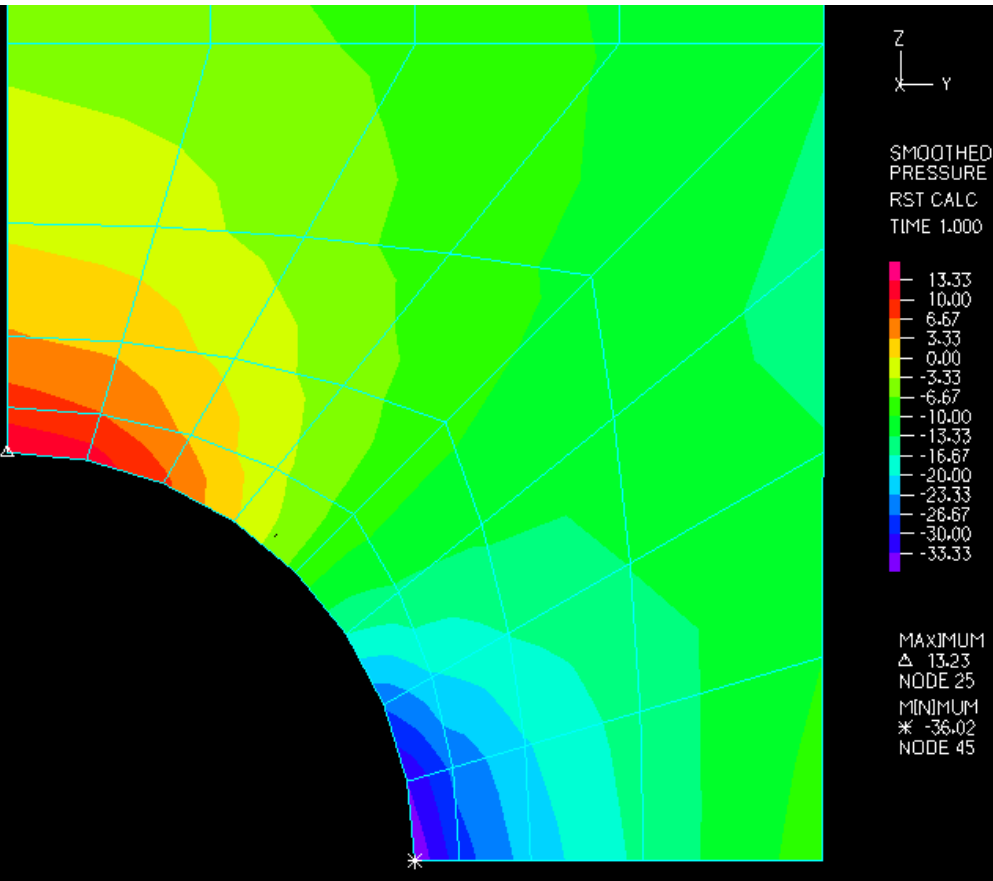
4-node displ-based element



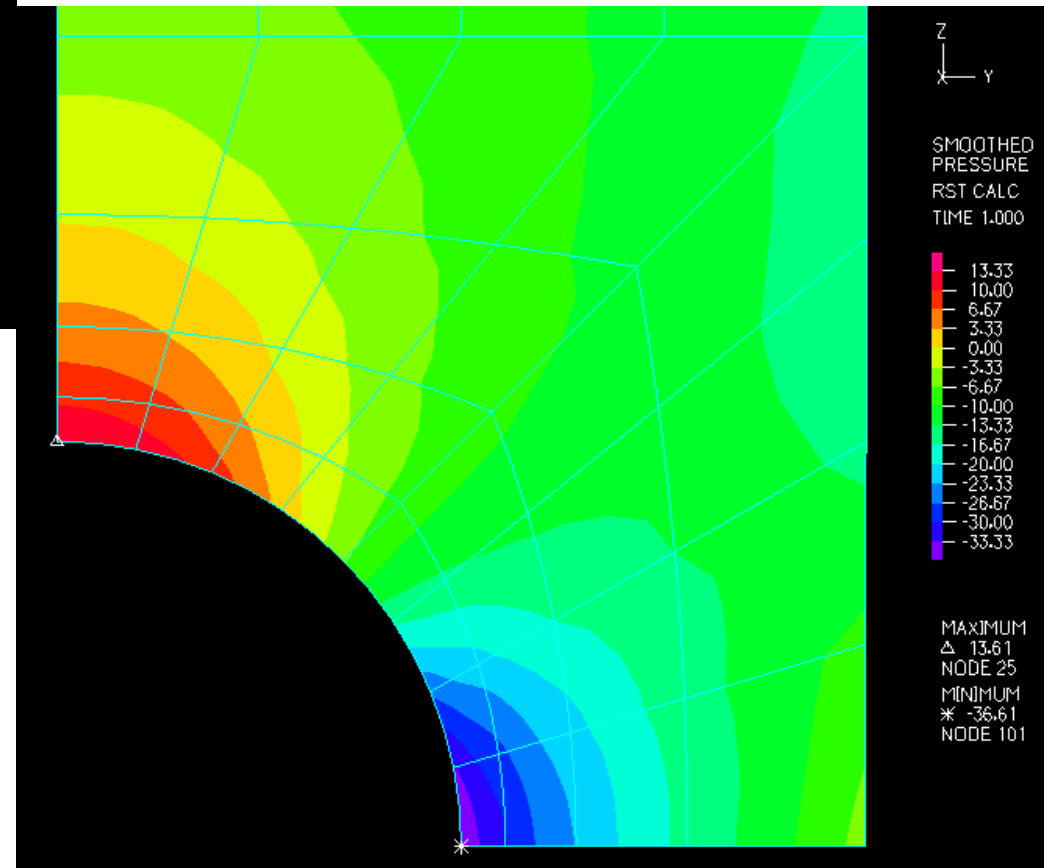
9-node displ-based element

Plane stress, Compressible material ($\nu = 0.25$)

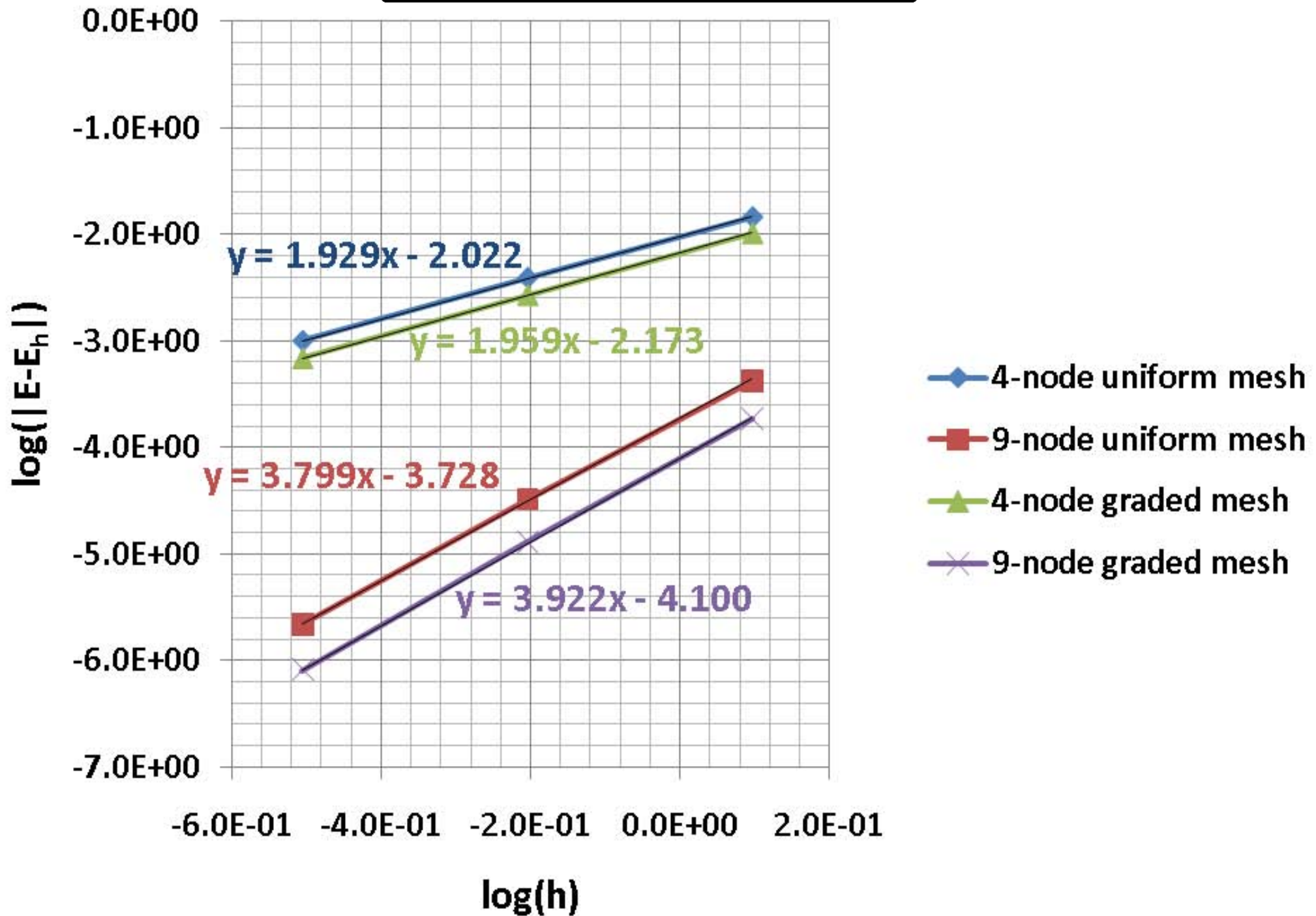
4-node displ-based element



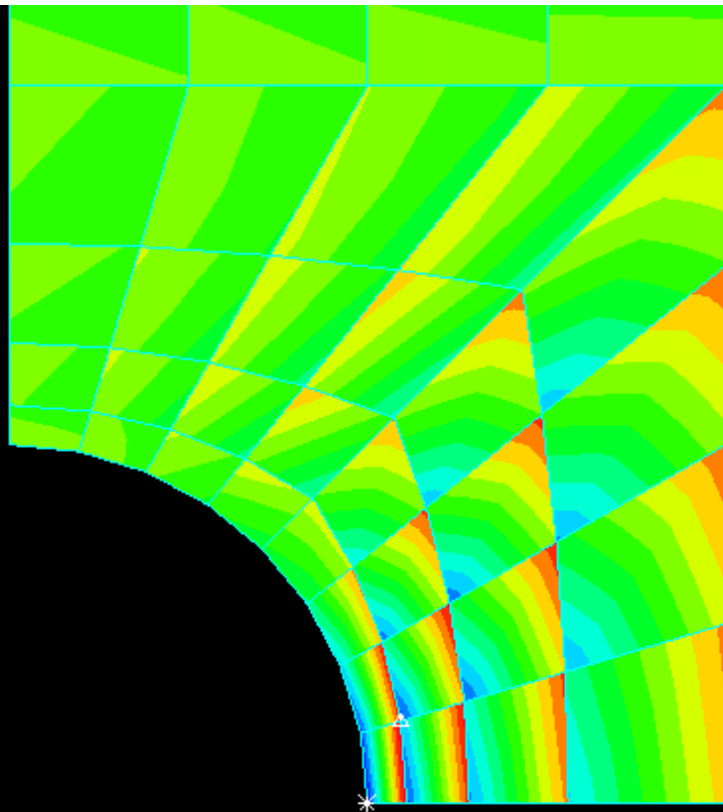
9-node displ-based element



Convergence Rate



Plane strain, Incompressible material ($\nu = 0.4999$)

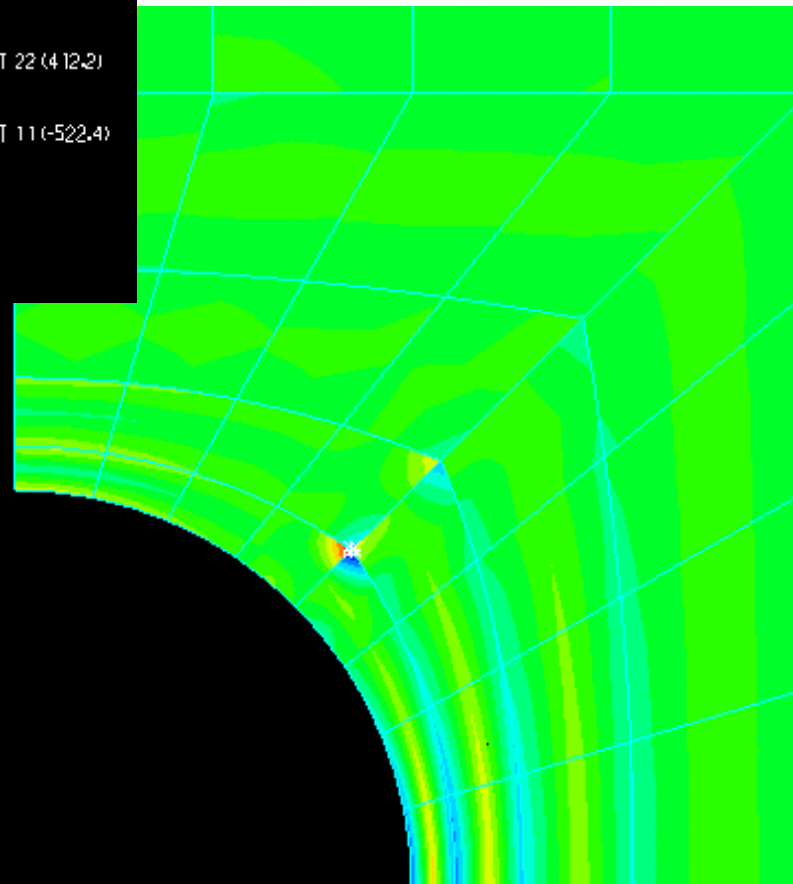


Z
Y
PRESSURE
RST CALC
TIME 1.000

600.0
360.0
120.0
-120.0
-360.0
-600.0
-840.0

MAXIMUM
△ 741.2
EG 1, EL 32, IPT 22 (4 12.2)
MINIMUM
* -877.6
EG 1, EL 32, IPT 11 (-522.4)

← 4-node displ-based element



Z
Y

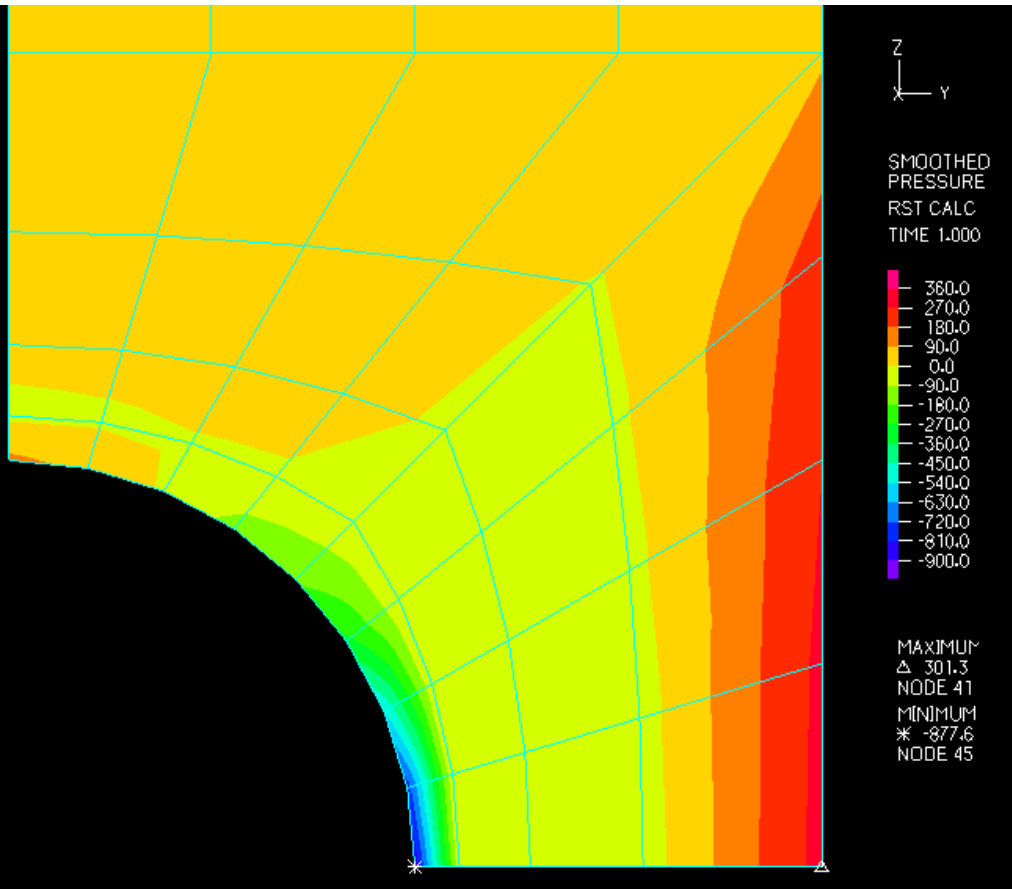
PRESSURE
RST CALC
TIME 1.000

1350.
900.
450.
0.
-450.
-900.
-1350.

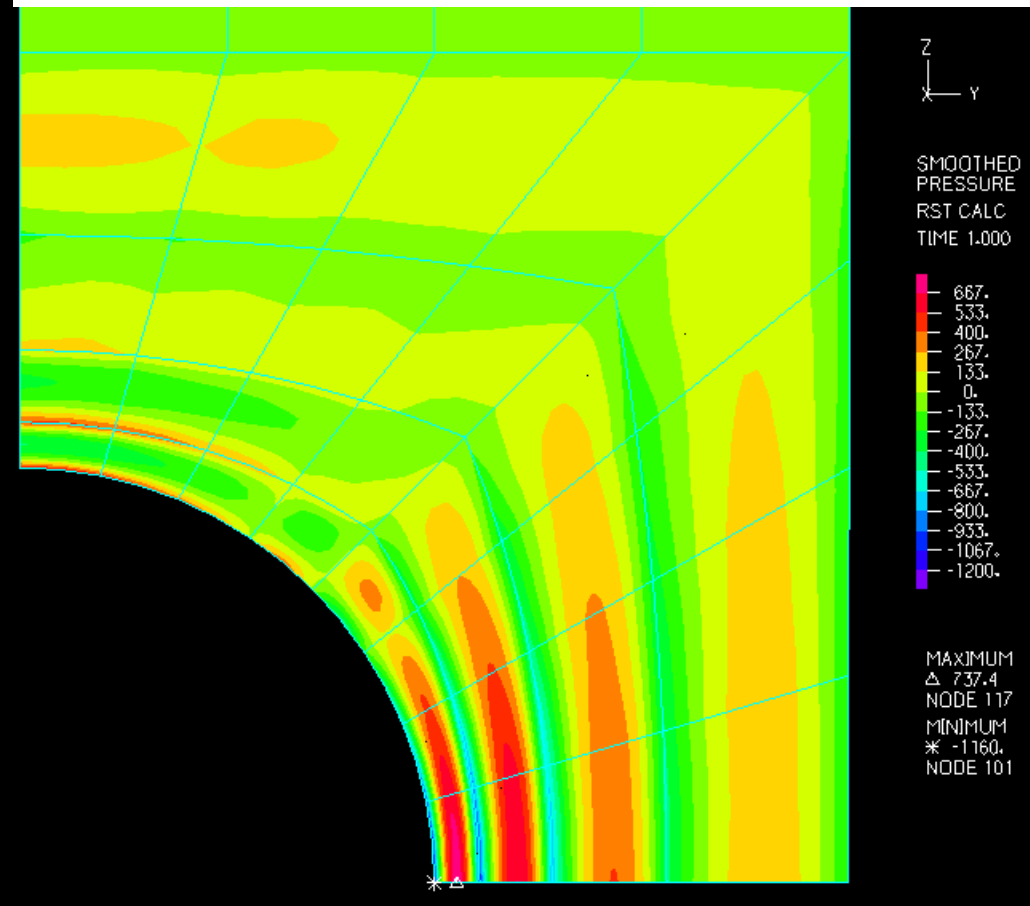
MAXIMUM
△ 1502.
EG 1, EL 13, IPT 33 (864.0)
MINIMUM
* -1616.
EG 1, EL 20, IPT 33 (-944.7)

9-node displ-based element →

Plane strain, Incompressible material ($\nu = 0.4999$)



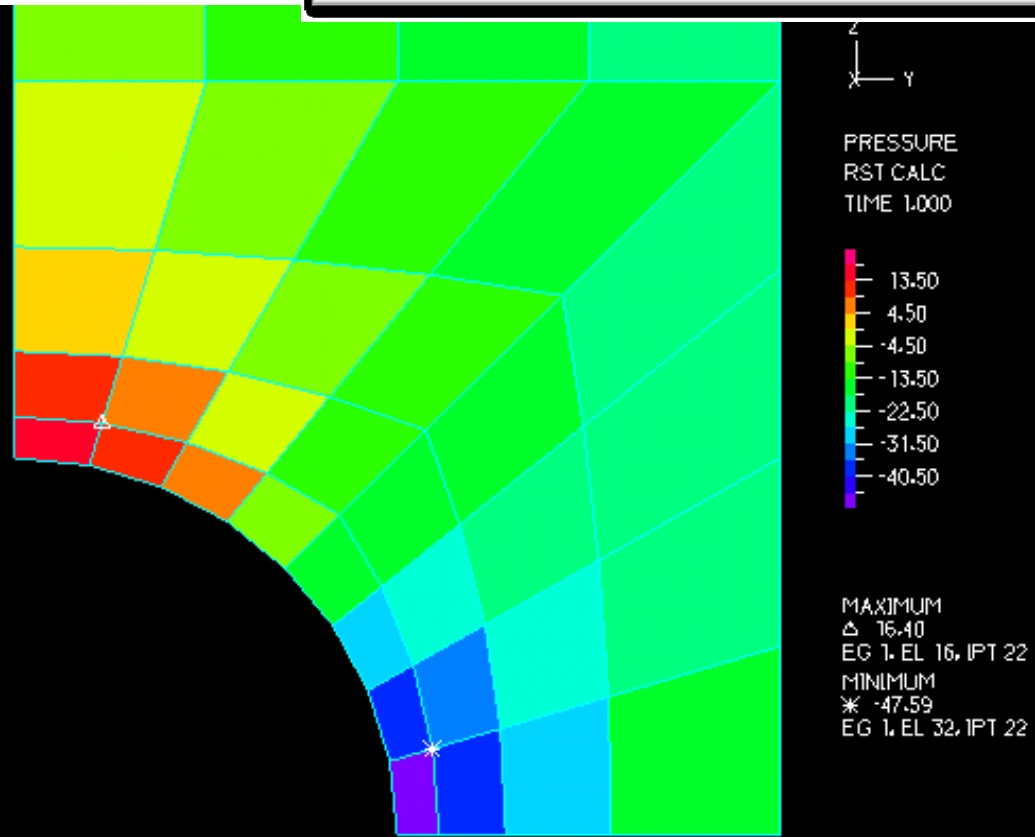
4-node displ-based element



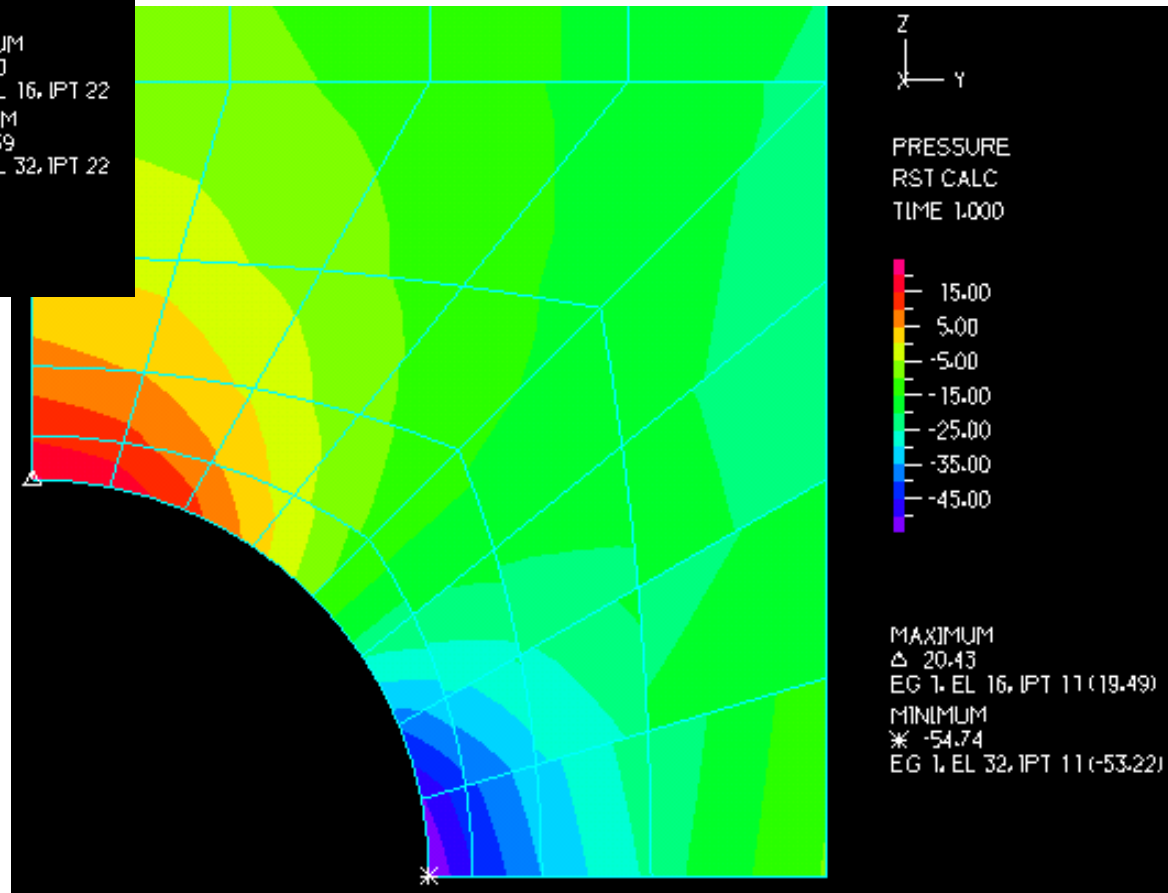
9-node displ-based element

Plane strain, Incompressible material ($\nu = 0.4999$)

4/1 (u/p) mixed element

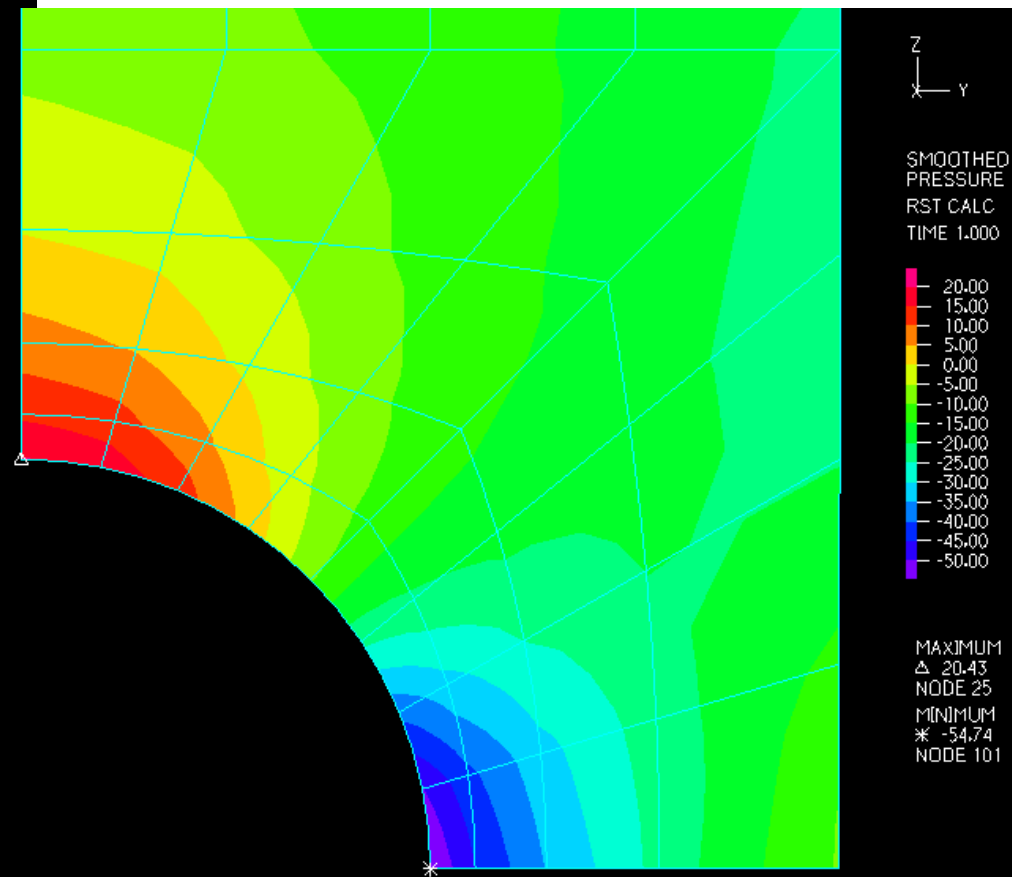
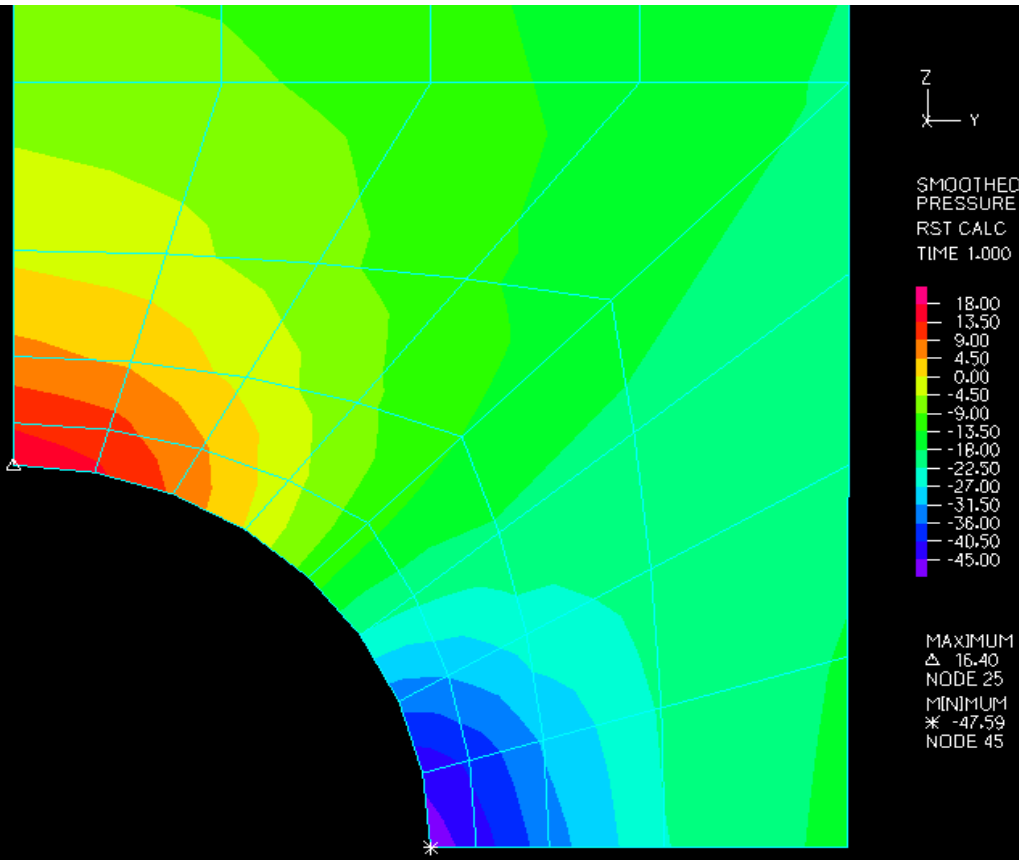


9/3 (u/p) mixed element



Plane strain, Incompressible material ($\nu = 0.4999$)

4/1 (u/p) mixed element



9/3 (u/p) mixed element