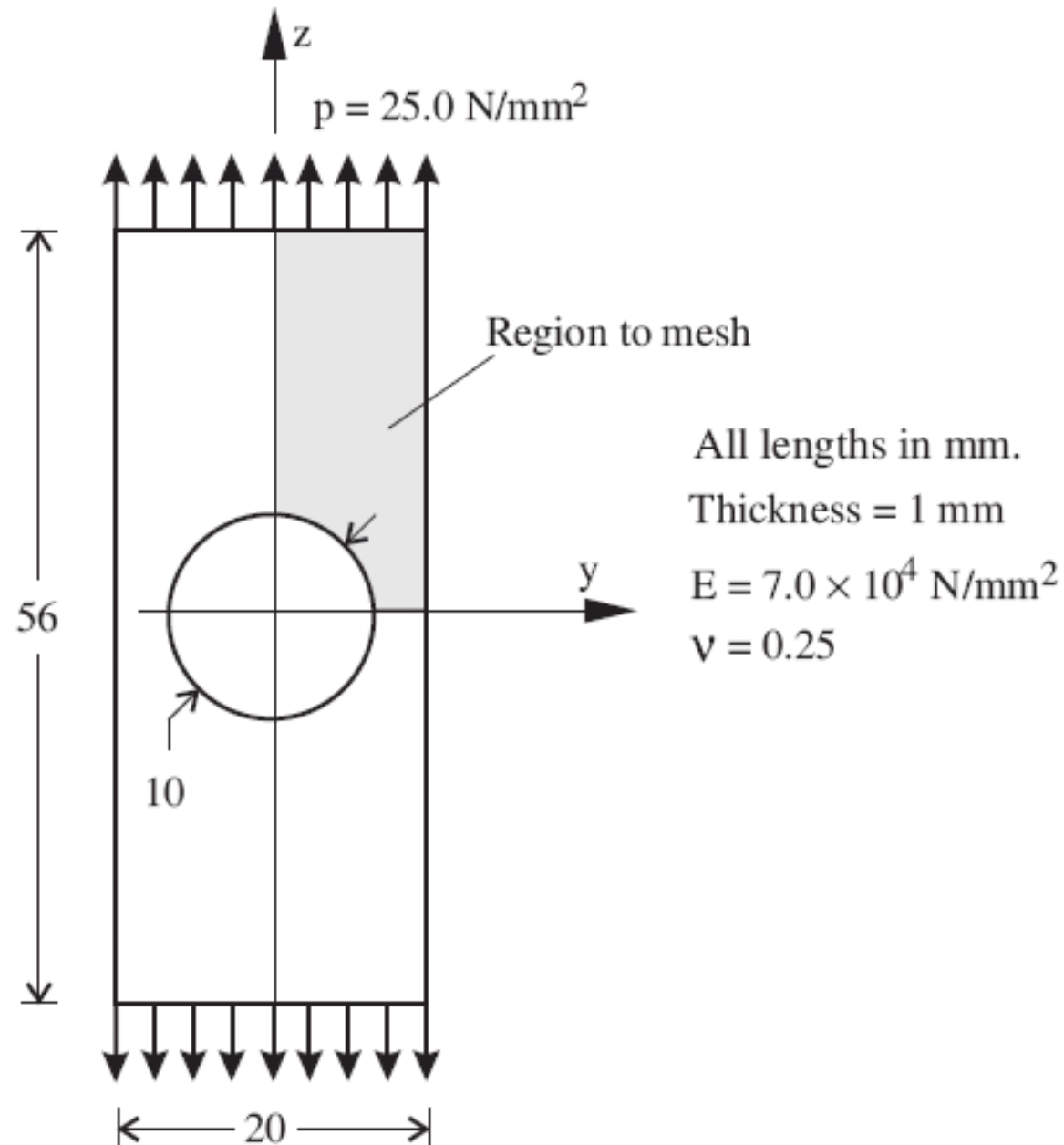
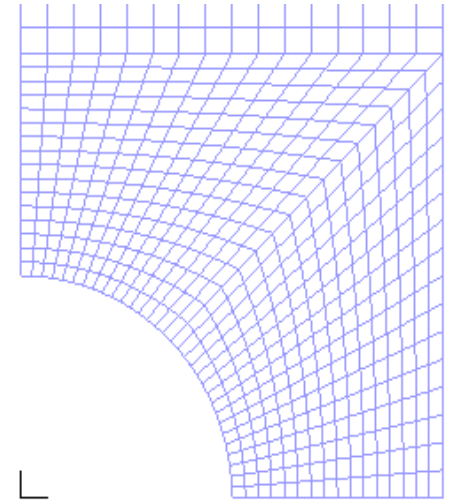
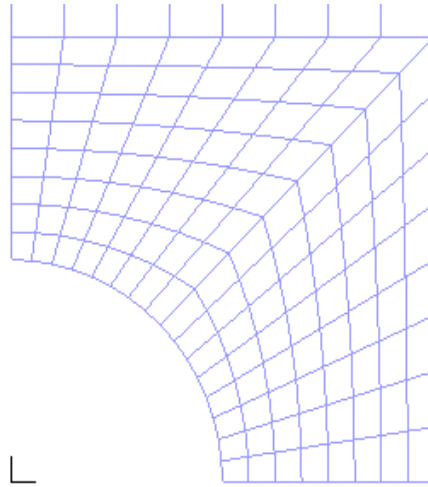
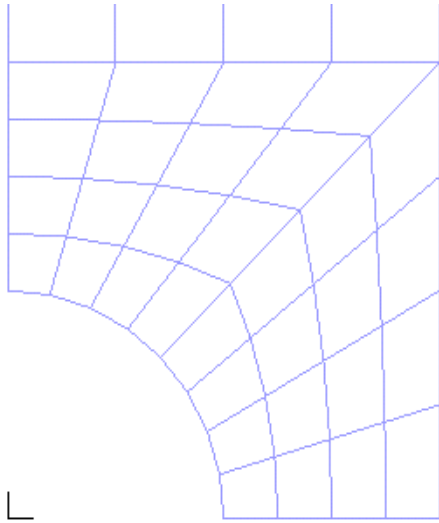
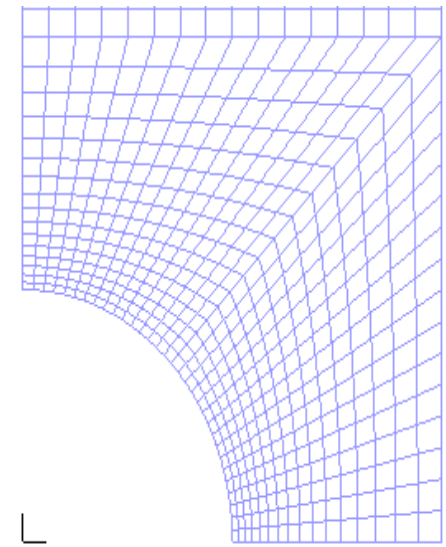
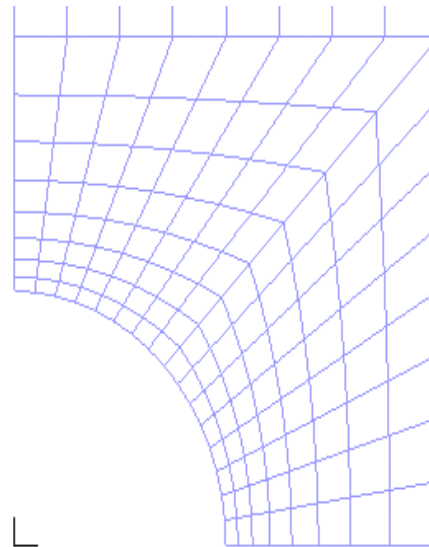
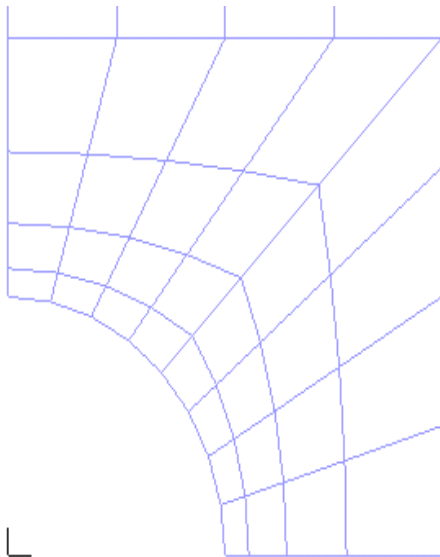


# Convergence demo – plate with a hole





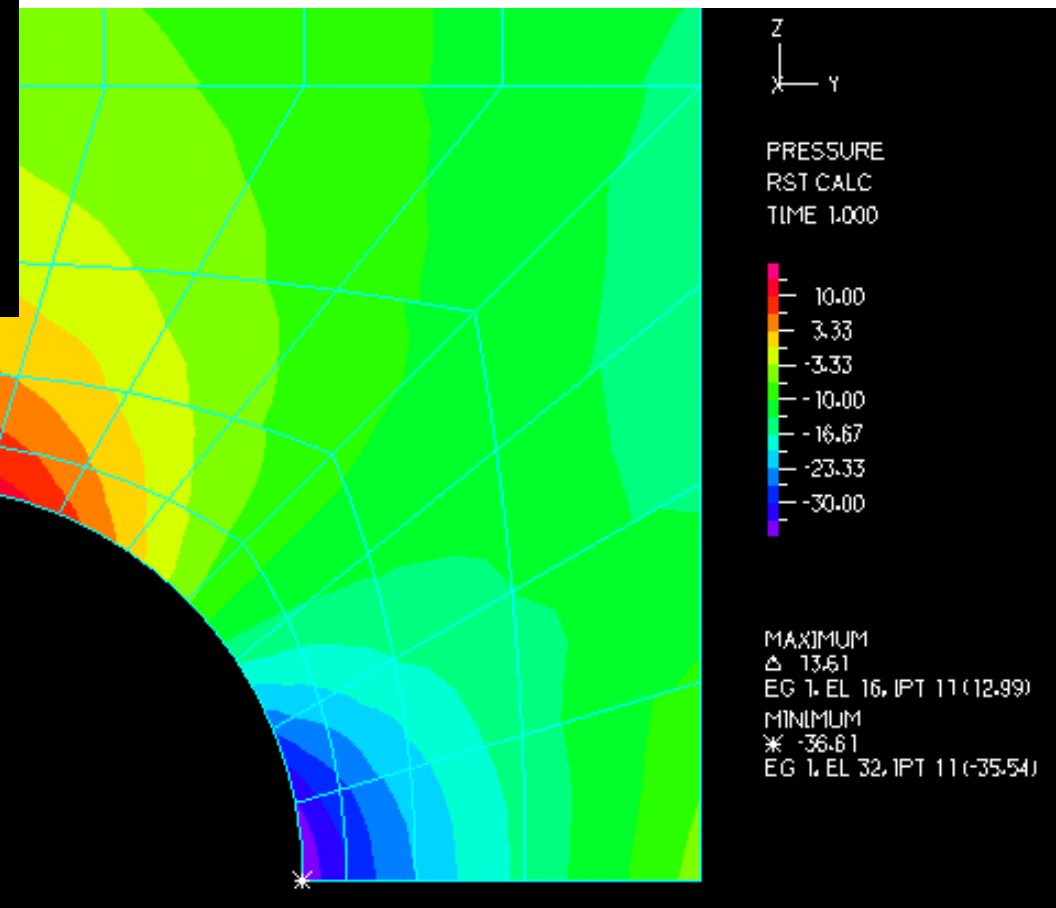
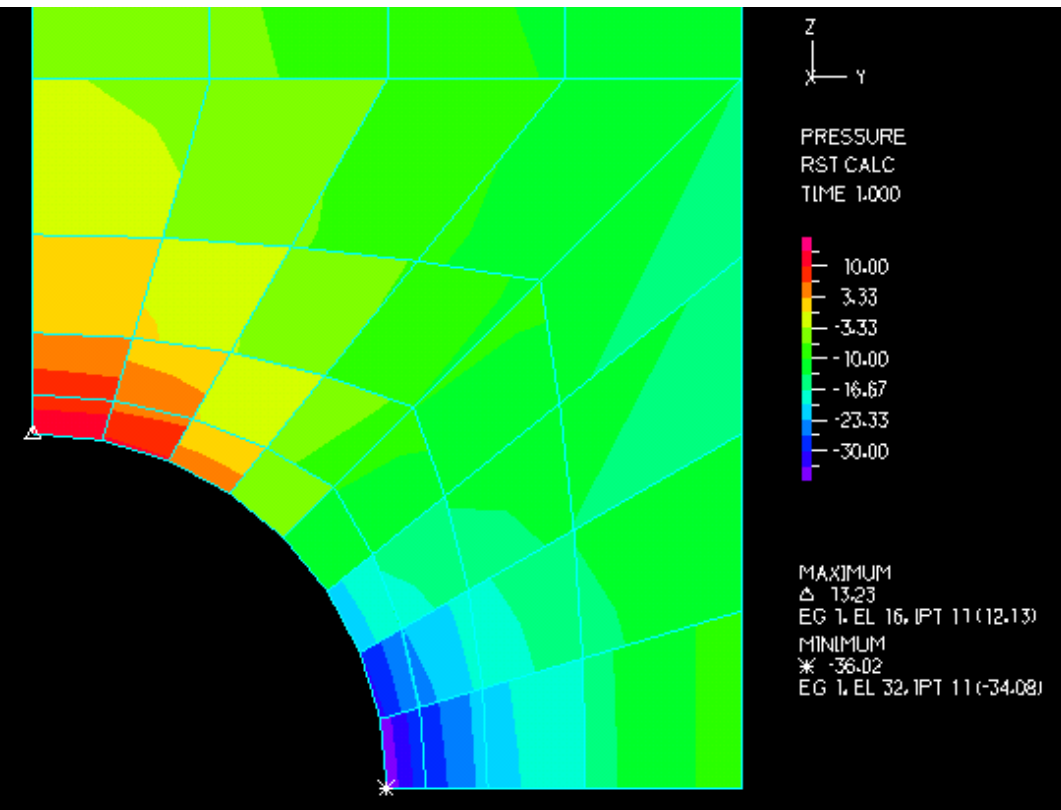
Uniform mesh refinement



Graded mesh refinement

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

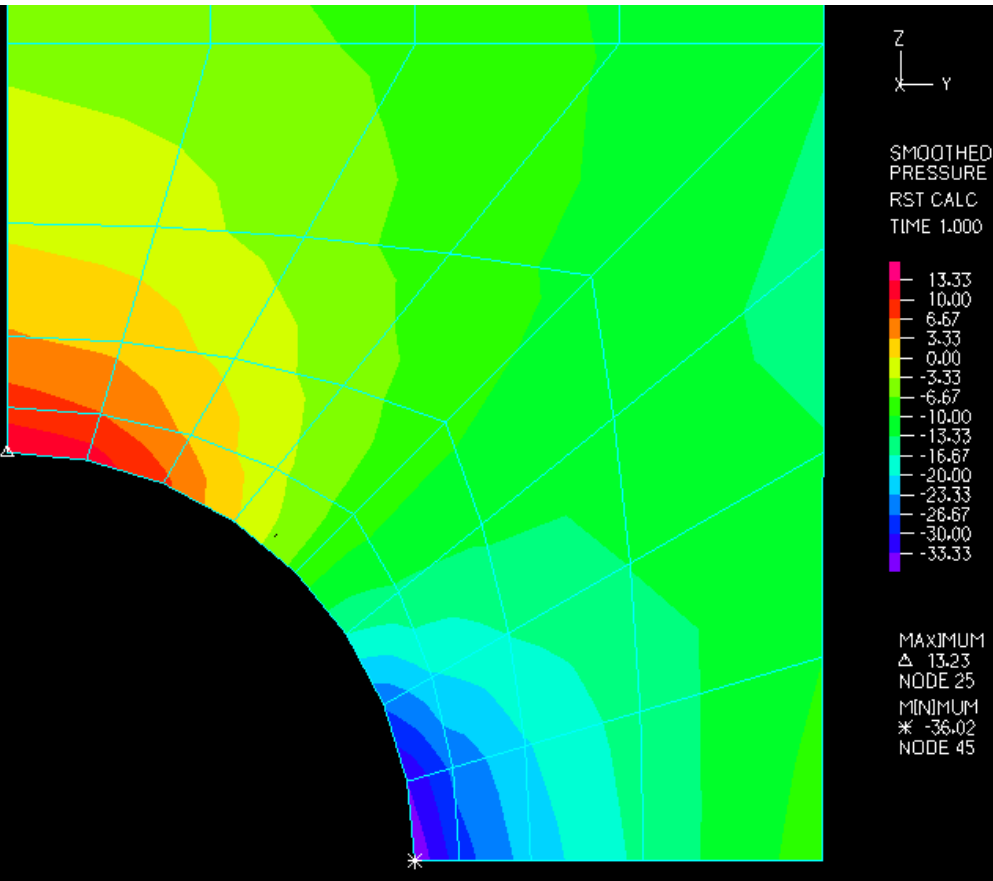
4-node displ-based element



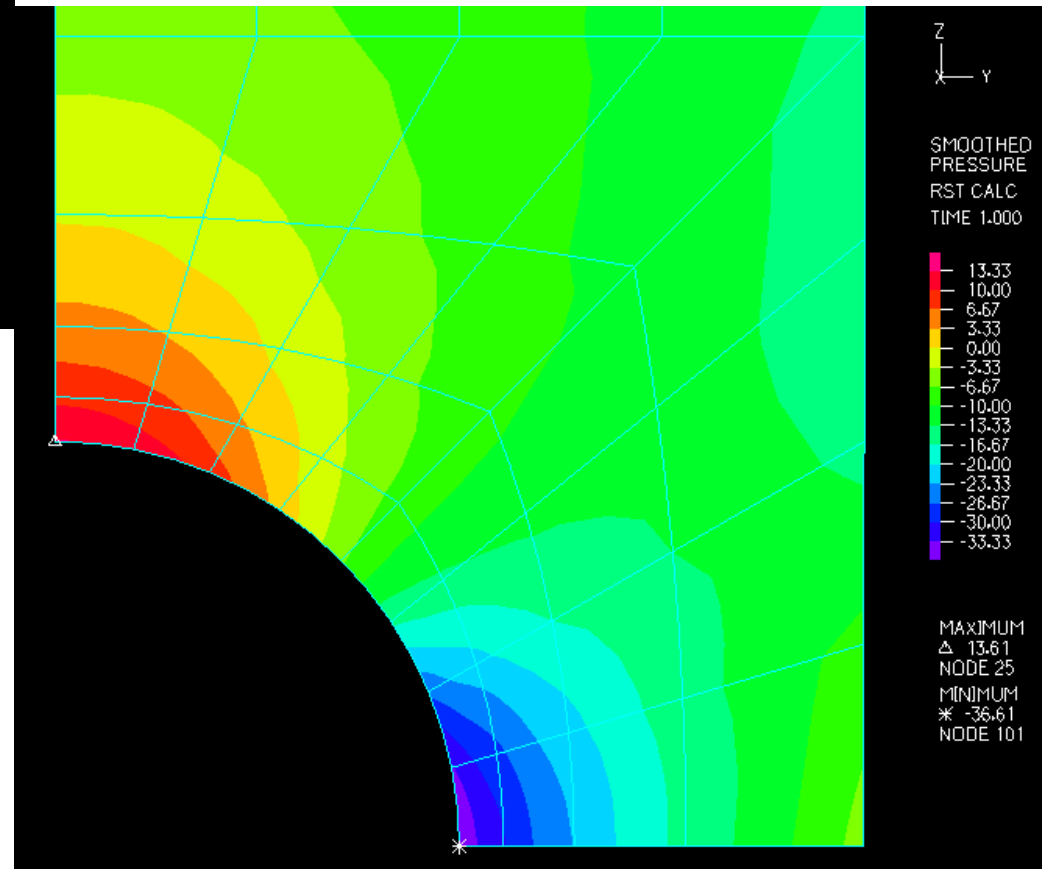
9-node displ-based element

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

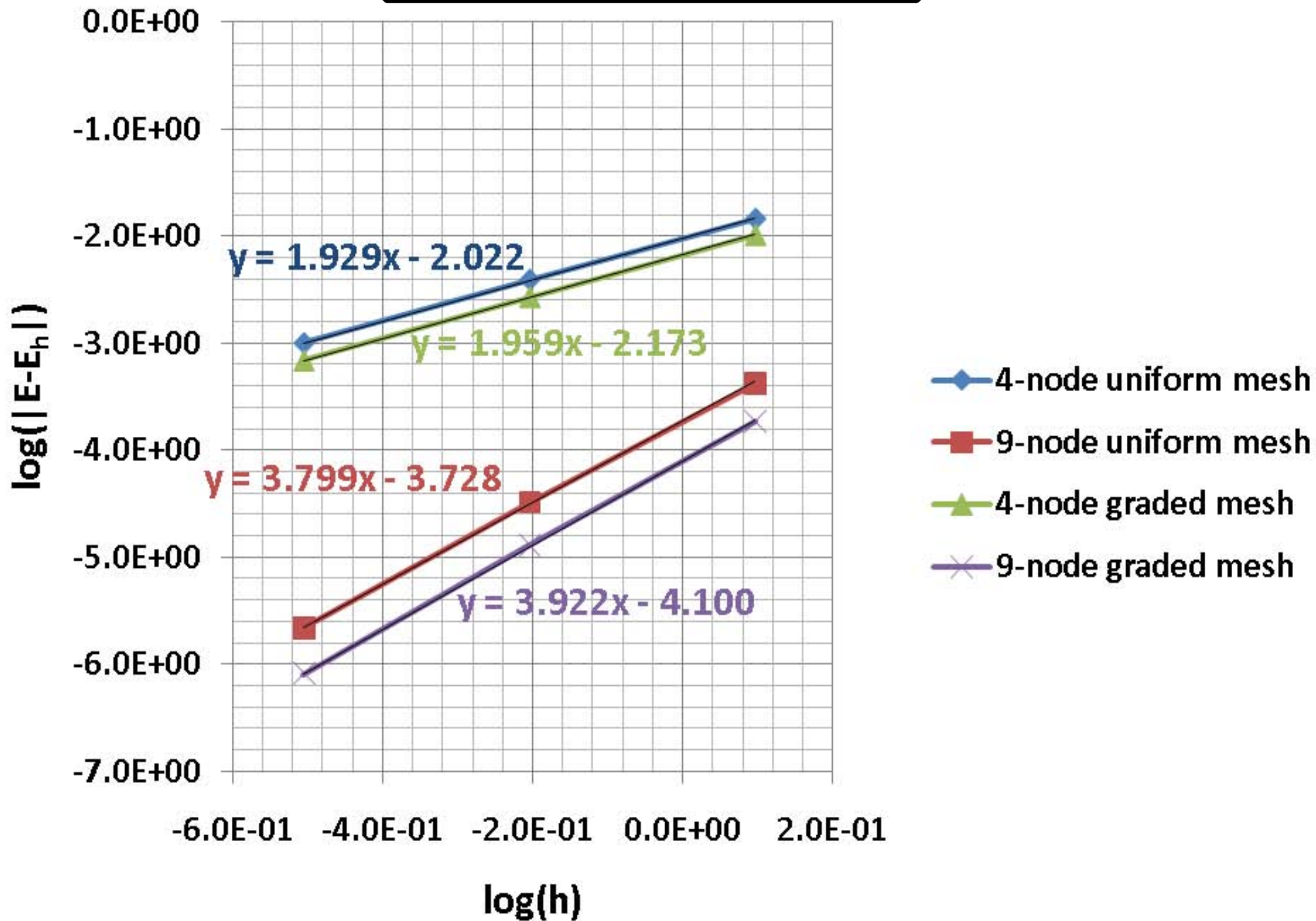
4-node displ-based element



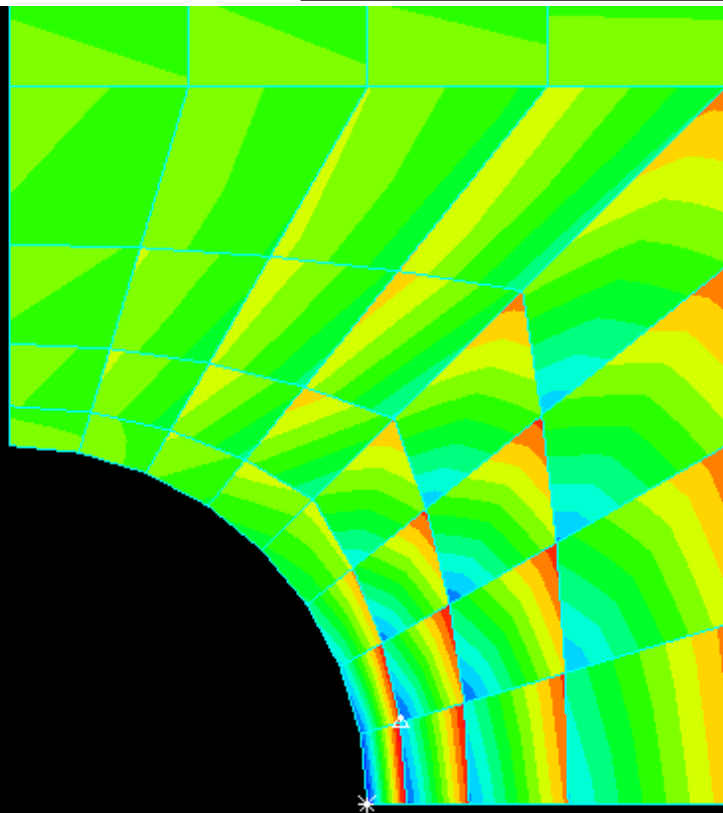
9-node displ-based element



## Convergence Rate



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



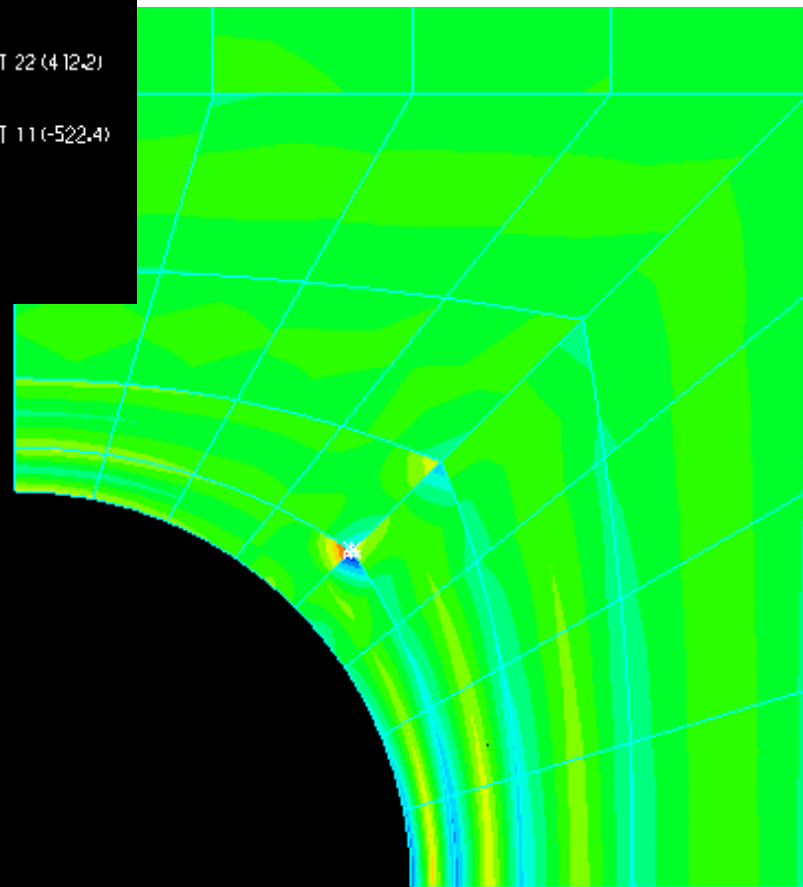
Z  
Y

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

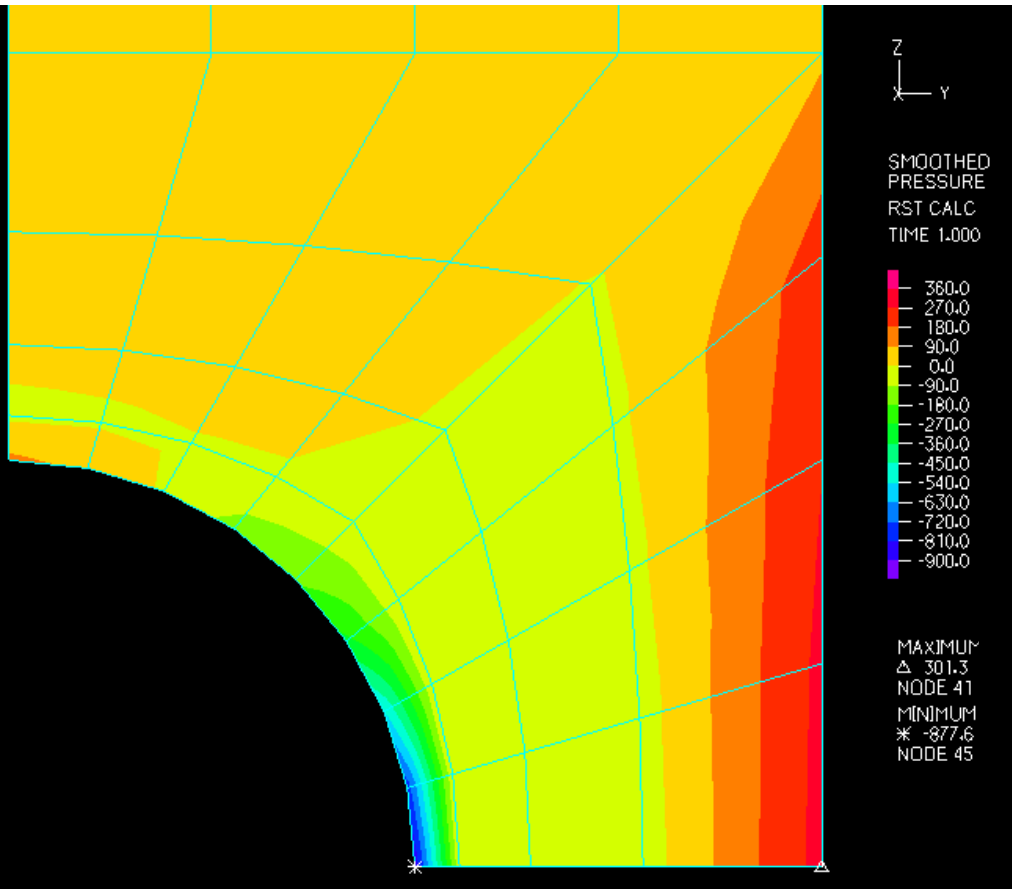
PRESSURE  
RST CALC  
TIME 1.000

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

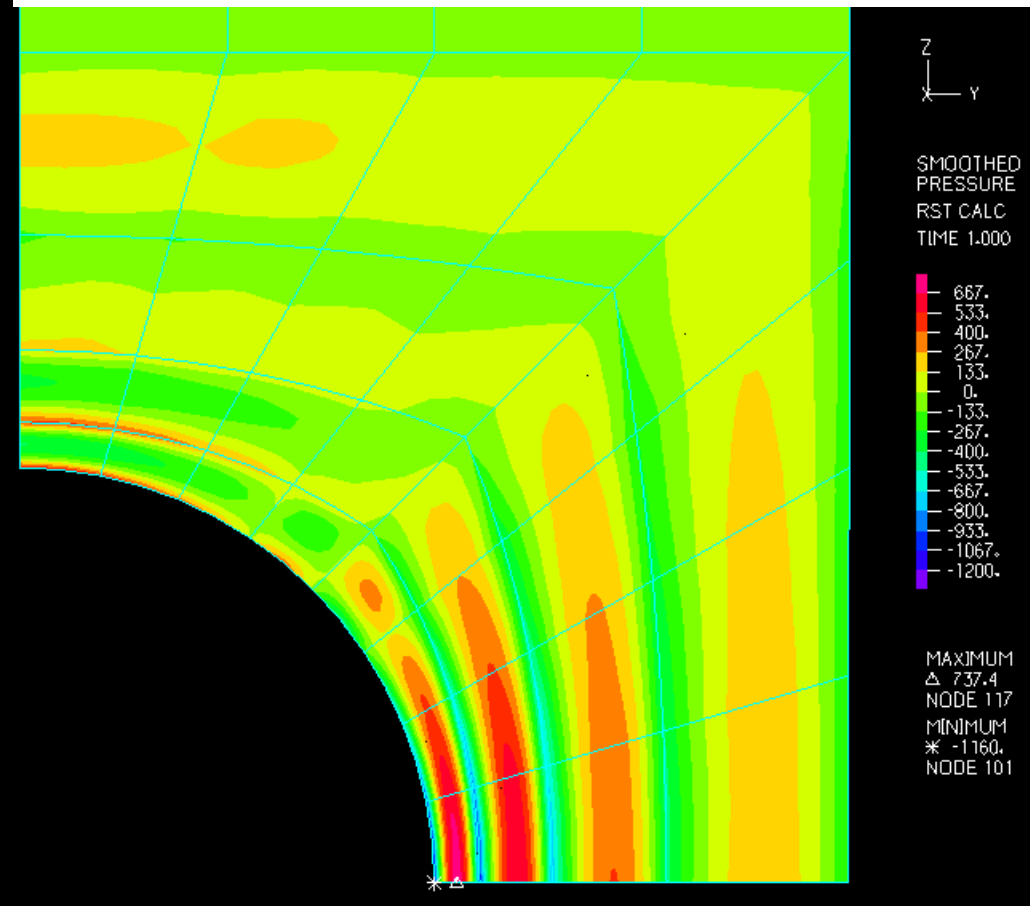
MAXIMUM  
△ 1502.  
EG 1, EL 13, IPT 33 (864.0)  
MINIMUM  
\* -1616.  
EG 1, EL 20, IPT 33 (-944.7)

9-node displ-based element →

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

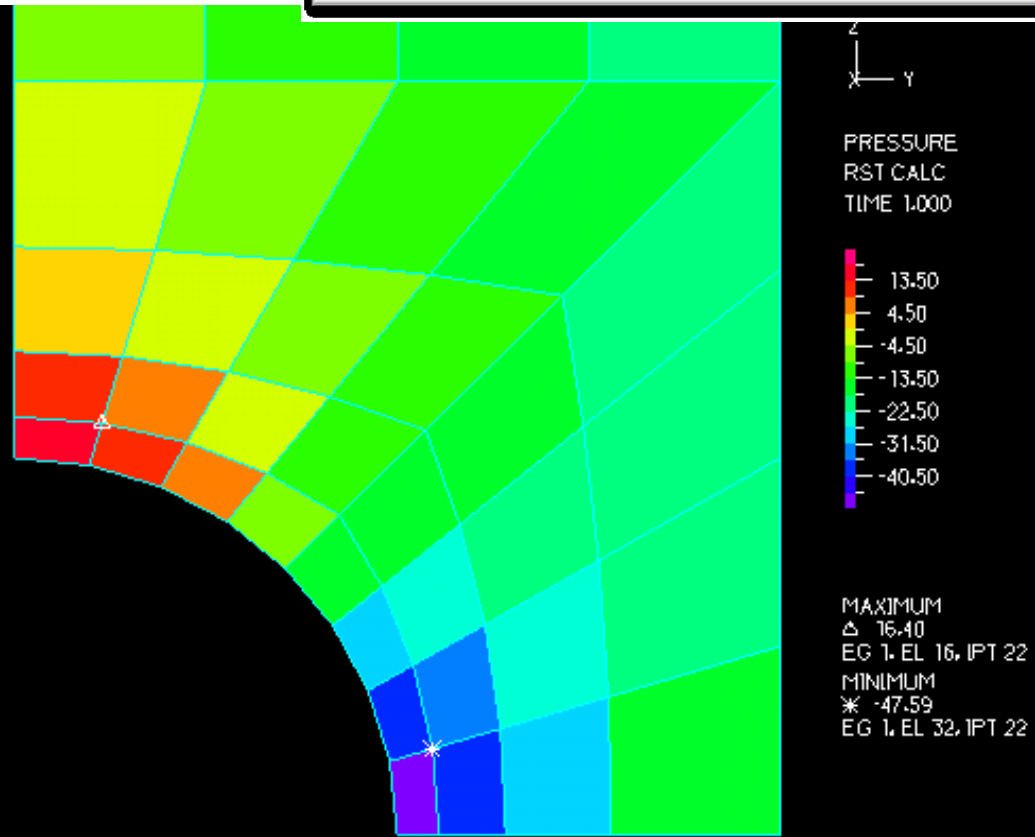


4-node displ-based element

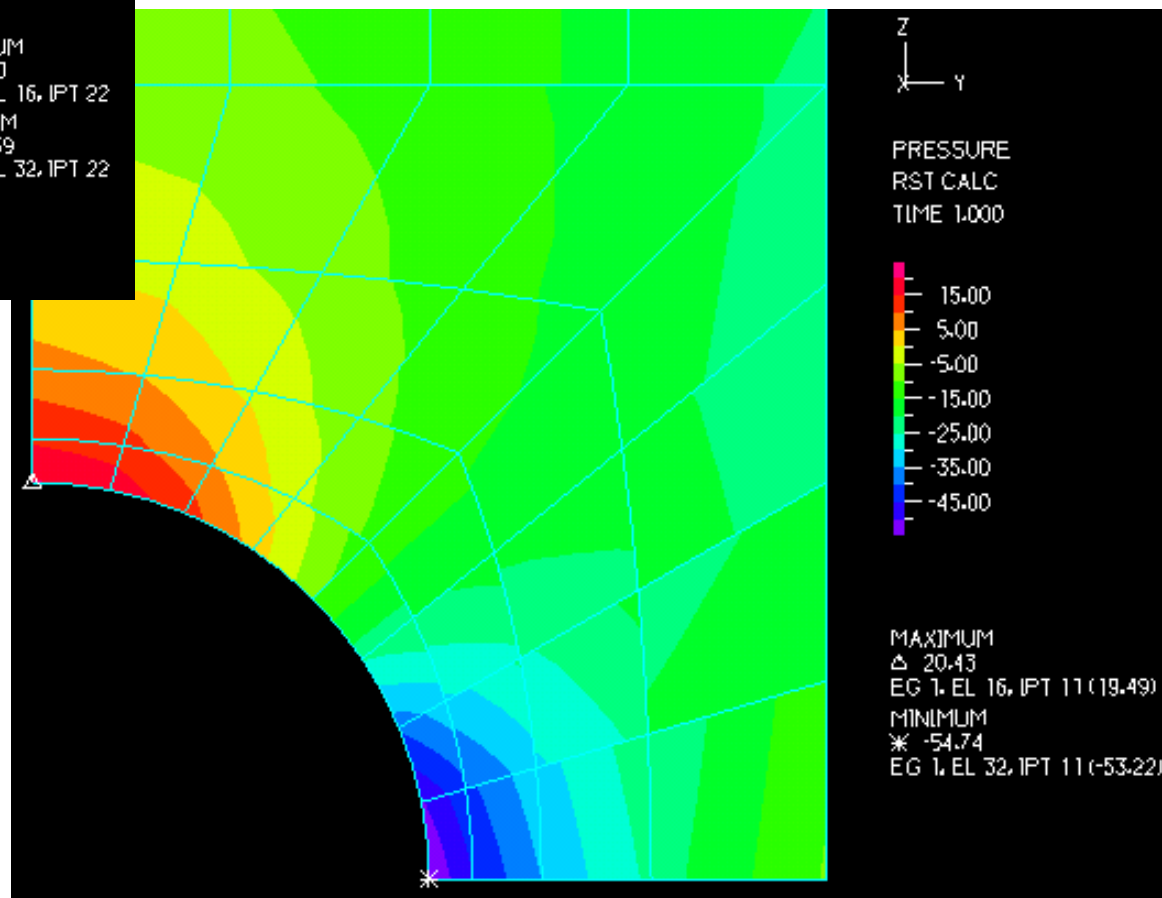


9-node displ-based element

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



← 4/1 (u/p) mixed element

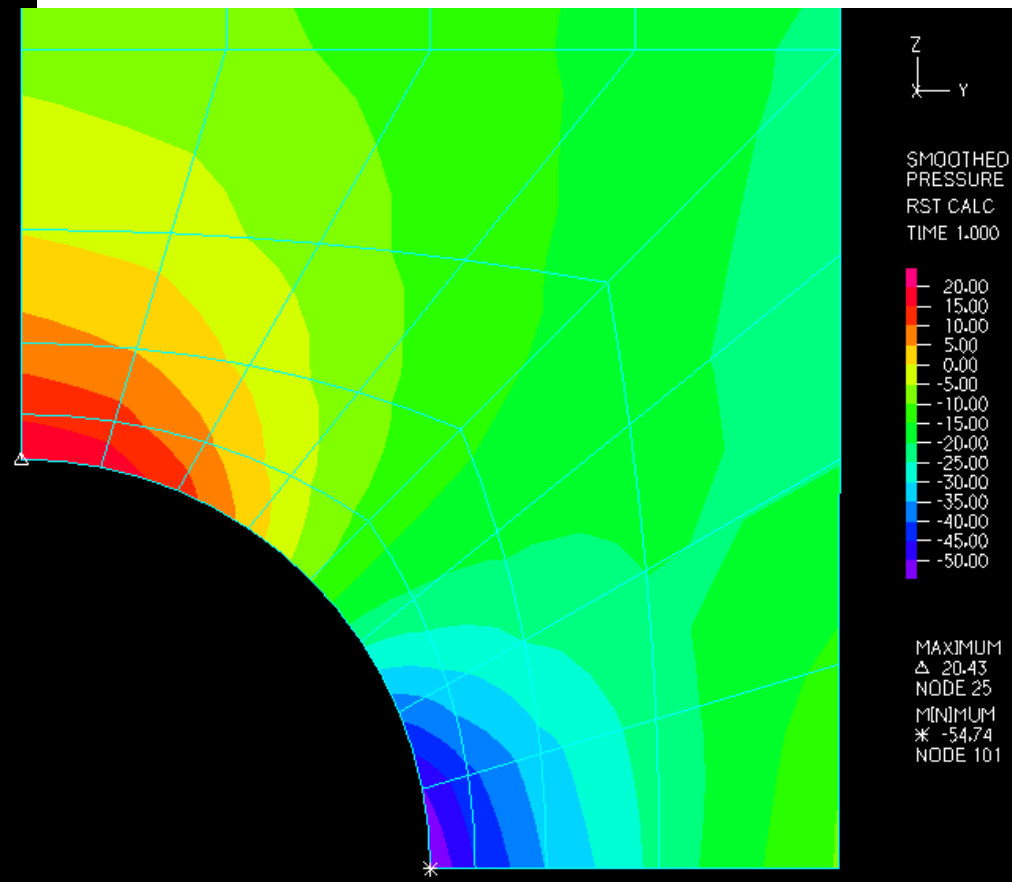
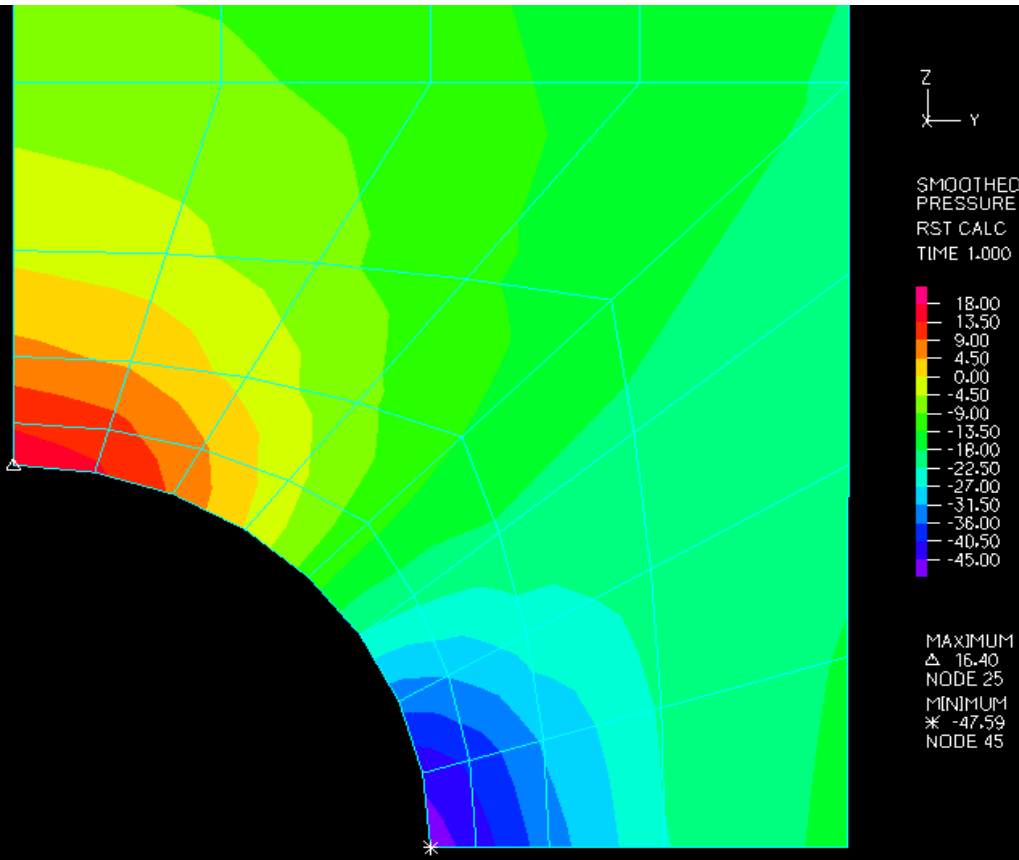


9/3 (u/p) mixed element →



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

4/1 (u/p) mixed element



9/3 (u/p) mixed element

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2.094 Finite Element Analysis of Solids and Fluids II  
Spring 2011

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