THE STRUCTURAL STATIC ANALYSIS TUTORIAL

Problem description: Structural Static Analysis of a Corner Bracket

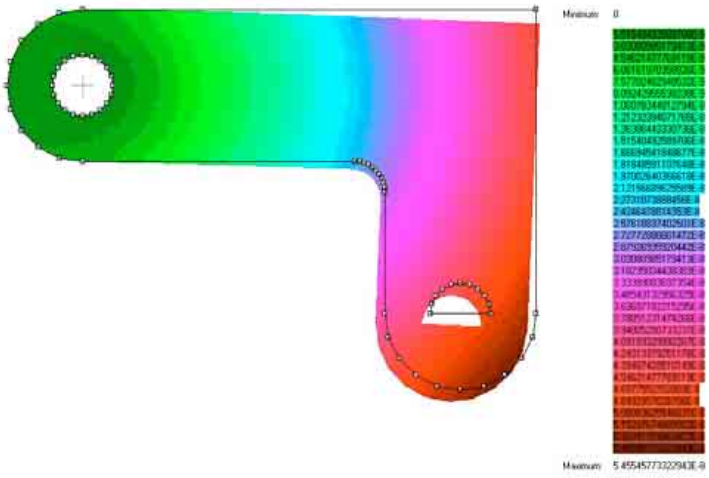


Fig. 1.

The bracket is made of steel and the loading environment consists of a welded constraint around the entire circumference of the pin hole in the upper left and a downward force applied to the bottom half of the hole in the lower right.

Given

The dimensions of the corner bracket are shown in the accompanying Fig 1. The bracket is made of steel with a Young's modulus of 3E10 Pa and Poisson's ratio of 0.3.

Summary of steps:

Preprocessor - New File - New
Set a Job Name
Choose the Physical Problem as Linear Plane Stress XY

Setting of used unit

Options - Unit - Centimeter

Geometry and boundary conditions

Input of the KeyPoints:
Preprocessor – Geometry file – Geometry Builder – KeyPoint (Ctrl+K)
Position x: 0 cm
Position y: -1 cm

Ctrl+K
Position x: 0 cm
Position y: 1 cm

Ctrl+K
Position x: 6 cm
Position y: 1 cm
Ctrl+K
Position x: 6 cm
Position y: -3 cm

Ctrl+K

Position x: *4 cm*

Position y: *-3 cm*

Ctrl+K

Position x: *4 cm*

Position y: *-1.4 cm*

Ctrl+K

Position x: *3.6 cm*

Position y: *-1 cm*

Input of the Straight Lines:

Preprocessor – Geometry file – Geometry Builder – StraightLine (Ctrl+L)

From KP (keypoint): *1*

To KP: *2*

B. C. Type: *0* *FREE* - *free movement*

B. C. 1: *0*

B. C. 2: *0*

B. C. 3: *0*

Others: *0*

Ctrl+L

From KP (keypoint): *2*

To KP: *3*

B. C. Type: *0* *FREE* - *free movement*

B. C. 1: *0*

B. C. 2: *0*

B. C. 3: *0*

Others: *0*

Ctrl+L

From KP (keypoint): *4*

To KP: *5*

B. C. Type: *0* *FREE* - *free movement*

B. C. 1: *0*

B. C. 2: *0*

B. C. 3: *0*

Others: *0*

Ctrl+L

From KP (keypoint): *6*

To KP: *0*

B. C. Type: *0* *FREE* - *free movement*

B. C. 1: *0*

B. C. 2: *0*

B. C. 3: *0*

Others: *0*

Input of the Circle Line:

Preprocessor – Geometry file – Geometry Builder –CircleLine (Ctrl+Q)

From KP (keypoint): *1*

To KP: *0*

Angle: *180°*

Dividing: *10*

B. C. Type: *0* *FREE* - *free movement*

B. C. 1: *0*

B. C. 2: *0*

B. C. 3: *0*

Others: *0*

Ctrl+Q
From KP (keypoint): *4*
To KP: *3*
Angle: *180°*
Dividing: *10*
B. C. Type: *0* *FREE* - *free movement*
B. C. 1: *0*
B. C. 2: *0*
B. C. 3: *0*
Others: *0*

Ctrl+Q
From KP (keypoint): *5*
To KP: *6*
Angle: *90°*
Dividing: *10*
B. C. Type: *0* *FREE* - *free movement*
B. C. 1: *0*
B. C. 2: *0*
B. C. 3: *0*
Others: *0*

Ctrl+K
Position x: *0 cm*
Position y: *-0.4 cm*
Ctrl+K
Position x: *0 cm*
Position y: *-0.4 cm*

Ctrl+Q
From KP (keypoint): *35*
To KP: *34*
Angle: *180°*
Dividing: *10*
B. C. Type: *13* - *NO movement*
B. C. 1: *1* - $u_x = 0$ *m*
B. C. 2: *1* - $u_y = 0$ *m*
B. C. 3: *0*
Others: *0*
Ctrl+Q
From KP (keypoint): *34*
To KP: *35*
Angle: *180°*
Dividing: *10*
B. C. Type: *13* - *NO movement*
B. C. 1: *1* - $u_x = 0$ *m*
B. C. 2: *1* - $u_y = 0$ *m*
B. C. 3: *0*
Others: *0*

Ctrl+K
Position x: *5.4 cm*
Position y: *-3 cm*
Ctrl+K
Position x: *4.6 cm*
Position y: *-3 cm*

Ctrl+Q
From KP (keypoint): *54*
To KP: *55*
Angle: *180°*
Dividing: *10*
B. C. Type: *0* *FREE* - *free movement*
B. C. 1: *0*
B. C. 2: *0*
B. C. 3: *0*
Others: *0*

Ctrl+L
From KP: *55*
To KP: *54*
B. C. Type: *14* - *pressure*
B. C. 1: *0*
B. C. 2: *-10000 Pa*
B. C. 3: *0*
Others: *0*

Material Model:

Preprocessor – MaterialModeler
Young Modul = 2E11 Pa
Poisson Ratio = 0.3
Others = 0
Click to "Add to local" button

Attributes:

Preprocessor – Attribute
Click in the area of bracket.
Select material (material 0)
Define size of mesh (max area of elementary triangle)
B. C. 1: 0 K - *initial temperature*
B. C. 2: 0 K - *end temperature*
Others = 0

Holes:

Preprocessor – Hole
Click in the area of the pin hole in the upper left.

Preprocessor – Hole
Click in the area of the hole in the lower right.

Meshing

Preprocessor – Mesh

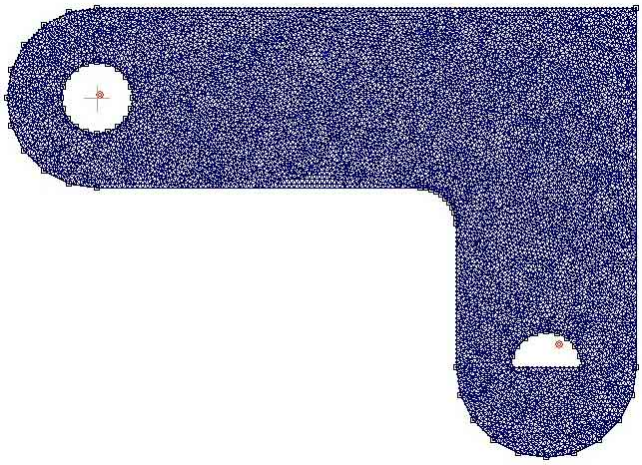


Fig 2. Mesh

Solution

Solver - Solve
Solving take several seconds.

Show Results

*PostProcessor – Nodal Results – Total Value – SelectALL *.Resl01 (DILATATION)*
*PostProcessor – Element Results – Total Value – SelectALL *.Resl02 (DEFORMATIO*N)

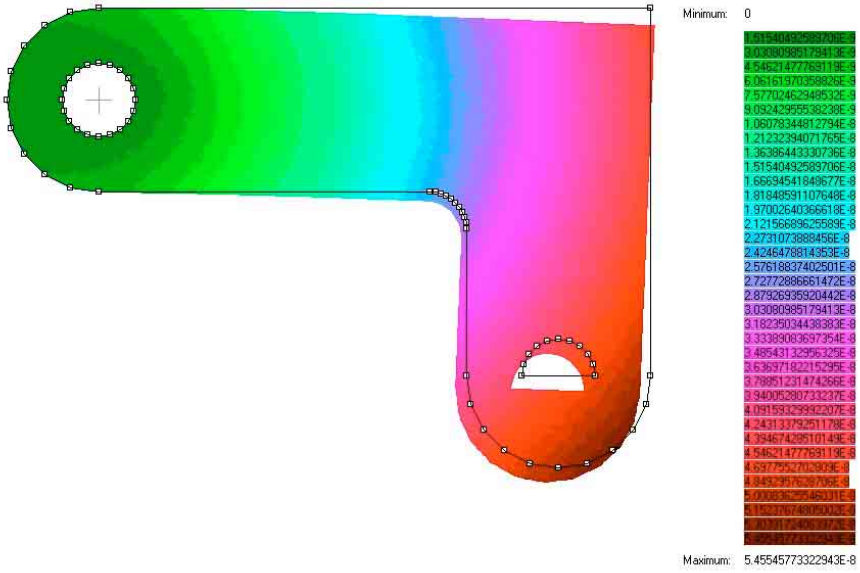


Fig. 3. Total Dilatation [m]

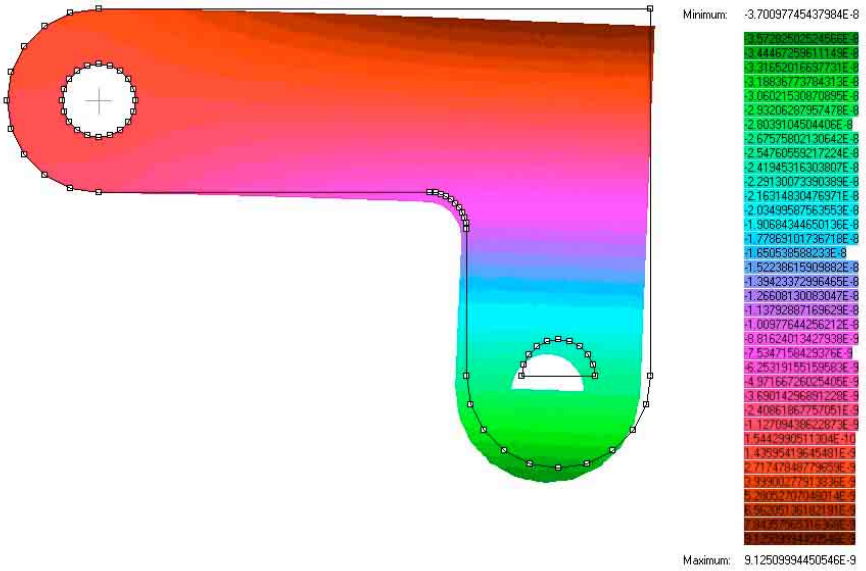


Fig. 4. Dilatation by x [m]

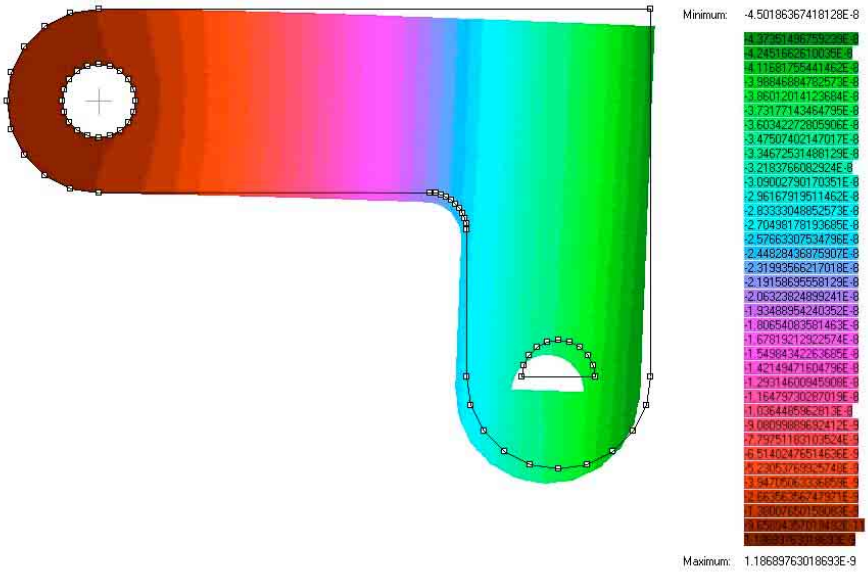


Fig. 5. Dilatation by y [m]

Summary of steps to reach a enlargement of results:

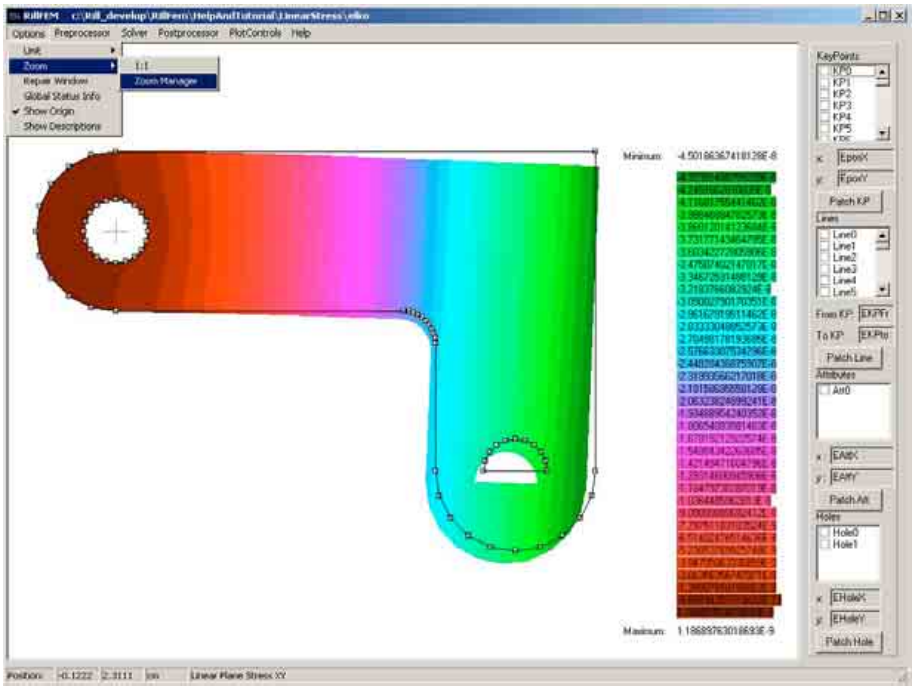


Fig. 6.

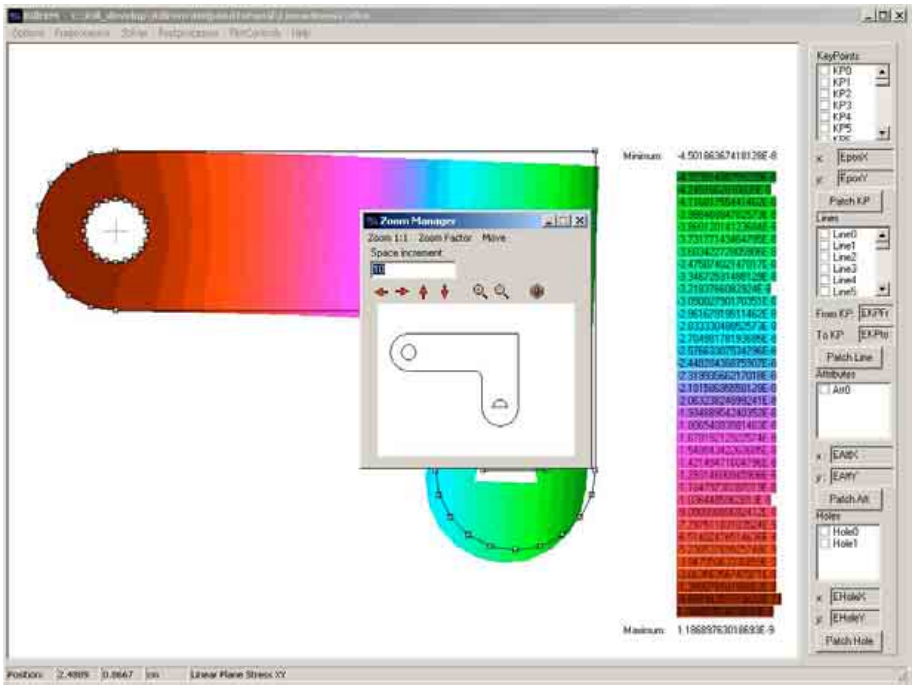
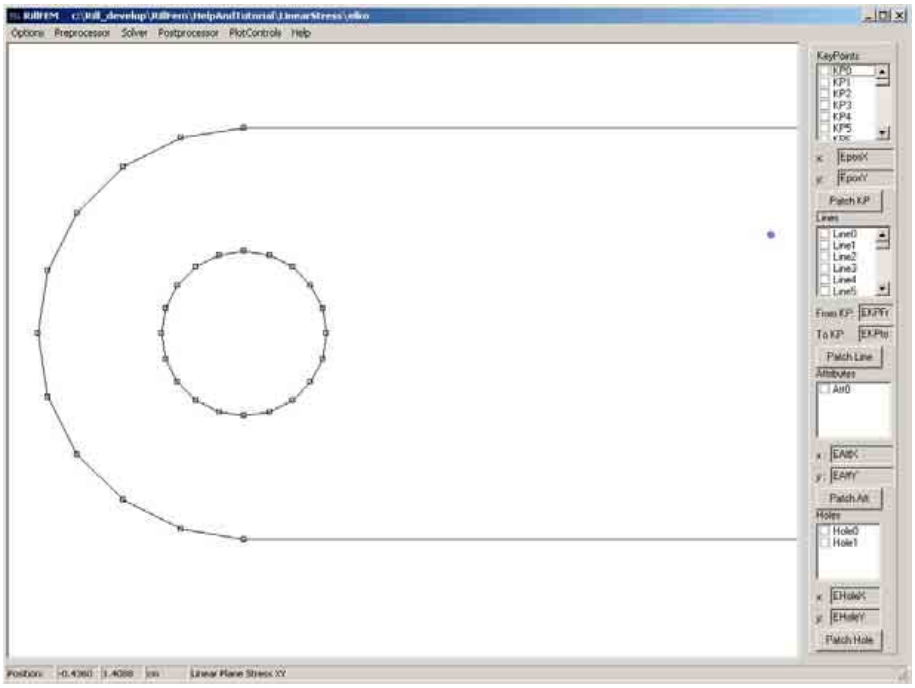


Fig. 7.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KeyPoints
Patch KP
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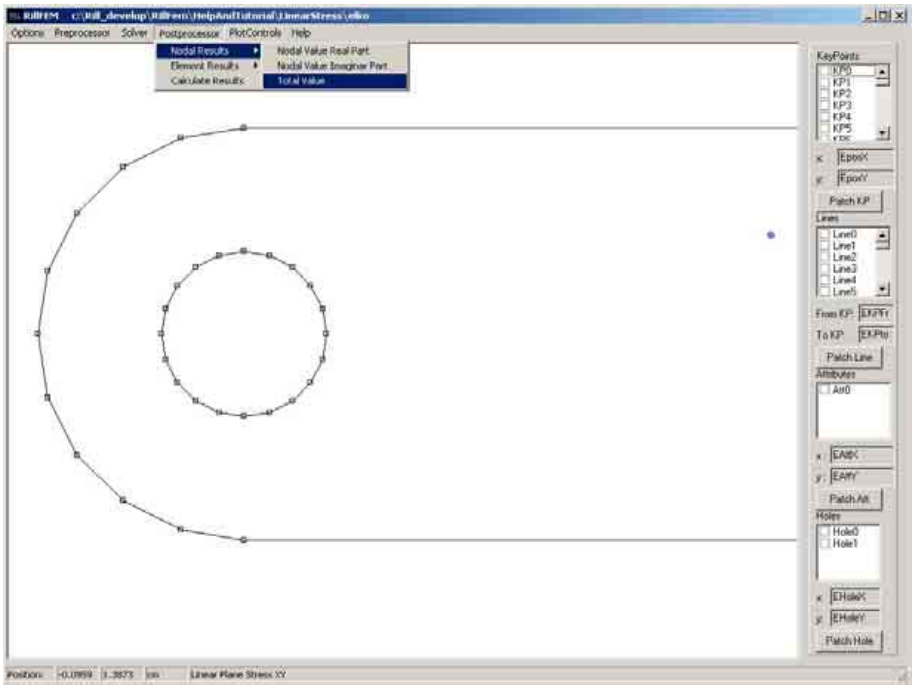
Attributes
Patch Att
Holes
Patch Hole

Fig. 8.


Options Preprocessor Solver Postprocessor PlotControls Help
Nodal Results
Element Results
Calculate Results
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Total Value
KeyPoints
Patch KP
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Attributes
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Holes
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Fig. 9.

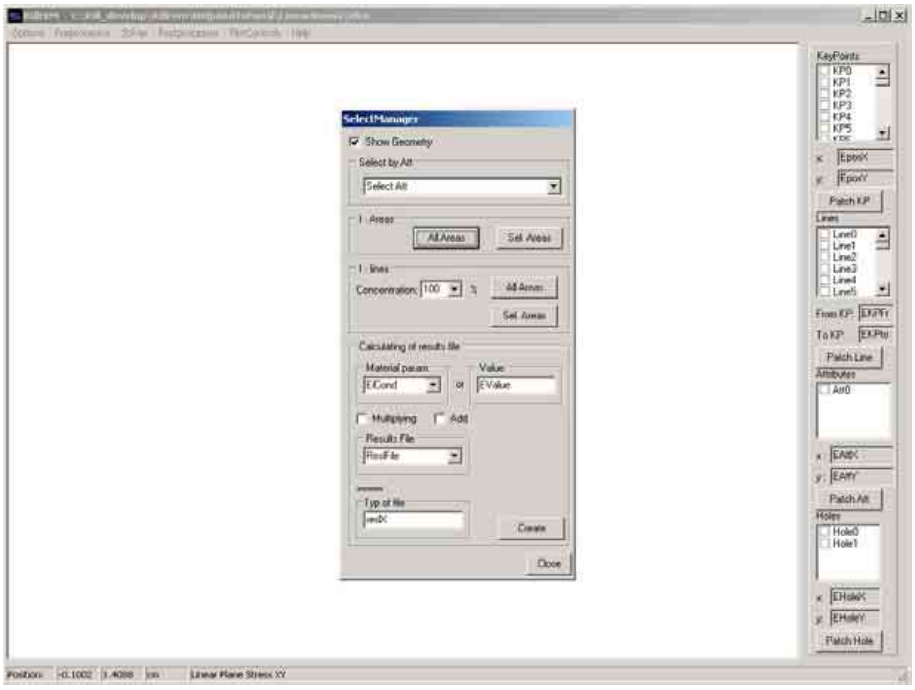
SelectManager
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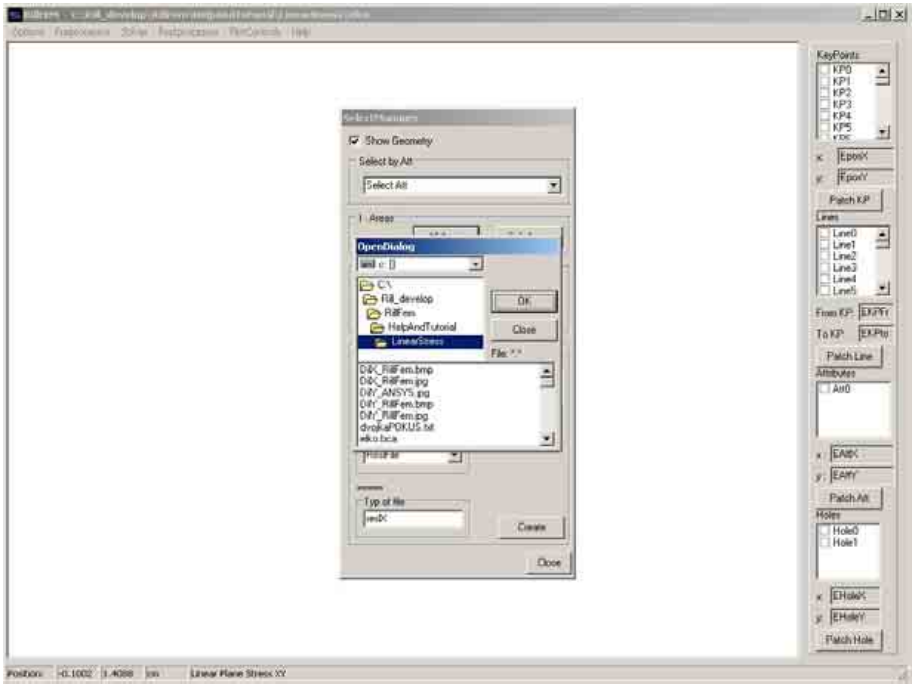
Fig. 10.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Holes
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Fig. 11.

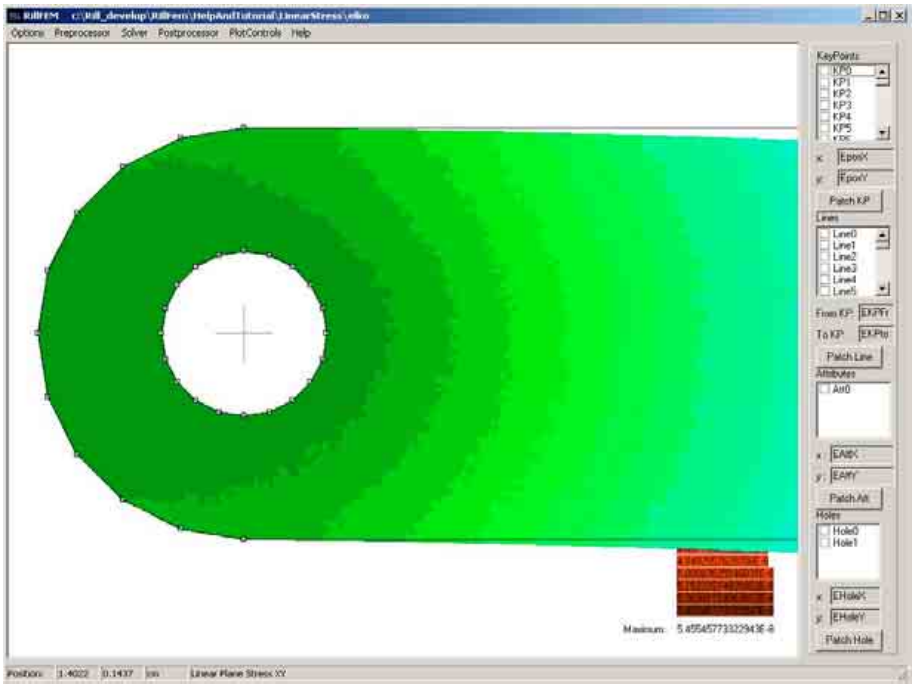

Fig. 12.

Comparison of results:

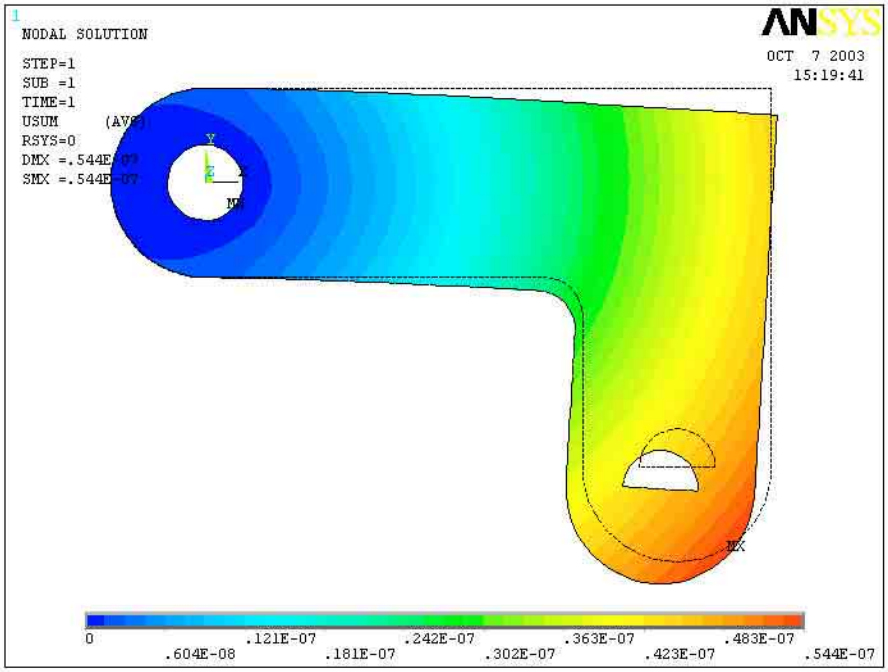

Fig. 13. Total Dilatation [m]

Congratulations! You have completed this tutorial.