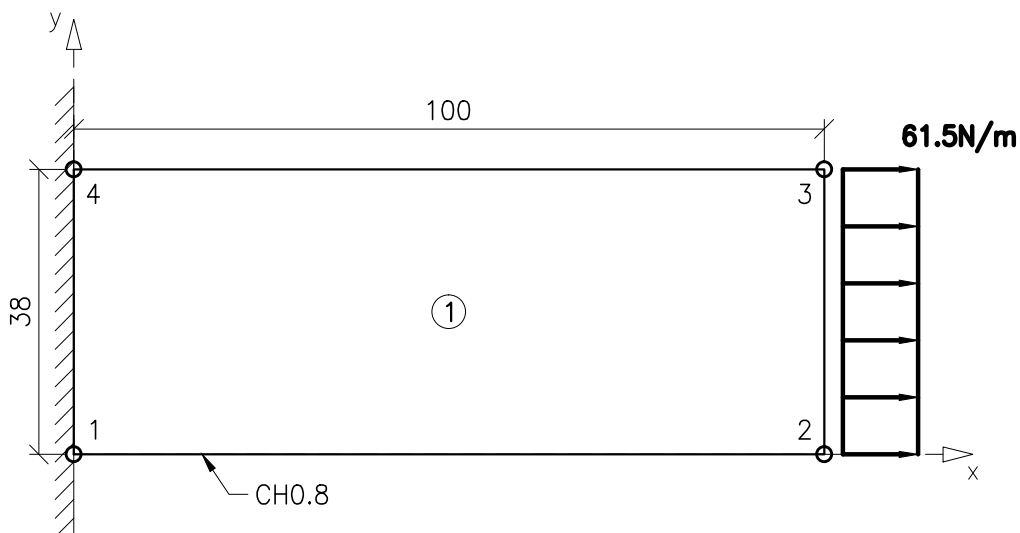# EXERCÍCIO 3.A

PROBLEMA:

EXTRAIR TENSÃO EQUIVALENTE AO LONGO DA CHAPA, FATOR DE SEGURANÇA QUANTO À TENSÃO DE ESCOAMENTO, DEFORMAÇÃO E DESLOCAMENTO AXIAL E FORÇA AO LONGO DA CHAPA NA DIREÇÃO X.
MODIFICAR O MODELO PARA INCLUIR O FURO, RECALCULAR E COMPARAR OS RESULTADOS.
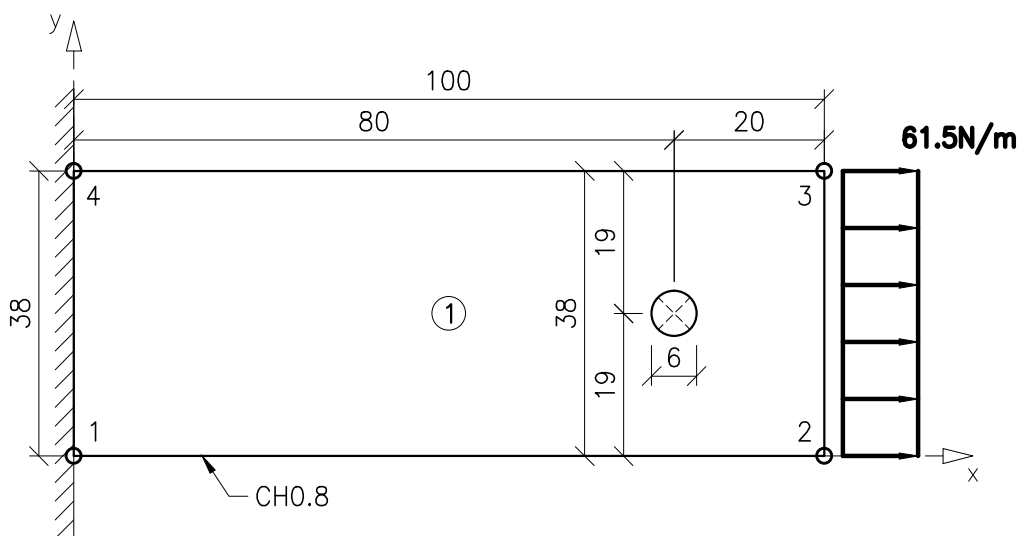
DADOS:

E = 200GPa
ν = 0.3
f_y = 230MPa

CHAPA SEM FURO
ESC.: 1/1   COTAS EM MILÍMETROS

CHAPA PERFURADA
ESC.: 1/1   COTAS EM MILÍMETROS

<table>
<tr><td colspan="3" align="center">EXERCÍCIO 3.A
Análise de uma chapa tracionada</td></tr>
<tr><td>/prep7</td><td>Preprocessor</td><td></td></tr>
<tr><td>ET,1,181</td><td>Element Type → Add/Edit/Delete → Add... →
    Library of Element Types = Structural Mass ; Shell ; 3D 4node 181
→ OK → Close</td><td></td></tr>
<tr><td>MP,EX,1,200
MP,PRXY,1,0.3</td><td>Material Props → Material Models → Structural → Linear → Elastic → Isotropic →
    EX = 200
    PRXY = 0.3
→ OK</td><td></td></tr>
<tr><td>SECTYPE,1,SHELL,,ESPESS,3
SECDATA,0.8,1</td><td>Sections → Shell → Lay-up → Add/Edit →
    Name = ESPESS
    ID = 1
    Thickness = 0.8
    Material ID = 1
→ OK</td><td></td></tr>
<tr><td>K,1,0,0,0
K,2,100,0,0
K,3,100,38,0
K,4,0,38,0</td><td>Modeling → Create → Keypoints → In Active CS →
    Keypoint number = 1
    Location in active CS = 0, 0, 0 → Apply →
    Keypoint number = 2
    Location in active CS = 100, 0, 0 → Apply →
    Keypoint number = 3
    Location in active CS = 100, 38, 0 → Apply →
    Keypoint number = 4
    Location in active CS = 0, 38, 0
 → OK</td><td></td></tr>
<tr><td>A,1,2,3,4</td><td>Modeling → Create → Areas → Arbitrary → Through KPs → <i>Clicar nos keypoints 1, 2, 3 e 4</i> → OK</td><td></td></tr>
<tr><td>LSEL,S,LOC,X,0
DL,ALL,,ALL,0
ALLSEL</td><td>Loads → Define Loads → Apply → Structural → Displacement → On Lines → <i>Clicar na line vertical à esquerda</i> →
    DOFs to be constrained = All DOF
→ OK</td><td></td></tr>
<tr><td>LSEL,S,LOC,X,100
SFL,ALL,PRES,-0.0615
ALLSEL</td><td>Loads → Define Loads → Apply → Structural → Pressure → On Lines → <i>Clicar na line vertical à direita</i> →
    Load PRES value = -0.0615
→ OK</td><td></td></tr>
</table>

/PSF,PRES,NORM,2	PlotCtrls → Symbols →
	    Surface Load Symbols = Pressures
	    Show pres and convect as = Arrows
	→ OK	

AATT,1,,1,,1	Meshing → Mesh Attributes → All Areas →
	    Material number = 1
	    Element type number = 1 SHELL181
	    Element section = 1 ESPESS
	→ OK	

AESIZE,ALL,2	Meshing → Size Cntrls → ManualSize → Areas → All Areas → Element edge length = 2 → OK	
AMESH,ALL	Meshing → Mesh → Areas → Free → *Clicar na area 1* → OK	
/ESHAPE,,1	PlotCtrls → Style → Size and Shape → Display of Element = ON → OK	
EPLOT	Plot → Elements	
/solu	**Solution**	
SOLVE	Solve → Current LS → OK	
/post1	**General Postproc**	
SET,,1	Read Results → First Set	
PLDISP	Plot Results → Deformed Shape → Items to be plotted = Def shape only → OK	
PRRSOL	List Results → Reaction Solu → Item to be listed = All items → OK	

ETABLE,TENEQV,S,EQV
ETABLE,FX,SMISC,1
ETABLE,DEFX,EPEL,X
ETABLE,DESLOCX,U,X
	Element Table → Define Table → Add… →
	    User label for item = TENEQV
	    Results data item = Stress ; von Mises SEQV → Apply →
	    User label for item = FX
	    Results data item = By sequence num ; SMISC, 1 → Apply →
	    User label for item = DEFX
	    Results data item = Strain-elastic ; X-dir'n EPEL X → Apply →
	    User label for item = DESLOCX
	    Results data item = DOF solution ; Translation UX	

|	→ OK → Close	
SALLOW,0.23	Safety Factor → Allowable Strs → Constant → Allowable stress = 0.23 → OK	

SFCALC,FSTEN,TENEQV,,3	Safety Factor → SF for ElemTable →
	    Item to be calculated = 1/SF
	    Label for calculated item = FSTEN
	    Elem table item for stress = TENEQV
	→ OK	

/DSCALE,,1000
/REPLOT
	PlotCtrls → Style → Displacement Scaling… →
	    Displacement scale factor = User specified
	    User specified factor = 1000
	→ OK	

PLETAB,TENEQV,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = TENEQV
	    Average at common nodes? = Yes - average
	→ OK	

PLETAB,FSTEN,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = FSTEN
	    Average at common nodes? = Yes - average
	→ OK	

PLETAB,DEFX,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = DEFX
	    Average at common nodes? = Yes - average
	→ OK	

PLETAB,DESLOCX,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = DESLOCX
	    Average at common nodes? = Yes - average
	→ OK	

PLETAB,FX,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = FX
	    Average at common nodes? = Yes - average
	→ OK	

/prep7	**Preprocessor**	
ACLEAR,ALL	Meshing → Clear → Areas → Pick All	
CYL4,80,19,3	Modeling → Create → Areas → Circle → Solid Circle →	

	WP X = 80 WP Y = 19 Radius = 3 → OK	
ASBA,1,2,,,DELETE	Modeling → Operate → Booleans → Subtract → Areas → **Clicar na area 1** → OK → **Clicar na area 2** → OK	
AATT,1,,1,,1	Meshing → Mesh Attributes → All Areas → Material number = 1 Element type number = 1 SHELL181 Element section = 1 ESPESS → OK	
AESIZE,ALL,2	Meshing → Size Cntrls → ManualSize → Areas → All Areas → Element edge length = 2 → OK	
AMESH,ALL	Meshing → Mesh → Areas → Free → Pick All → OK	
/solu	**Solution**	
SOLVE	Solve → Current LS → OK	
/post1	**General Postproc**	
SET,,1	Read Results → First Set	
PLDISP	Plot Results → Deformed Shape → Items to be plotted = Def shape only → OK	
PRRSOL	List Results → Reaction Solu → Item to be listed = All items → OK	
ETABLE,REFL	Element Table → Define Table → Update → Close	
SFCALC,FSTEN,TENEQV,,3	Safety Factor → SF for ElemTable → Item to be calculated = 1/SF Label for calculated item = FSTEN Elem table item for stress = TENEQV → OK	
PLETAB,TENEQV,AVG	Element Table → Plot Elem Table → Item to be plotted = TENEQV Average at common nodes? = Yes - average → OK	
PLETAB,FSTEN,AVG	Element Table → Plot Elem Table →	

	Item to be plotted = FSTEN Average at common nodes? = Yes - average → OK	

PLETAB,DEFX,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = DEFX
	    Average at common nodes? = Yes - average
	→ OK	

PLETAB,DESLOCX,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = DESLOCX
	    Average at common nodes? = Yes - average
	→ OK	

PLETAB,FX,AVG	Element Table → Plot Elem Table →
	    Item to be plotted = FX
	    Average at common nodes? = Yes - average
	→ OK	

FINISH	**Finish**	

TENSÃO EQUIVALENTE (VON MISES)
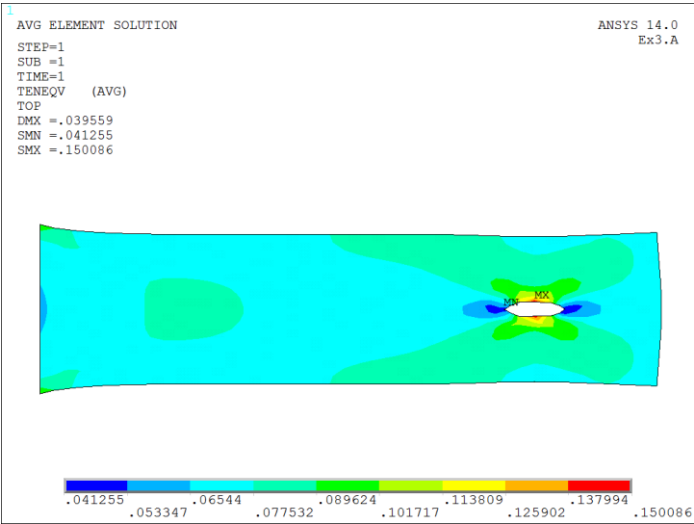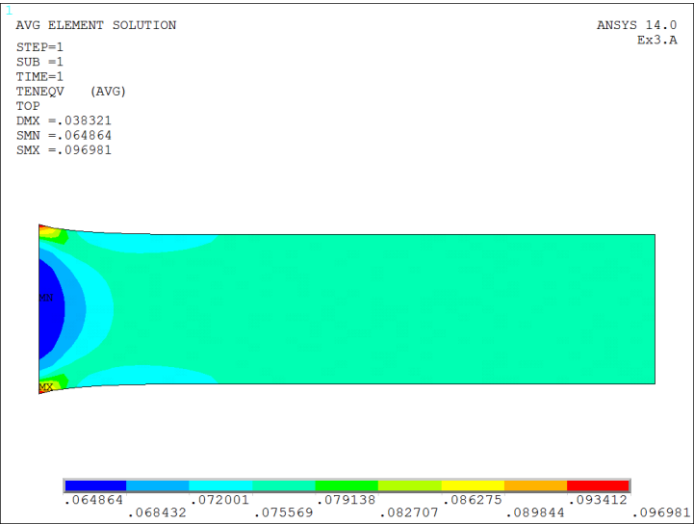
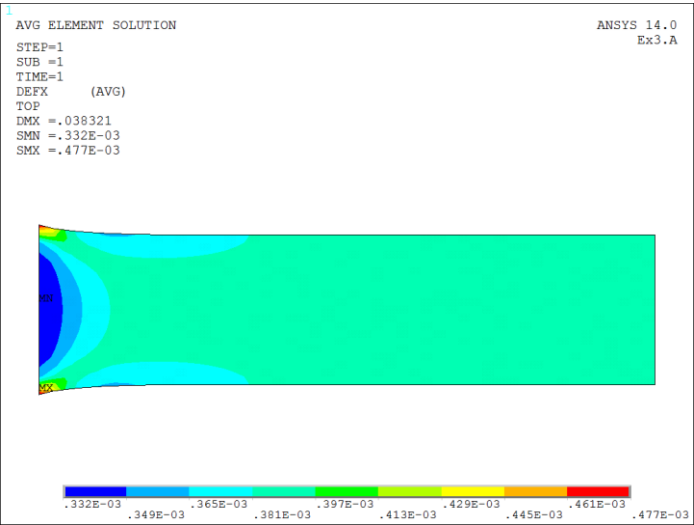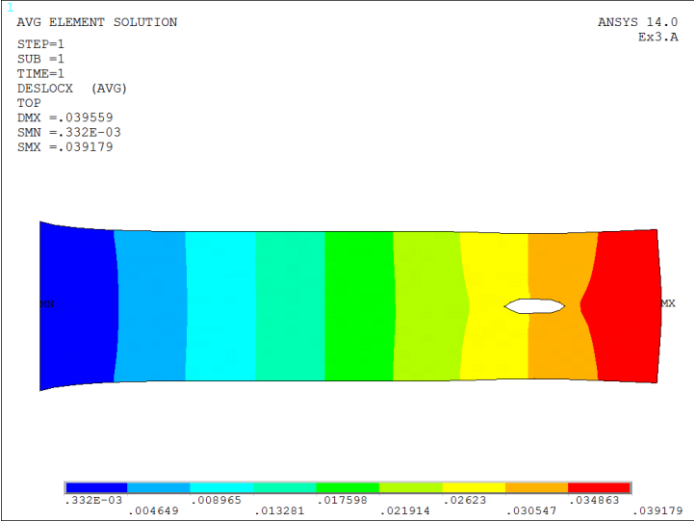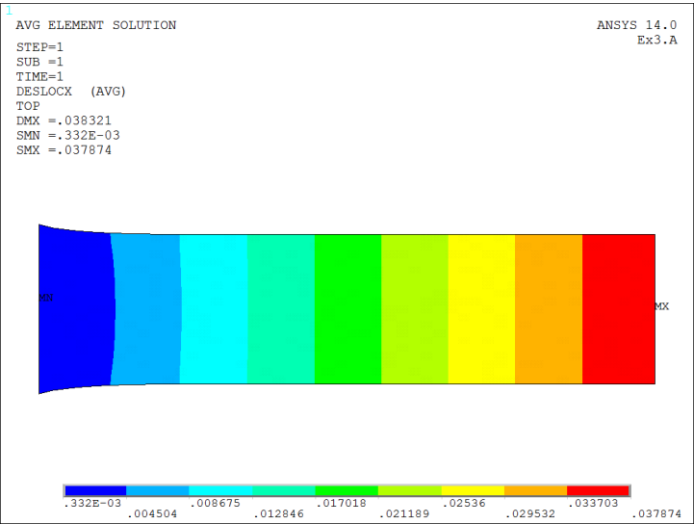# FATOR DE SEGURANÇA (TENSÃO DE ESCOAMENTO)
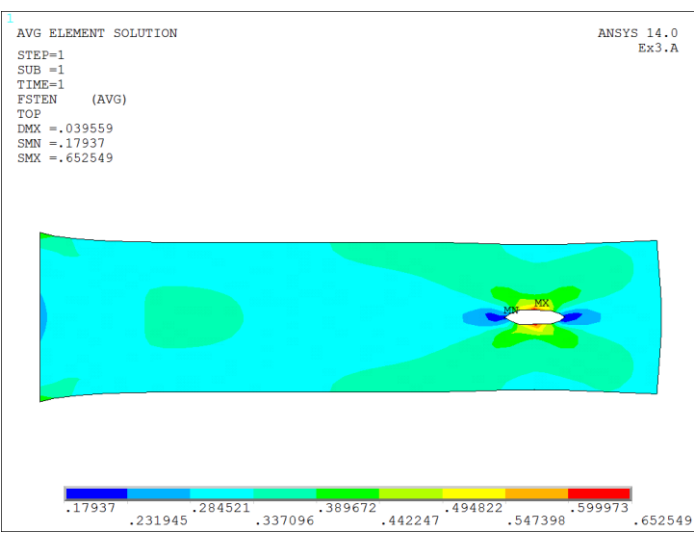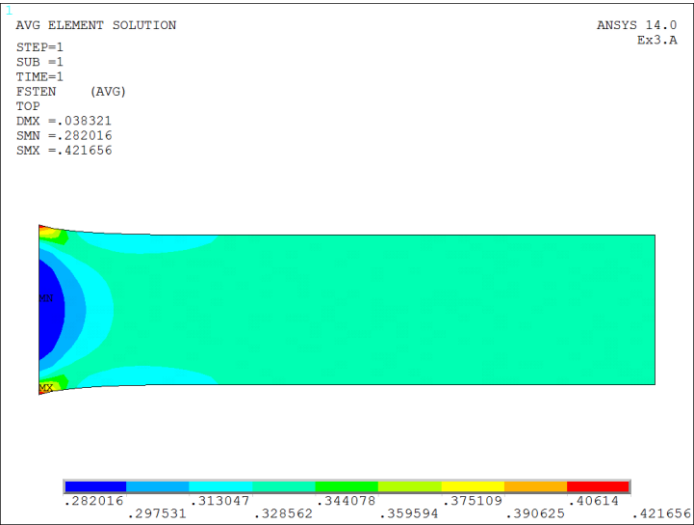
DEFORMAÇÃO AXIAL (EM X)
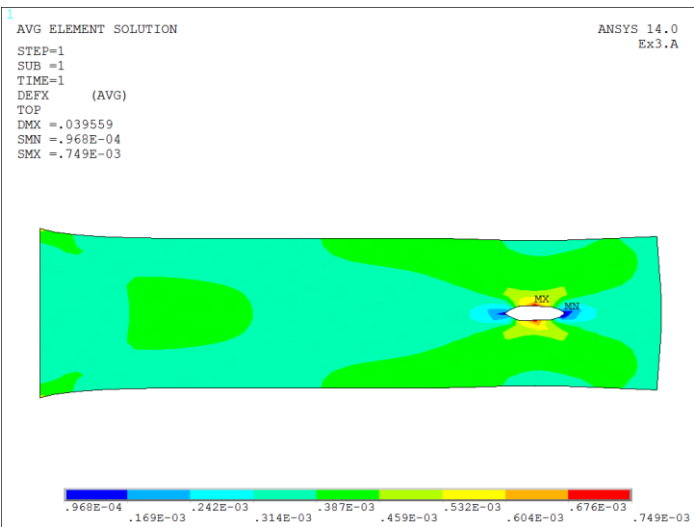
DESLOCAMENTO AXIAL (EM X)

FORÇA AXIAL (EM X)