Command line for truss forces, example in the class F,1,FY,-1.0

ORVE_DD RECOM_DD CON FORMON I



Truss Example: Reaction Forces



 First, we compute reaction forces by adding up forces from individual elements that contribute to reaction forces:

$$R_1^2 = f_1^{e_1} + f_1^{e_2} = 0 + 0.5715 = 0.5715$$
(397a)
$$R_2^3 = f_1^{e_1} + f_2^{e_3} = 0 + -0.5714 = -0.5714$$
(397b)

$$R_1^3 = f_3^{e_1} + f_1^{e_3} = 0 + -0.5714 = -0.5714$$
(397b)
$$R_2^3 = f_4^{e_1} + f_2^{e_3} = 0.4285 + 0.5714 = 0.9999$$
(397c)

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Nodal displacements

PRINT U NODAL SOLUTION PER NODE

***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

LOAD STEP= 1 SUBSTEP= 1 TIME= 1.0000 LOAD CASE= 0

THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN THE GLOBAL COORDINATE SYSTEM

 NODE
 UX
 UY
 UZ
 USUM

 1 -0.42641E-004-0.30124E-003
 0.0000
 0.30424E-003

 2 0.0000
 -0.12000E-003
 0.0000
 0.12000E-003

 3 0.0000
 0.0000
 0.0000
 0.0000

```
MAXIMUM ABSOLUTE VALUES
```



MAXIMUM ABSOLUTE VALUES	5 0 zlo
NODE 1 1 0 1	-
VALUE -0.42641E-004-0.30124E-003 0.0000 0.30424E-003	
$\begin{array}{c} e \\ u_{1} \\ u_{2} \\ u_{3} \\ u_{$	
$ \mathbf{k}^{0} \mathbf{k}^{0}_{1} = \frac{117111}{2.8} \begin{bmatrix} 0.000}{0.000} \\ 0.000 \\ 0.1001 \\ 13 \\ 2.5 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	
$\mathbf{\kappa} = \begin{bmatrix} 0.32 \pm 0.231 & 0.24 \pm 0.181 & -0.34 \\ 0.32 \pm 0.281 & 0.18 \pm 0.231 & -0.18 \\ -0.28 & -0.281 & 0.28 \pm 0.18 \\ -0.28 & -0.281 & -0.281 \\ -0.2$	
$\mathbf{F} = \mathbf{F}_{\mathbf{N}} + \mathbf{F}_{\mathbf{C}} = \begin{bmatrix} 0\\-1\\0 \end{bmatrix} + \begin{bmatrix} 0.1105\\-0.1106\\0 \end{bmatrix} \Rightarrow \begin{bmatrix} 0.1105\\-1.1106\\0 \end{bmatrix} \Rightarrow \begin{bmatrix} U_1\\U_2\\U_3\\U_3\\U_3\\U_3\\U_3\\U_3\\U_3\\U_3\\U_3\\U_3$	A - 1

Numbers encircled in the computation of essential BC force are displacements corresponding to free dofs. As mentioned before, in reality we do not consider them in computation of this force, but in hand calculation we just put zero for those values.

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ADON,

Element forces



PRINT ELEM ELEMENT SOLUTION PER ELEMENT

***** POST1 ELEMENT SOLUTION LISTING ***** LOAD STEP 1 SUBSTEP= 1 TIME= 1.0000 LOAD CASE= 0 3 2 MAT= 1 XC,YC,ZC= 0.000 0.2000 EI = 1 NODES= 0.000 AREA= 10.000 LINK180 FORCE= 0.42857 STRESS= 0.42857E-01 EPEL= 0.42857E-04 TEMP= 0.00 0.00 EPTH= 0.0000 2 NODES= 2 1 MAT= 1 XC,YC,ZC= 0.8000 -0.6000 0.000 AREA= 10.000 LINK180 EL= FORCE=-0.71429 STRESS=-0.71429E-01 EPEL=-0.71429E-04 TEMP= 0.00 0.00 EPTH= 0.0000



Problems with 2D / 3D elements: We create the geometry and apply BC (supports, loads), ... on geometry not on element nodes

Define the element





Create the geometry (in 2D, 3D create keypoints (0D), lines (1D), areas (2D), and volumes (3D) geometry objects and then mesh it (create elements and nodes)



In PltCntrs -> Numbering

<u>File Select List Plot PlotCtrls WorkPlane Parameters Macro MenuCtrls Help</u>		> FEM ∨
	- I I I I I I I I I I I I I I I I I I I	
Toolbar	۲	
SAVE DB RESUM DB QUIT POWRGRPH		
	Plot Numbering Controls	×
Main Menu 🛞	[/PNUM] Plot Numbering Controls	
rences AREAS	KP Keypoint numbers 🔽 On	
OCESSOF TYPE NUM	LINE Line numbers 🔽 On	
ment Type	AREA Area numbers 🔽 🔽	
al Constants	VOLU Volume numbers T Off	
tions	NODE Node numbers	
deling	Elem / Attrib numbering No numbering	•
Create	TABN Table Names	
	SVAL Numeric contour values 🔽 Off	
□ Areas	DOMA Domain numbers 🔽 Off	
Arbitrary	[/NUM] Numbering shown with Colors & number	s •
By 2 Corners	[/REPLOT] Replot upon OK/Apply? Replot	•
	OK Apply Cancel	Help

We end up with 8 rather than 6 keypoints

LIST ALL SELECTED KEYPOINTS. DSYS= 0

NO.	Х,Ү	,Z LOCATION	THXY,THYZ,THZX ANGLES							
1 0.000	0000	0.000000	0.000000	0.0000	0.0000	0.0000				
2 10.00	0000	0.000000	0.000000	0.0000	0.0000	0.0000				
3 10.00	0000	1.000000	0.000000	0.0000	0.0000	0.0000				
4 0.000	0000	1.000000	0.000000	0.0000	0.0000	0.0000				
5 0.000	0000	1.000000	0.000000	0.0000	0.0000	0.0000				
6 10.00	0000	1.000000	0.000000	0.0000	0.0000	0.0000				

7	10.00000	1.500000	0.000000	0.0000	0.0000	0.0000
8	0.000000	1.500000	0.000000	0.0000	0.0000	0.0000

I am going to merge coinciding keypoints

Preferences	AREAS			2021					
Preprocessor	AREA NUM								
Element Type		merge contract of equivalently before thems							
Real Constants		[NUMMRG] Merge Coincident or Equivalently Defined It	ems						
Material Props		Label Type of item to be merge	Keypoints						
Sections		TOLER Range of coincidence	0.01						
Modeling		GTOLER Solid model tolerance							
Meshing		ACTION Merge items or select?							
Checking Ctrls			Merge items						
Numbering Ctrls	8		C Select w/o merge						
Merge Items	5	SWITCH Retain lowest/highest?	LOWest number +						
Compress Numbers			-						
Set Start Number	1								
Reset Start Num	2 X	OK Apply	Cancel	Help					
Start Num Status									
Add Num Offset									

LIST ALL SELECTED KEYPOINTS. DSYS= 0

NO.	Х,	Y,Z LOCATIOI	THXY, THYZ, THZX ANGLES				
1 0.00	00000	0.000000	0.000000	0.0000	0.0000	0.0000	
2 10.0	00000	0.000000	0.000000	0.0000	0.0000	0.0000	
3 10.0	00000	1.000000	0.000000	0.0000	0.0000	0.0000	
4 0.00	00000	1.000000	0.000000	0.0000	0.0000	0.0000	
7 10.0	00000	1.500000	0.000000	0.0000	0.0000	0.0000	
8 0.0	00000	1.500000	0.000000	0.0000	0.0000	0.0000	

Breaking the top line into 3 segments so that we can apply the pressure on the left one





All surfaces (here lines) are by default traction free (no load), so we only need to apply load on line 9







We just need to set the materials for areas 1 and 2 (E1 and E2) and then mesh it with elements



Choose material 2 (E2) for top layer

		1									Anev
Preferences	-	ARE	AS	🚰 Area Attributes						\times	2021 P
Preprocessor		ARE	A NUM	LAATTI Assiss Ame		Distant Asses					20216
Element Type		σ		[AATT] Assign Attrit	outes to	PICKED Areas					STUDEN
Real Constants				MAT Material num	ber			2	-		AUG 26 2021
Material Props				REAL Real constant	set num	ber		None de	fined •	·]	15:21:20
Sections											
🗉 Modeling				TYPE Element type	number			1 PLA	NE183	•	
Meshing				ESYS Element coord	linate sy	s		0	•		
Mesh Attributes				SECT Element section	on			None de	fined	7	_
Default Attribs			8					1			1.6
All Keypoints		4									3
All Lines											6.2
											2
🖬 All Areas				OK	1	Apply	Cance		Help	1	
					1					1	
All Volumes											

LIST ALL SELECTED AREAS.

NUMBER	LOC	P LI	NES			AREA	ELEM	SIZE	#NC	DES	#E	EM	MAT	REAL	TYP	ESYS	SECN
1 1	1	2	3	4	N/A	0.000	0	0	1	0	1	0	0				
21	3	6	7	5	N/A	0.000	0	0	2	0	1	0	0				

All is left is meshing the domain	
Ansys Mechanical Enterprise Utility Menu (plate)	- □ × > FEM ∨ .
	MeshTool
	Element Attributes:
	Global 💌 Set
SAVE_DB RESUM_DB QUIT POWRGRPH	Smart Size
Main Menu 🛞	Fine 5 Coarse
Preferences AREAS Preprocessor AREA NUM Element Type U Real Constants AUG 26 2021 Material Props 15:21:20	Size Controlt: Global Set Clear Areas Set Clear Lines Set Clear Copy Flip
Modeling Meshing	Layer Set Clear
Mesh Attributes	Keypts Set Clear
MeshTool A2 L6 B Size Cntrls A2 L6 Mesher Opts A1 L2 Mesh X L1 2	Meshi Areas Shape: C Tri C Qued C Free C Mapped C Sweep
Modify Mesh Check Mesh Clear Checking Ctris	3 or 4 sided v
Archive Model Coupling / Ceqn	Refine at: Elements
E Loads Path Operations Solution	Close Help
Press mesh Select all	
Solving it	
Solution is done!	
Close	
Main Menu Status Command X	
■ Preferences S 0 L U T I 0 N 0 P T I 0 N S 2021 R2 ■ Preprocessor ■ Solution PROBLEM DIMENSIONALITY.	
Image: SE Manager Lood STEP NUMBER. is to ad STEP. is to ad STEP. is to ad STEP. is to add STEP. It ad	
Diagnostics Diagnosti	

General Postnroc





1. How to plot it on undeformed geometry

 YZ Shear street XZ Shear street Ist Principal st 2nd Principal st 3rd Principal st 	ss ss t <mark>ress</mark> tress						•
Undisplaced shape key							
Undisplaced shape key	Deformed shape only						•
Scale Factor	Off		•	1e-3	0		
Additional Options							8
		OK	App	v	Cancel	1	Help

2. How to make the plot only for certain materials



y menu (plate)

PlotCtrls WorkPlane Parameters Macro MenuCtrls Help

Pan Zoom Rotate View Settings	,			
Numbering Symbols				
Style	Hidden Line Options			
Font Controls Window Controls	Size and Shape . Edge Options	 •		
Erase Options	Contours	•	Uniform Contours	AIT
Animate	Graphs Colors	;	Non-uniform Contours Contour Style	AU
Device Options Redirect Plots Hard Copy	Light Source Translucency Texturing	•	Contour Labeling	
	Background			

Min and max for bottom layer

3. How to specify the range of contour plot



ELEMENT SOLUTI	ON							/	۱n:
STEP=1 SUB =1								s	
S1 (NOAV DMX =.155E-03 SMN =827842 SMX =.135937	rG)							AUG 2 15	26 20 5:40
			MX						
N X									
9	777778	655556	533333	411111	288889	166667	044444	.077778	2