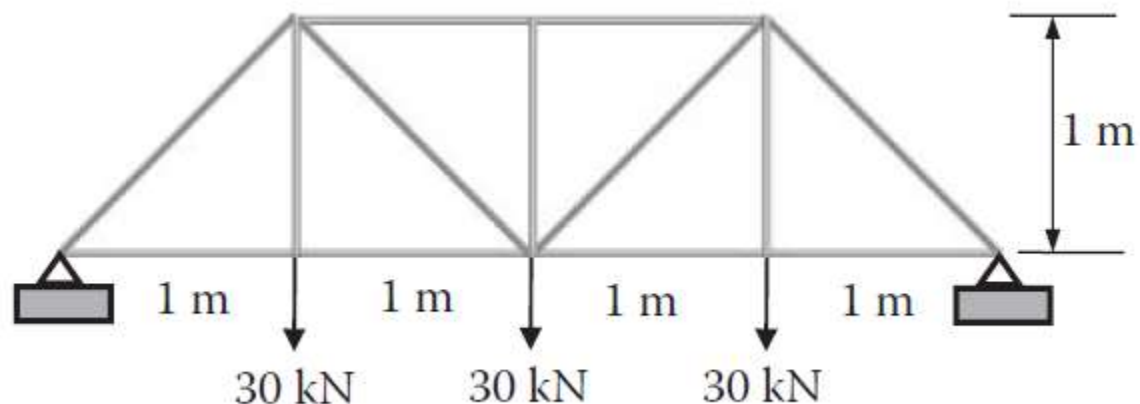


Nedjelja 2

Modeliranje rešetkastih konstrukcija konačnim elementima

Postavka zadatka

Rešetkasta konstrukcija prikazana na slici je izrađena od drvenih greda, kvadratnog poprečnog presjeka $W \times H = 60 \times 60 \text{ mm}$. Karakteristike greda od bora: $E = 13.1 \text{ GPa}$ i $\nu = 0.29$. Odrediti pomjeranje zglobova konstrukcije.



Noseća konstrukcija mosta

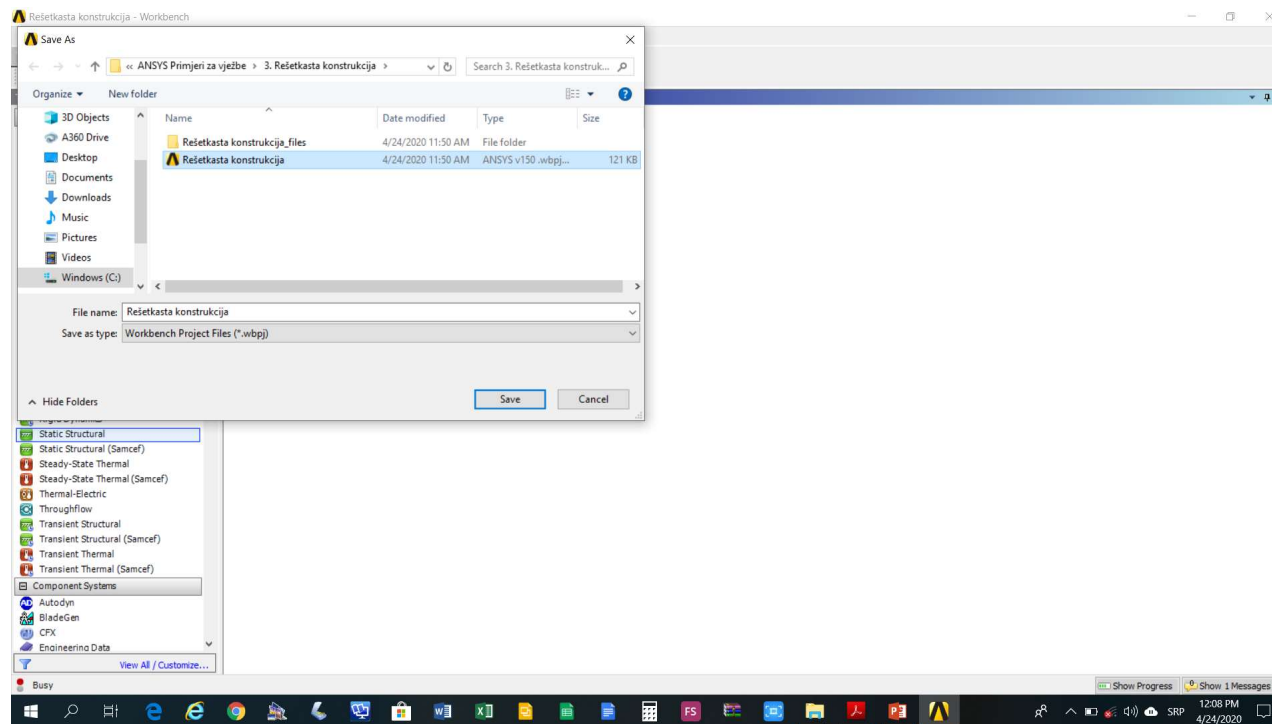


Noseća konstrukcija kranske dizalice



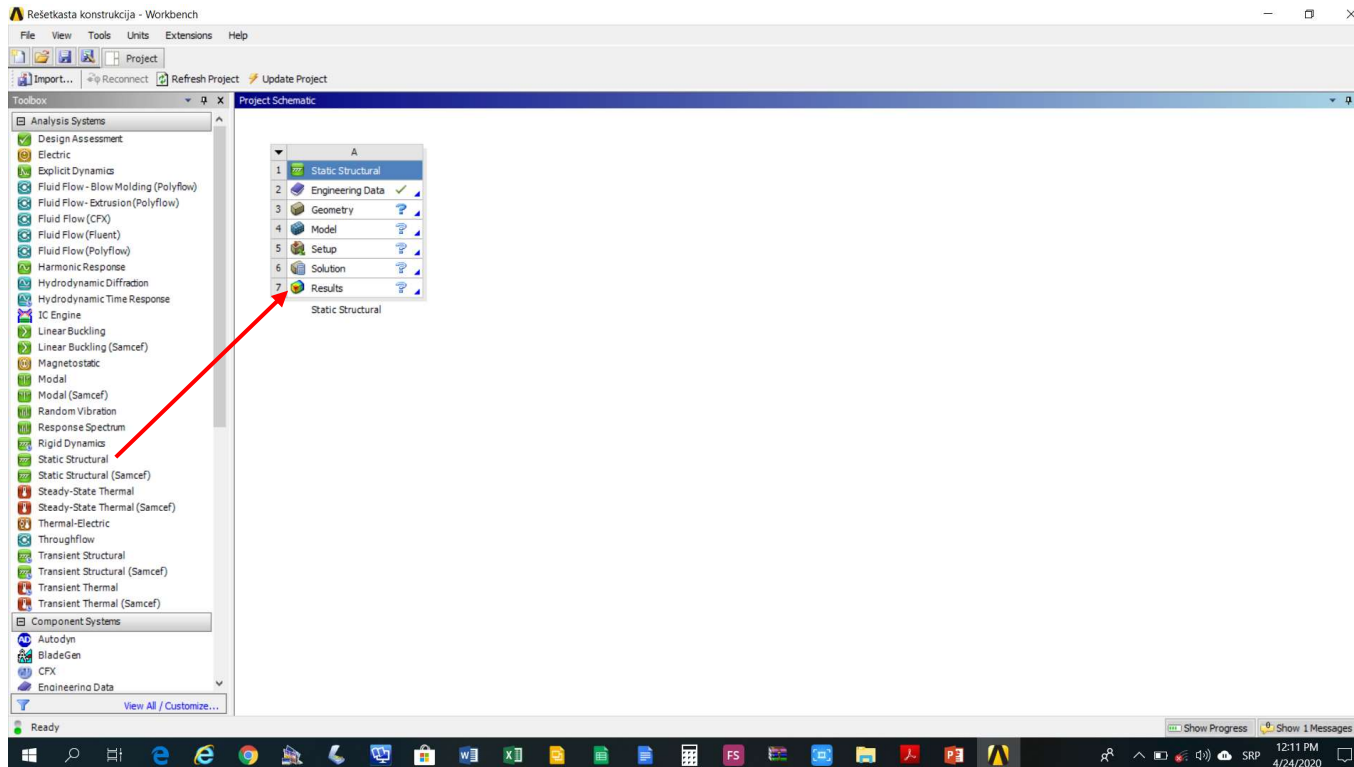
Modeliranje rešetkaste konstrukcije

Aktivirati program ANSYS i sačuvati prazan projekat pod nazivom Rešetkasta konstrukcija



Modeliranje rešetkaste konstrukcije

Kreirati statičku linearnu analizu (*Static Structural*) na shemi projekta (*Project Schematic*)



Modeliranje rešetkaste konstrukcije

Aktivirati modul Engineering Data (*Engineering Data->Edit*) i dodati novi materijal *Click here to add new material*

The screenshot displays the ANSYS Workbench Engineering Data interface. On the left, the 'Engineering Data' component is selected, and a context menu is open with the 'Edit...' option highlighted. The main window shows the 'Properties of Outline Row 3: Structural Steel' table, which lists various material properties and their values. A 'Click here to add a new material' button is visible at the bottom of the table. The 'Table of Properties Row 2: Density' is also shown, displaying the density value of 7850 kg m⁻³ at 0°C. The 'Chart of Properties Row 2: Density' shows a plot of density versus temperature, with a single data point at 0°C.

Property	Value	Unit
Density	7850	kg m ⁻³
Isotropic Secant Coefficient of Thermal Expansion		
Isotropic Elasticity		
Derive from	Young's Modulus a...	
Young's Modulus	2E+11	Pa
Poisson's Ratio	0.3	
Bulk Modulus	1.6667E+11	Pa
Shear Modulus	7.6923E+10	Pa
Alternating Stress Mean Stress	Tabular	
Strain-Life Parameters		
Tensile Yield Strength	2.5E+08	Pa
Compressive Yield Strength	2.5E+08	Pa
Tensile Ultimate Strength	4.6E+08	Pa
Compressive Ultimate Strength	0	Pa

Temperature [C]	Density [kg m ⁻³]
0	7850

Modeliranje rešetkaste konstrukcije

Unijeti karakteristike novog linearno elastičnog i izotropnog materijala (*Isotropic Elasticity*)

Rešetkasta konstrukcija - Workbench

File Edit View Tools Units Extensions Help

Project A2:Engineering Data

Filter Engineering Data Engineering Data Sources

Toolbox

- Physical Properties
- Linear Elastic**
- Isotropic Elasticity
- Orthotropic Elasticity
- Anisotropic Elasticity
- Hyperelastic Experimental Data
- Hyperelastic
- Chaboche Test Data
- Plasticity
- Creep
- Life
- Strength
- Gasket
- Viscoelastic Test Data
- Viscoelastic
- Shape Memory Alloy
- Damage
- Cohesive Zone
- Fracture Criteria

Properties of Outline Row 4: Borovina

	A	B	C	D	E
1	Property	Value	Unit		
2	Isotropic Elasticity				
3	Derive from	Young's Modulus a...			
4	Young's Modulus	13100	MPa		
5	Poisson's Ratio	0.29			
6	Bulk Modulus	1.0397E+10	Pa		
7	Shear Modulus	5.0775E+09	Pa		

Table of Properties Row 5: Isotropic Elasticity

	A	B
1	Temperature (C)	Poisson's Ratio
2		0.29
*		

Outline of Schematic A2: Engineering Data

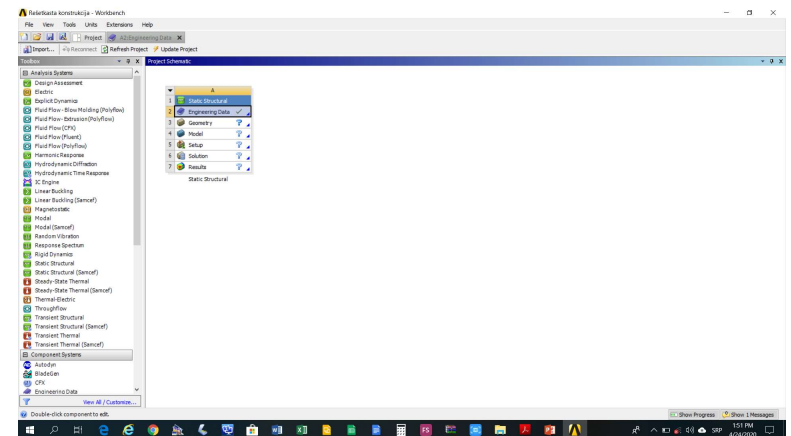
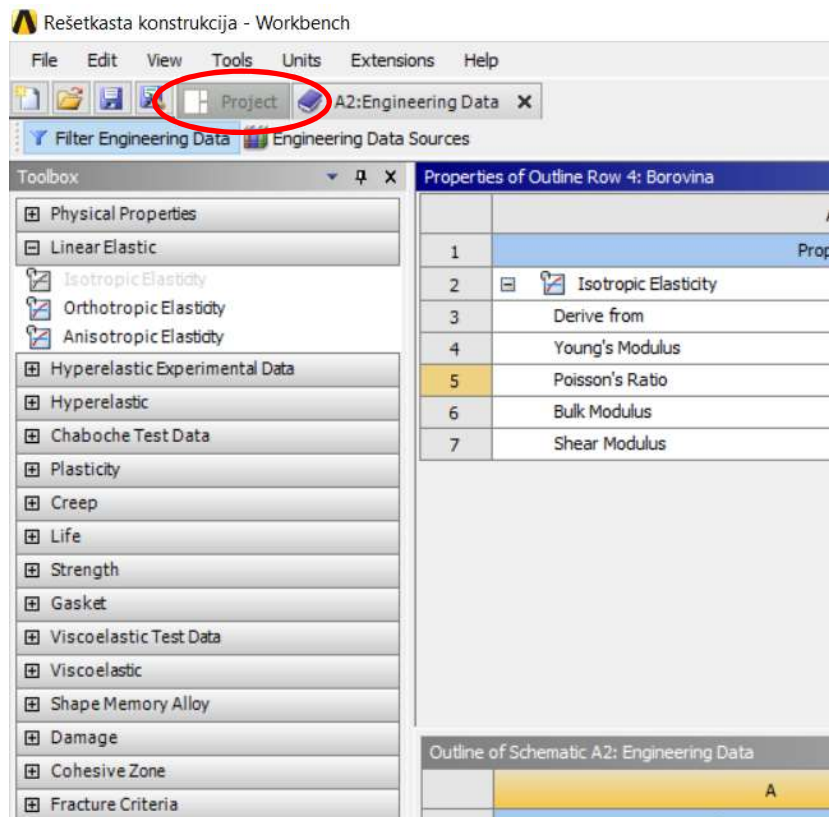
	A	B	C	D
1	Contents of Engineering Data	source		Description
2	Material			
3	Structural Steel			Fatigue Data at zero mean stress comes from 1998 ASME BPV Code, Section 8, Div 2, Table 5-110.1
4	Borovina			
*				Click here to add a new material

Chart of Properties Row 5: Isotropic Elasticity

Poisson's Ratio

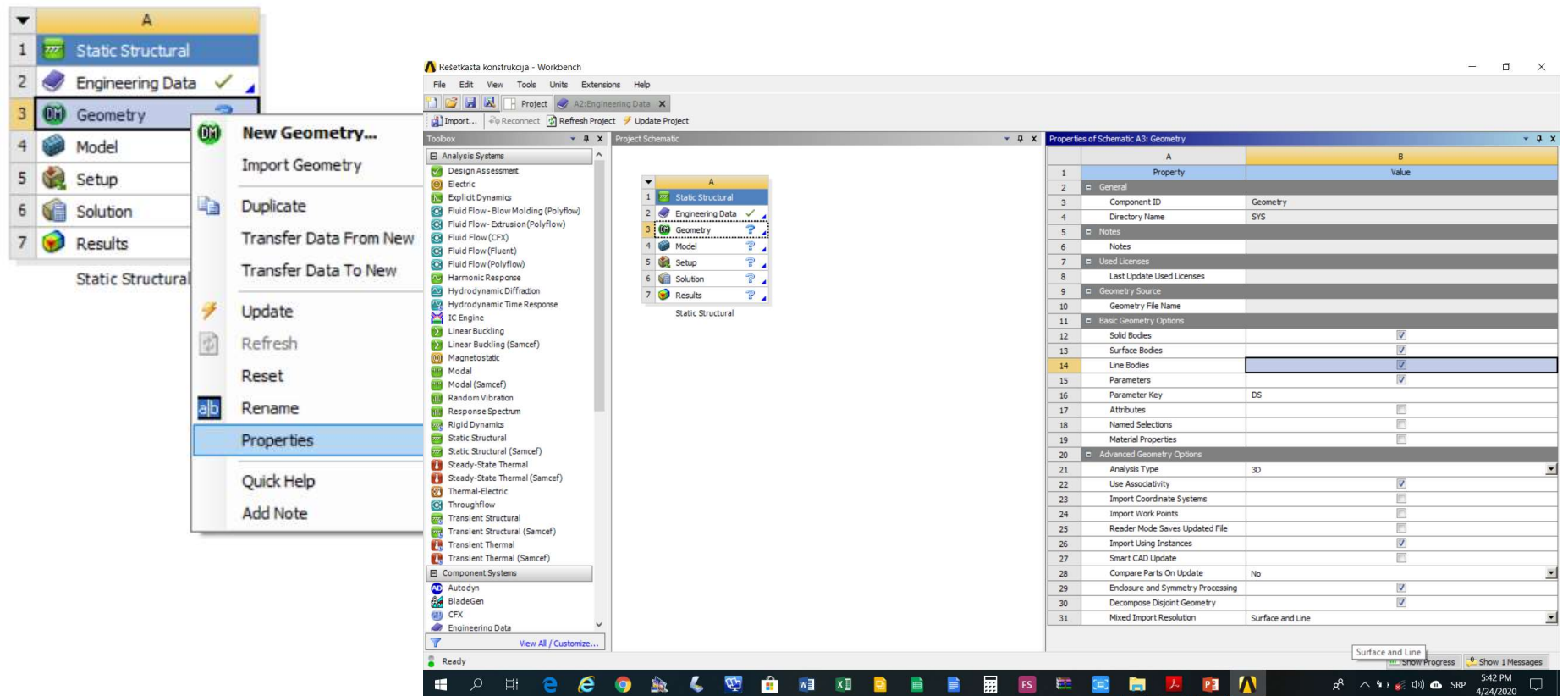
Modeliranje rešetkaste konstrukcije

Izabrati opciju *Project* za povratak na shemu projekta



Modeliranje rešetkaste konstrukcije

Izvršiti podešavanja modula Design Modeler
(*Geometry*->*Properties*->*Line Bodies = On*)

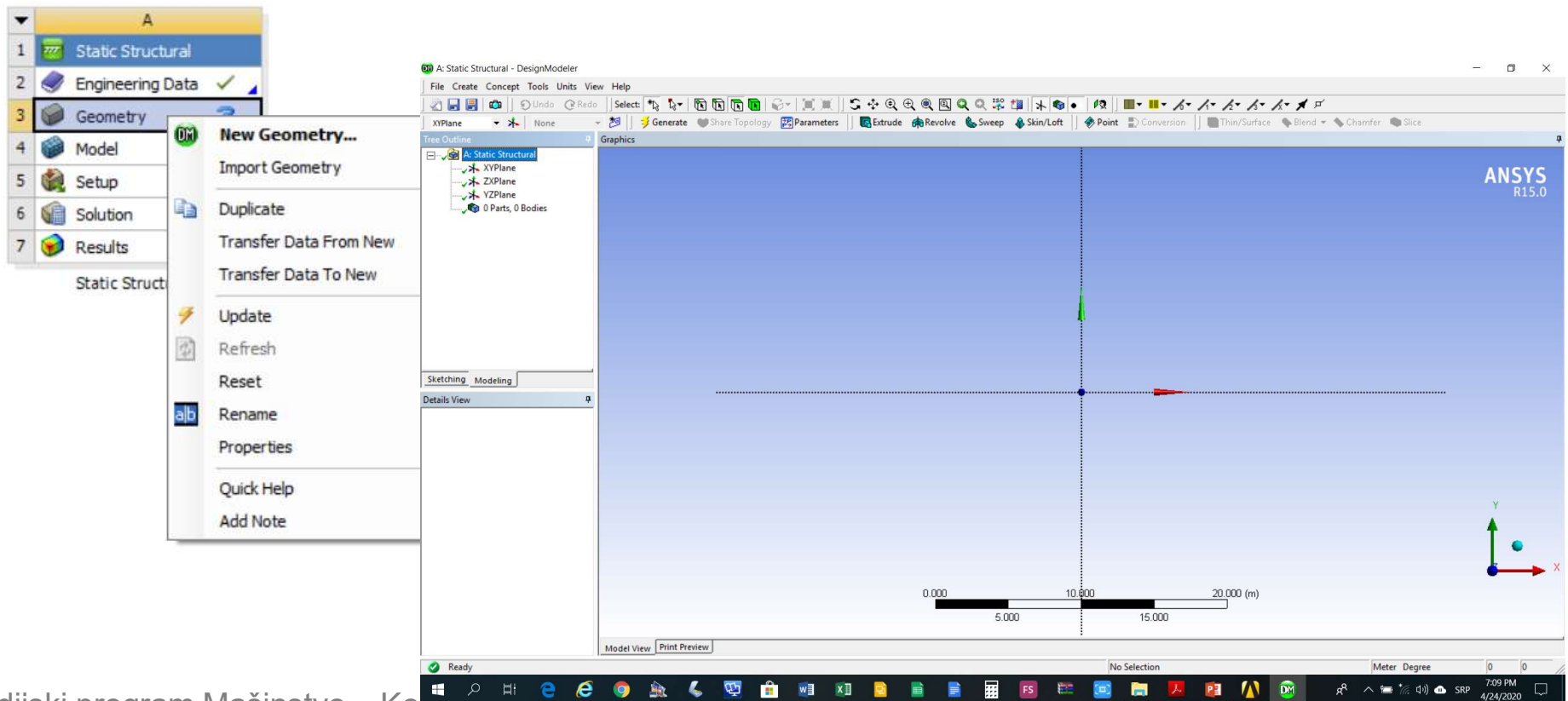


The screenshot displays the ANSYS Workbench interface. On the left, the 'Properties' dialog for the 'Geometry' component is open, showing a list of options. The 'Line Bodies' checkbox is checked. The main window shows the 'Project Schematic' with the 'Geometry' component selected. The 'Properties of Schematic A3: Geometry' table is visible on the right.

Property	Value
Component ID	Geometry
Directory Name	SYS
Notes	
Used Licenses	
Last Update Used Licenses	
Geometry Source	
Geometry File Name	
Basic Geometry Options	
Solid Bodies	<input checked="" type="checkbox"/>
Surface Bodies	<input checked="" type="checkbox"/>
Line Bodies	<input checked="" type="checkbox"/>
Parameters	<input checked="" type="checkbox"/>
Parameter Key	DS
Attributes	<input type="checkbox"/>
Named Selections	<input type="checkbox"/>
Material Properties	<input type="checkbox"/>
Advanced Geometry Options	
Analysis Type	3D
Use Associativity	<input checked="" type="checkbox"/>
Import Coordinate Systems	<input type="checkbox"/>
Import Work Points	<input type="checkbox"/>
Reader Mode Saves Updated File	<input type="checkbox"/>
Import Using Instances	<input checked="" type="checkbox"/>
Smart CAD Update	<input type="checkbox"/>
Compare Parts On Update	No
Enclosure and Symmetry Processing	<input checked="" type="checkbox"/>
Decompose Disjoint Geometry	<input checked="" type="checkbox"/>
Mixed Import Resolution	Surface and Line

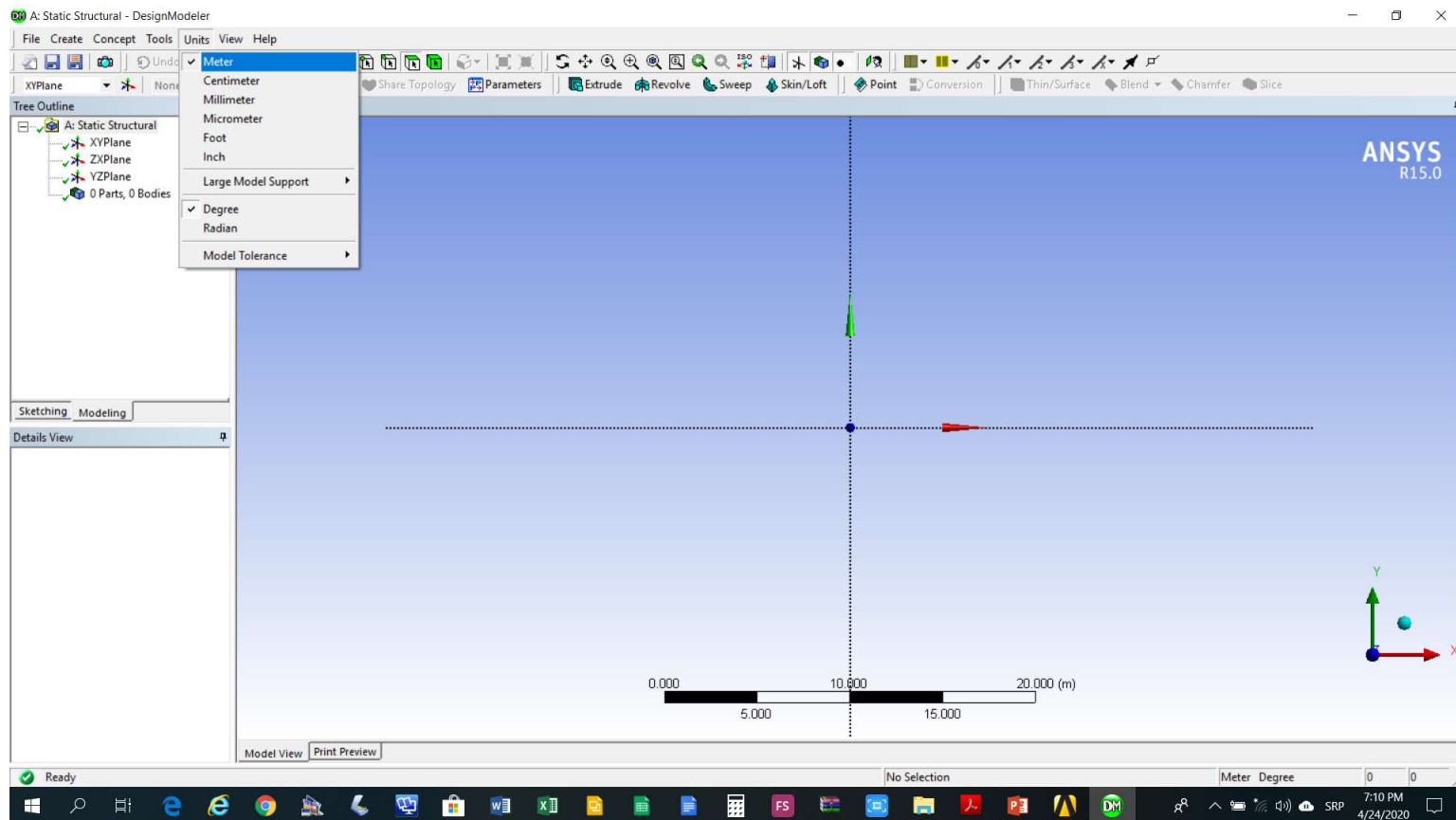
Modeliranje rešetkaste konstrukcije

Aktivirati modul Design Modeler (*Geometry->New Geometry*)



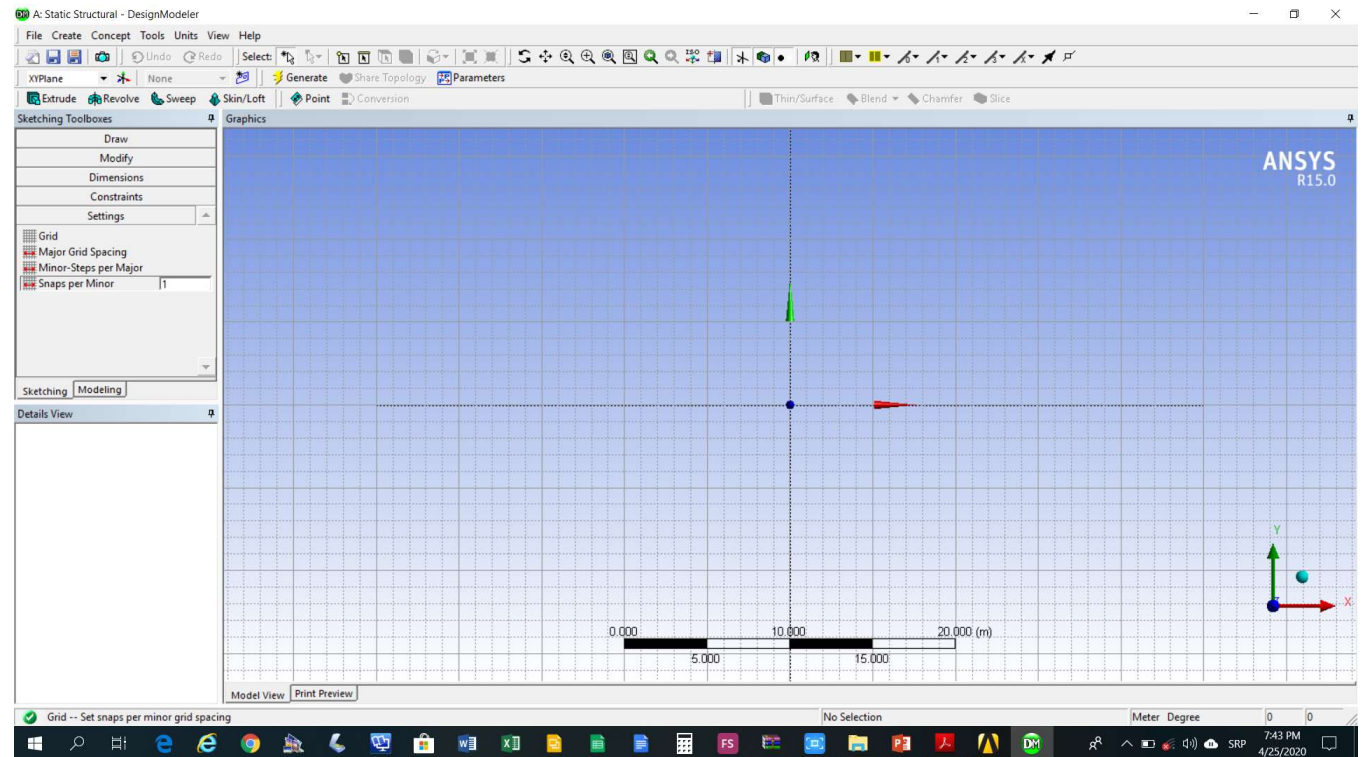
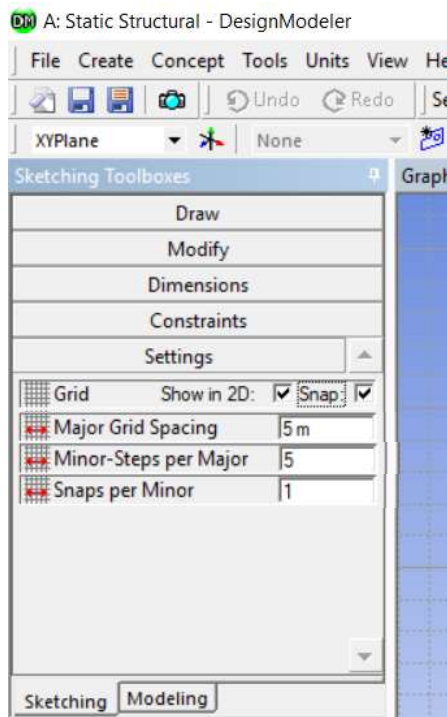
Modeliranje rešetkaste konstrukcije

Podesiti dužinske jedinice (Units->Meter)



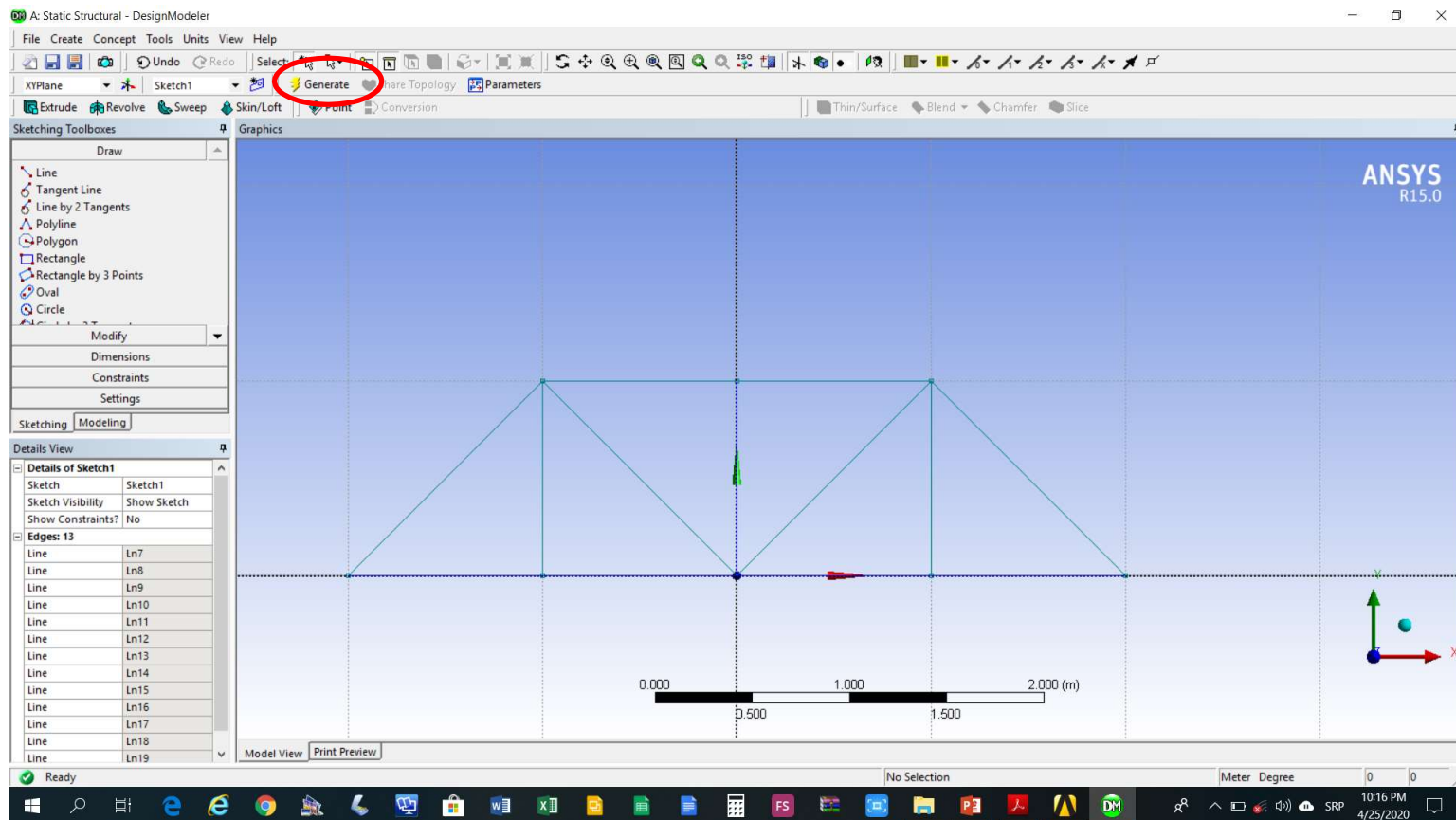
Modeliranje rešetkaste konstrukcije

Podesiti parametre mreže i skokovitog kretanja
(*Sketching->Settings->Grid*) (*Show in 2D = On*)
(*Snap = On*)



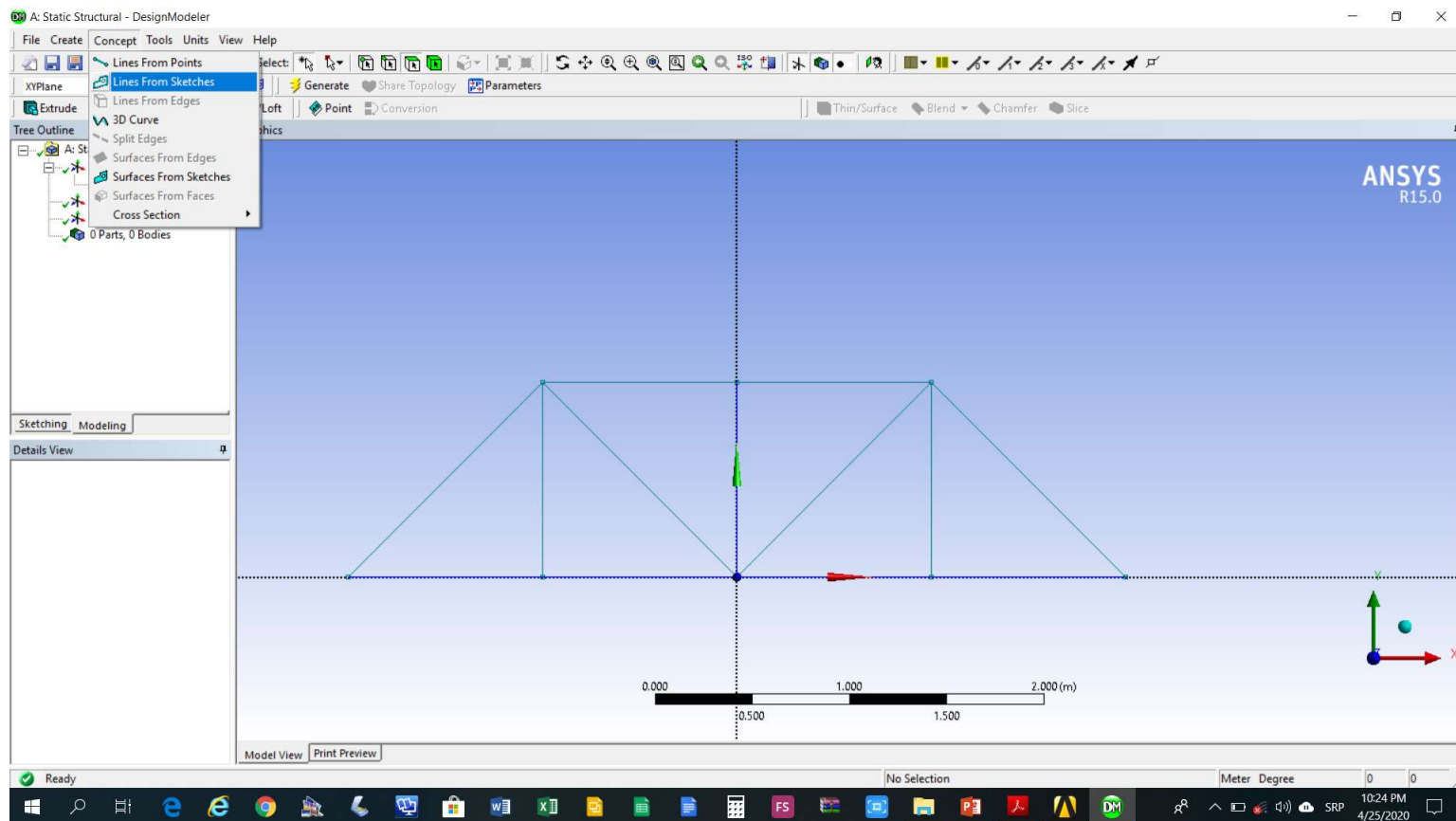
Modeliranje rešetkaste konstrukcije

Nacrtati konstrukciju (*Sketching*->*Draw*->*Line*)
okončati crtanje skice komandom *Generate*



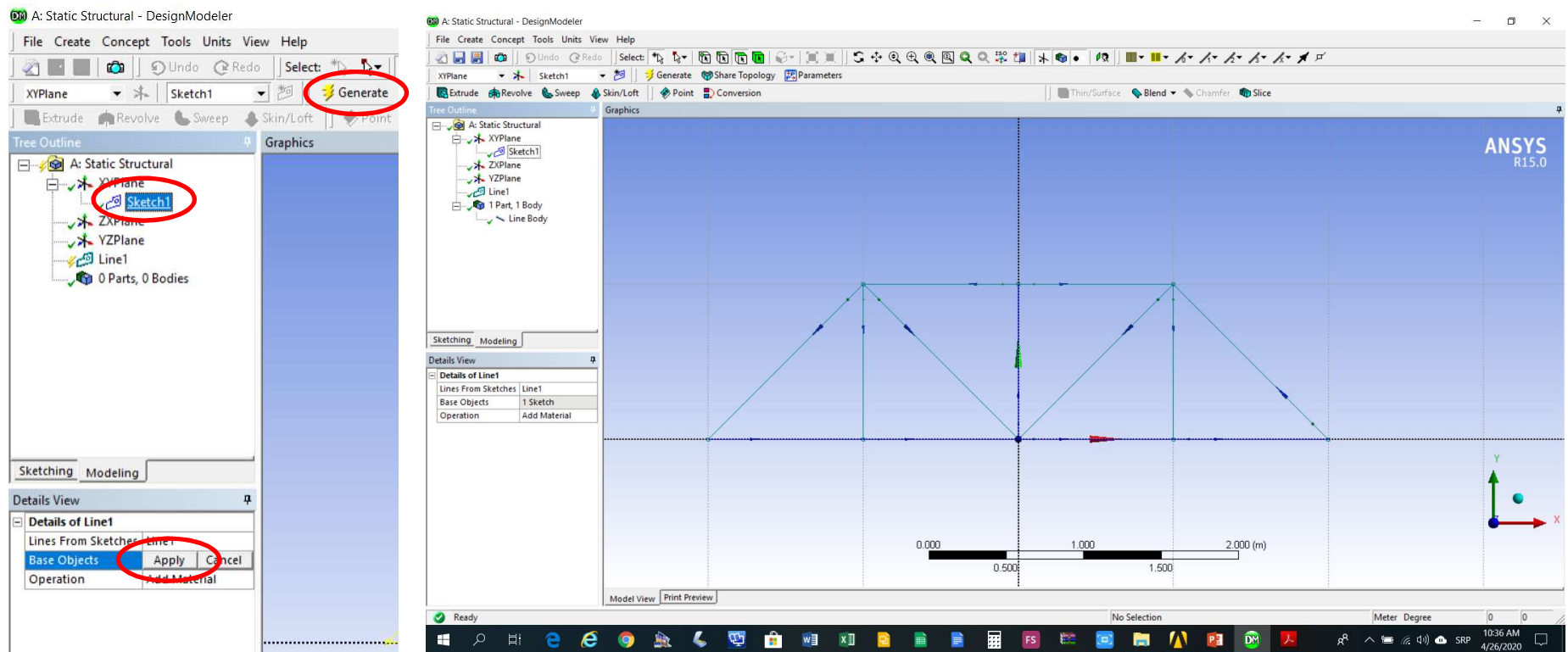
Modeliranje rešetkaste konstrukcije

Aktivirati opciju (*Concept*->*Lines from Sketches*)



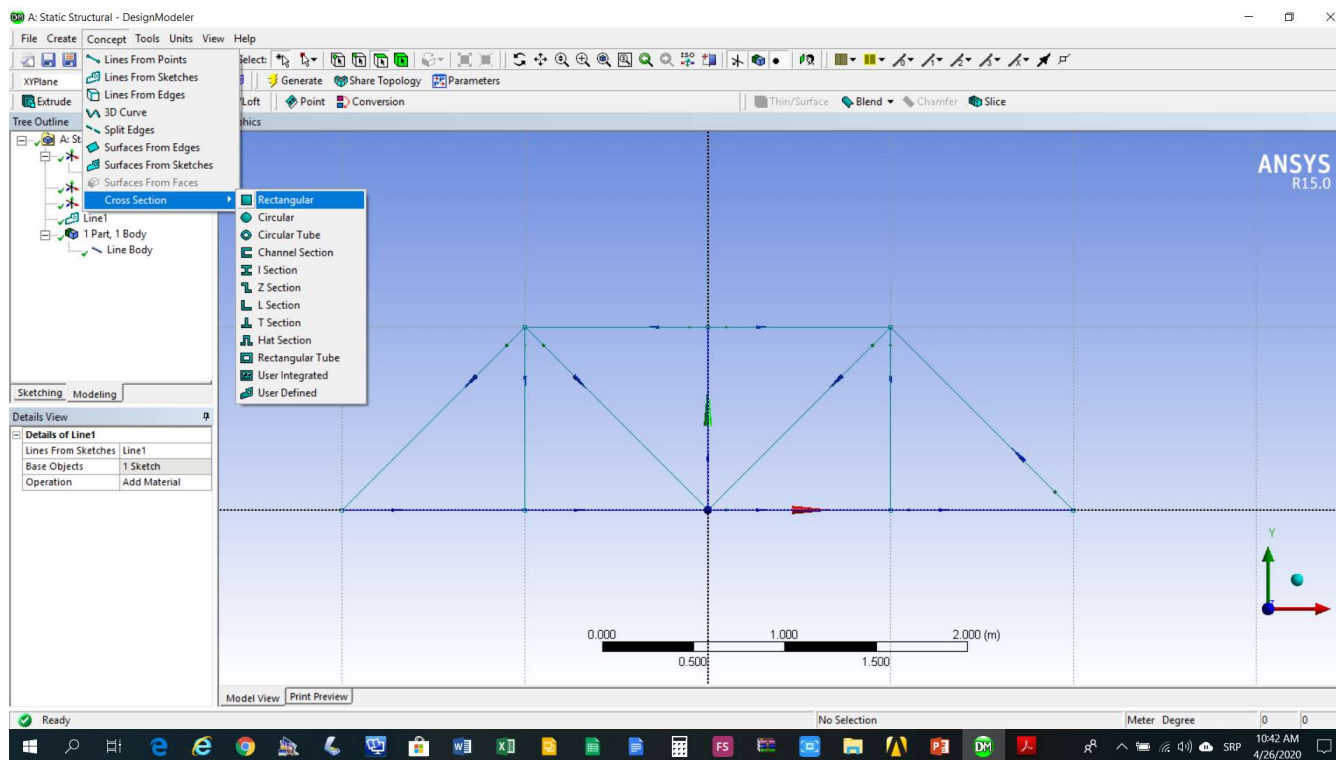
Modeliranje rešetkaste konstrukcije

Izabrati skicu *Sketch1* sa stabla modela (*Tree Outline*) i dugme *Detail View*->*Apply*, okončati kreiranje linijskog tijela opcijom *Generate*



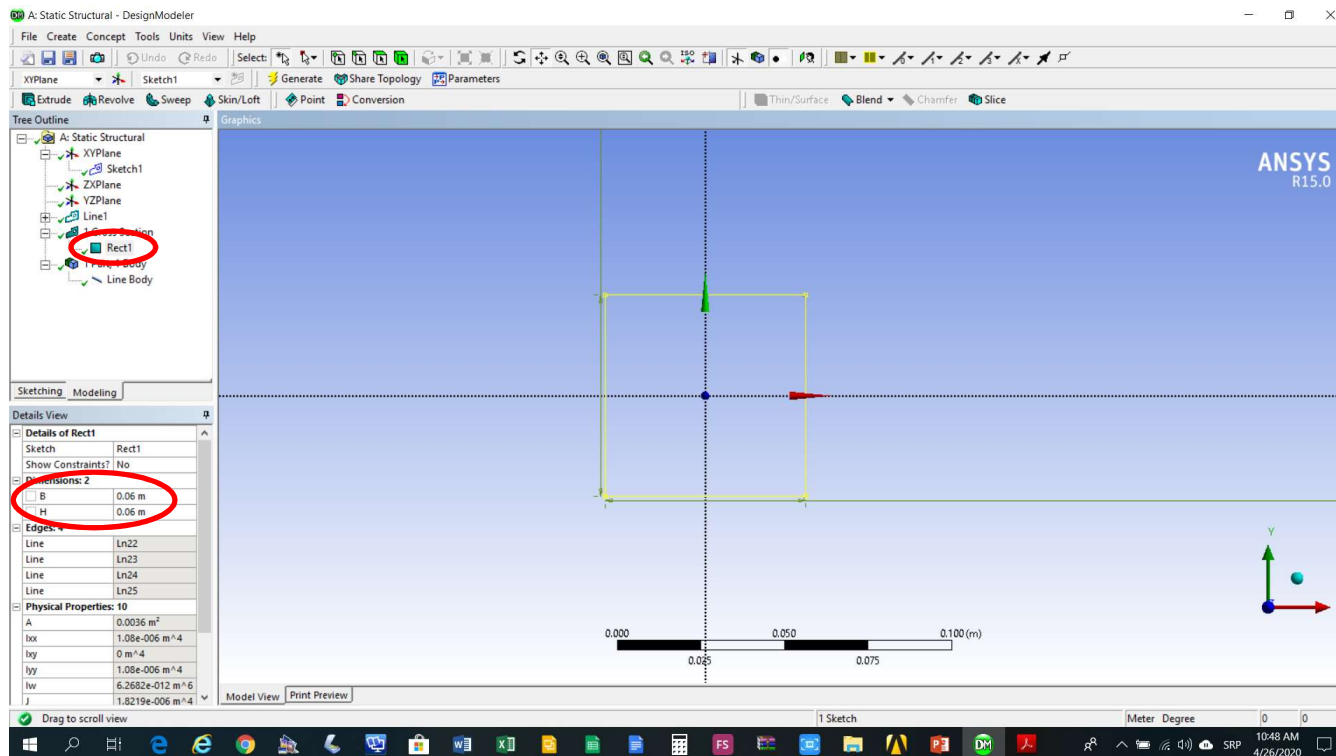
Modeliranje rešetkaste konstrukcije

Kreirati kvadratni poprečni presjek *Rect1*
(*Concept*->*Cross Section*->*Rectangular*)



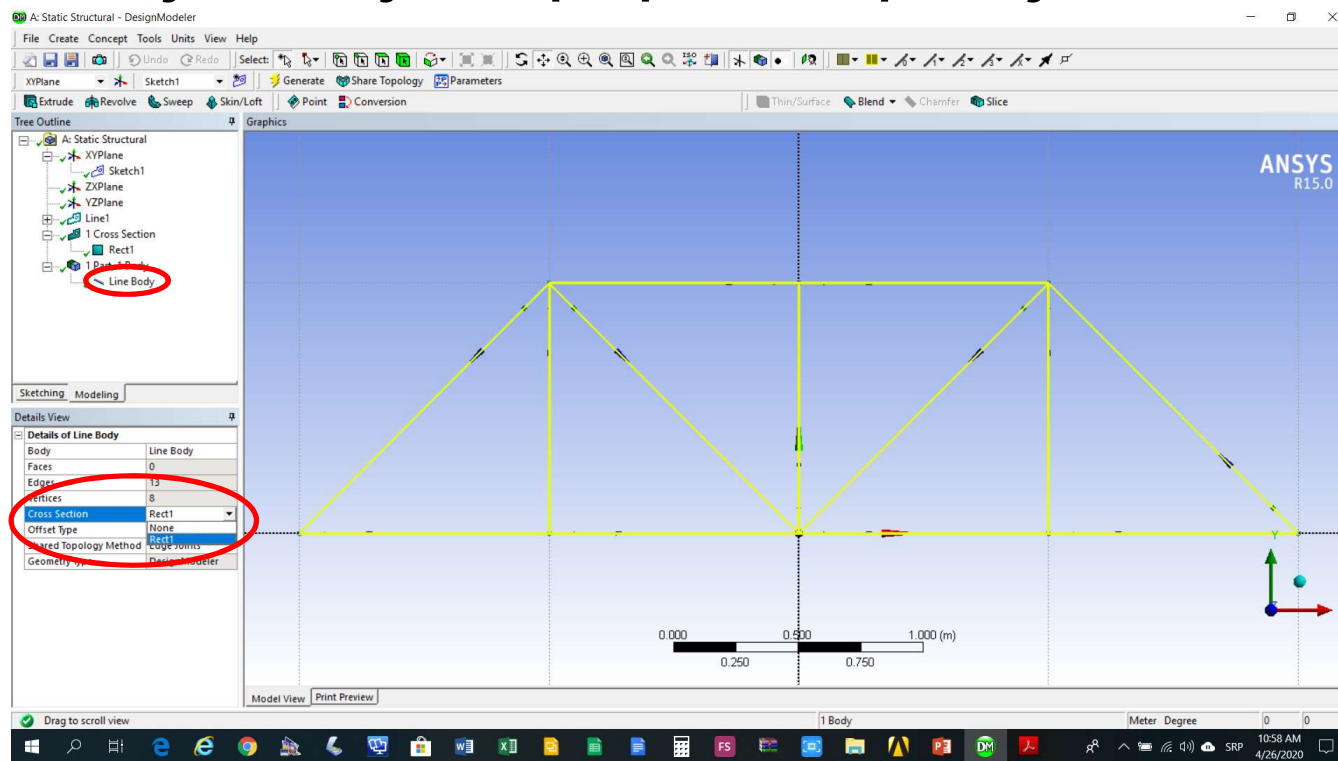
Modeliranje rešetkaste konstrukcije

Podesiti dimenzije poprečnog presjeka *Detail View*->*B* i *Detail View*->*H*



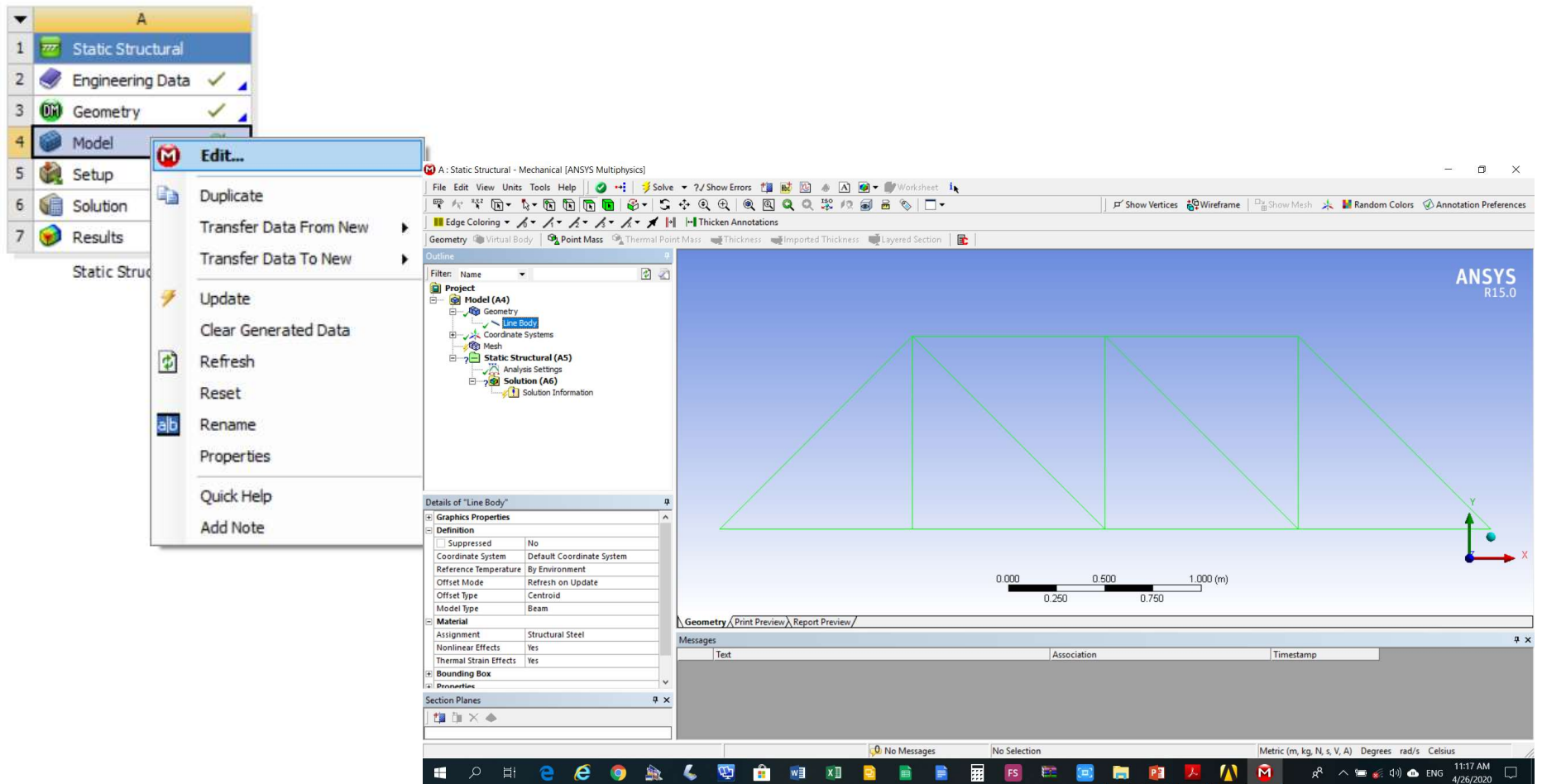
Modeliranje rešetkaste konstrukcije

Izabrati *Line Body* i sa liste *Detail View*->*Cross Section* izabrati *Rect1* kako bi se elementima konstrukcije dodjelo poprečni presjek



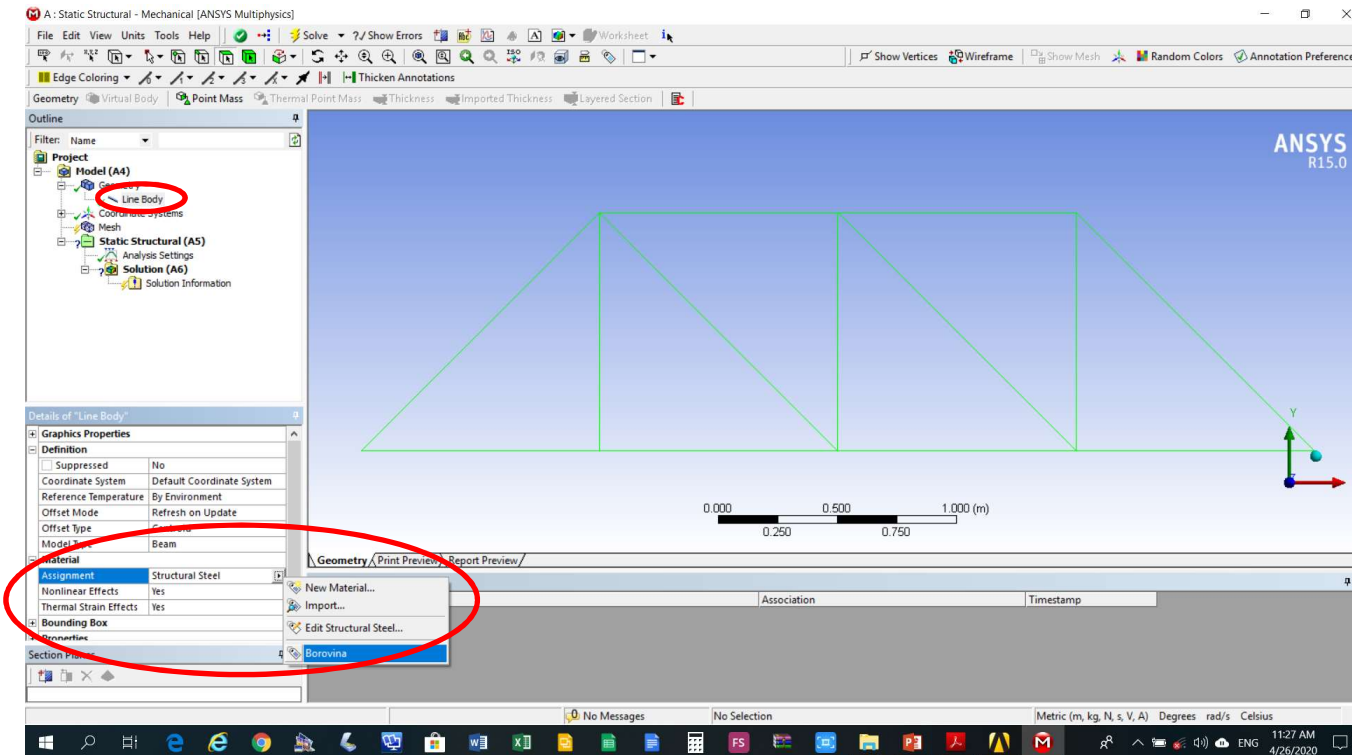
Modeliranje rešetkaste konstrukcije

Aktivirati modul Static Structural (*Model*->*Edit*)



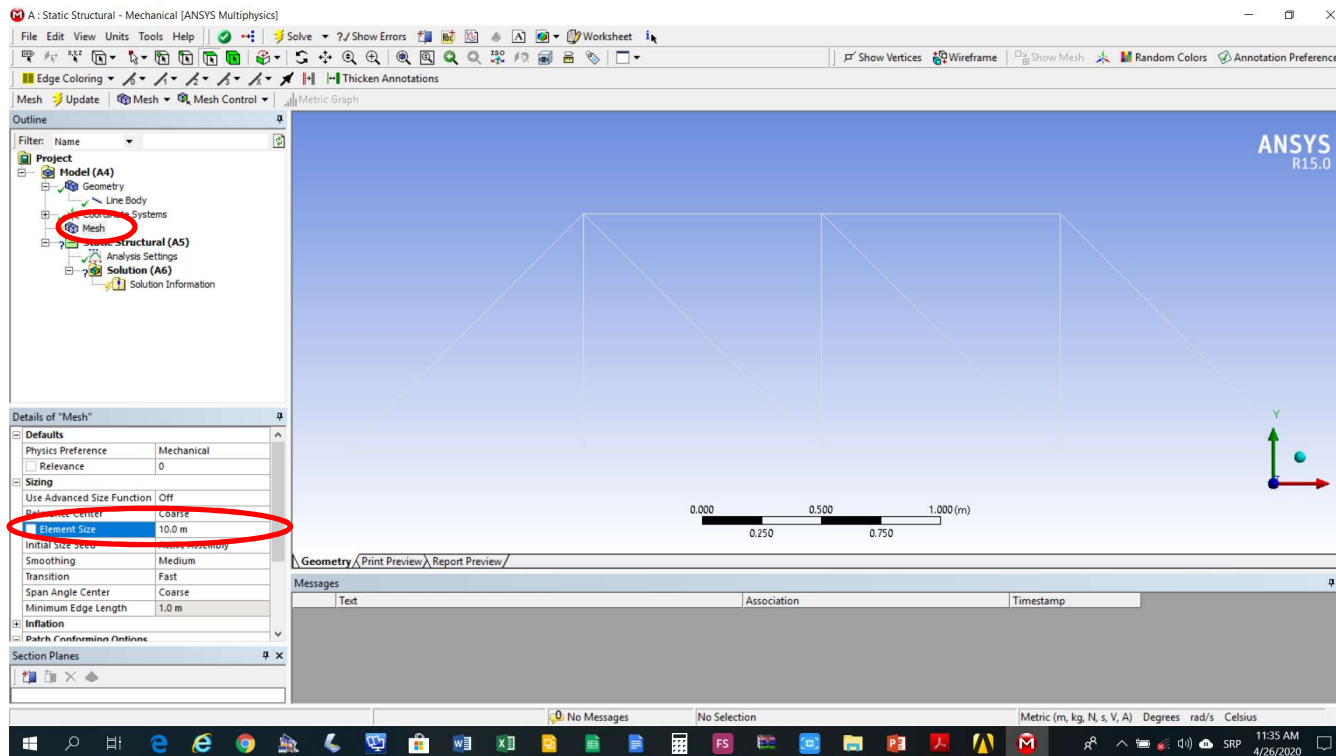
Modeliranje rešetkaste konstrukcije

Dodjeliti materijal elementima konstrukcije
(*Details of Line Body->Assignment*)



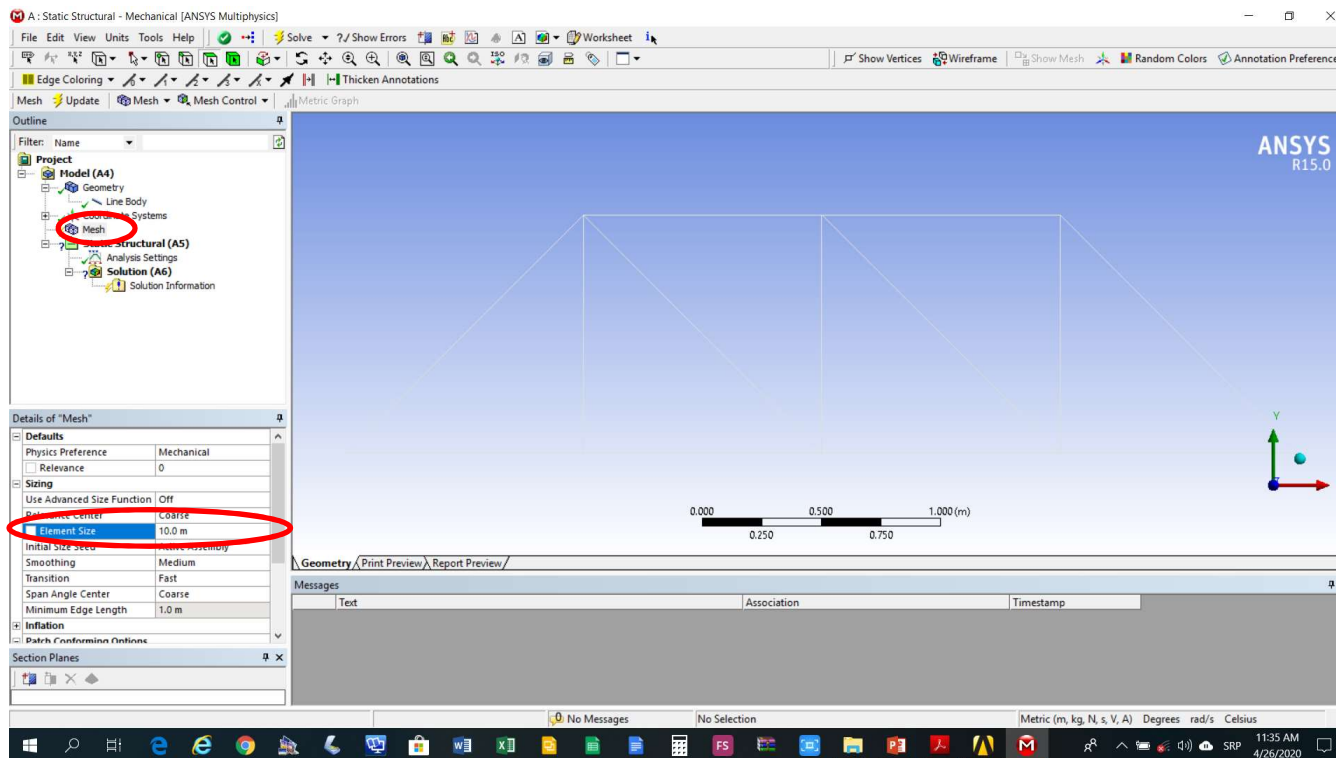
Modeliranje rešetkaste konstrukcije

Zadavanje veličine konačnog elementa (*Details of Mesh->Element Size*)



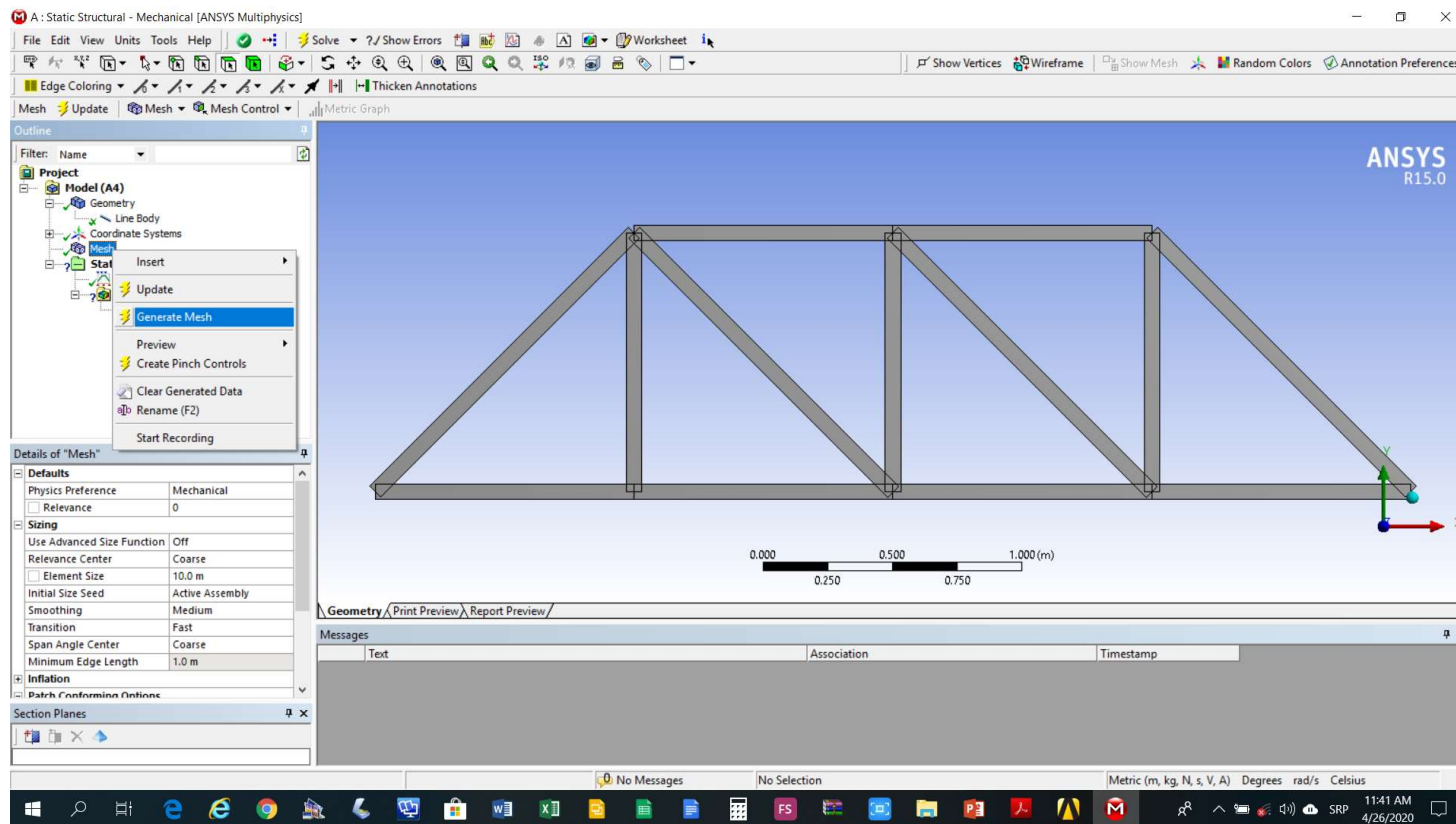
Modeliranje rešetkaste konstrukcije

Zadata veličina konačnog elementa je 10 m kako bi svaki element konstrukcije bio modeliran jednim konačnim elementom



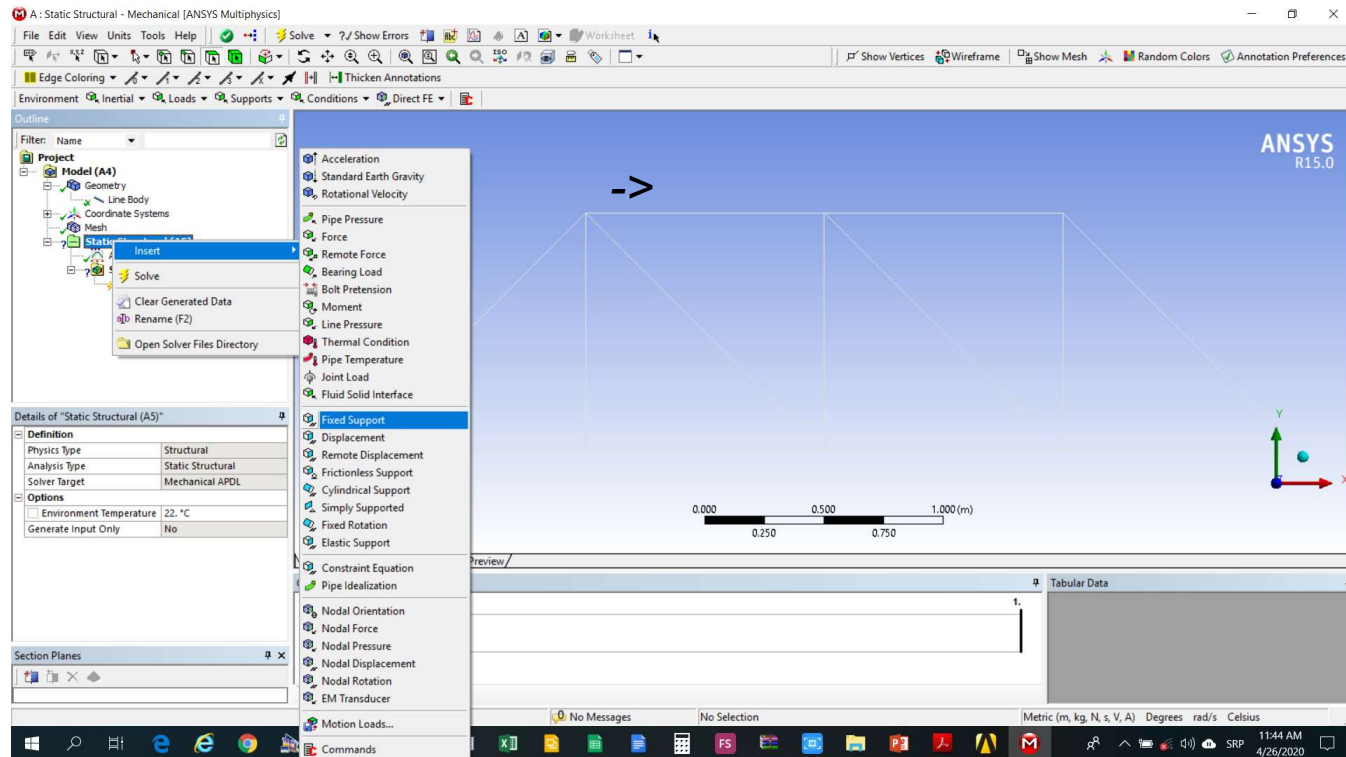
Modeliranje rešetkaste konstrukcije

Generisanje mreže konačnih elemenata (*Mesh*-> *Generate Mesh*)



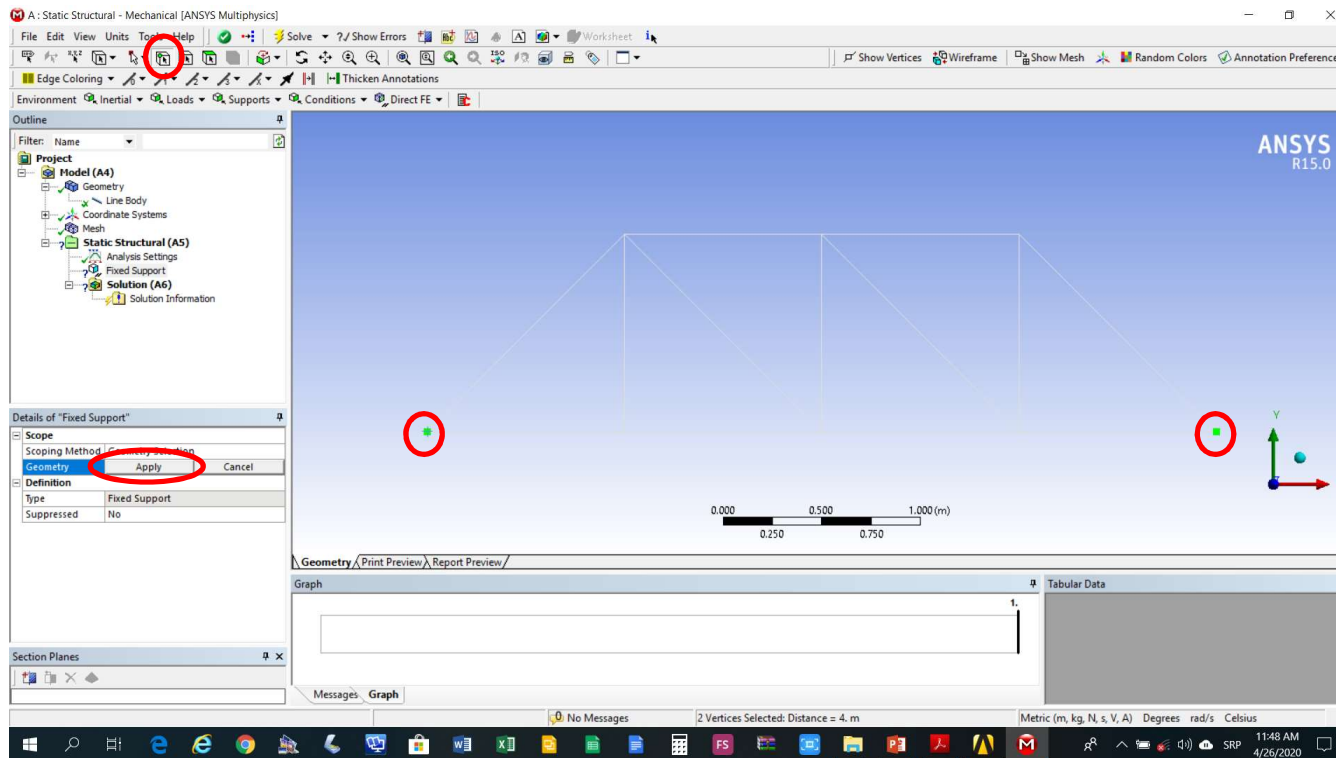
Modeliranje rešetkaste konstrukcije

Dodavanje nepokretnih oslonaca modelu (*Static Structural*->*Insert*->*Fixed Support*)



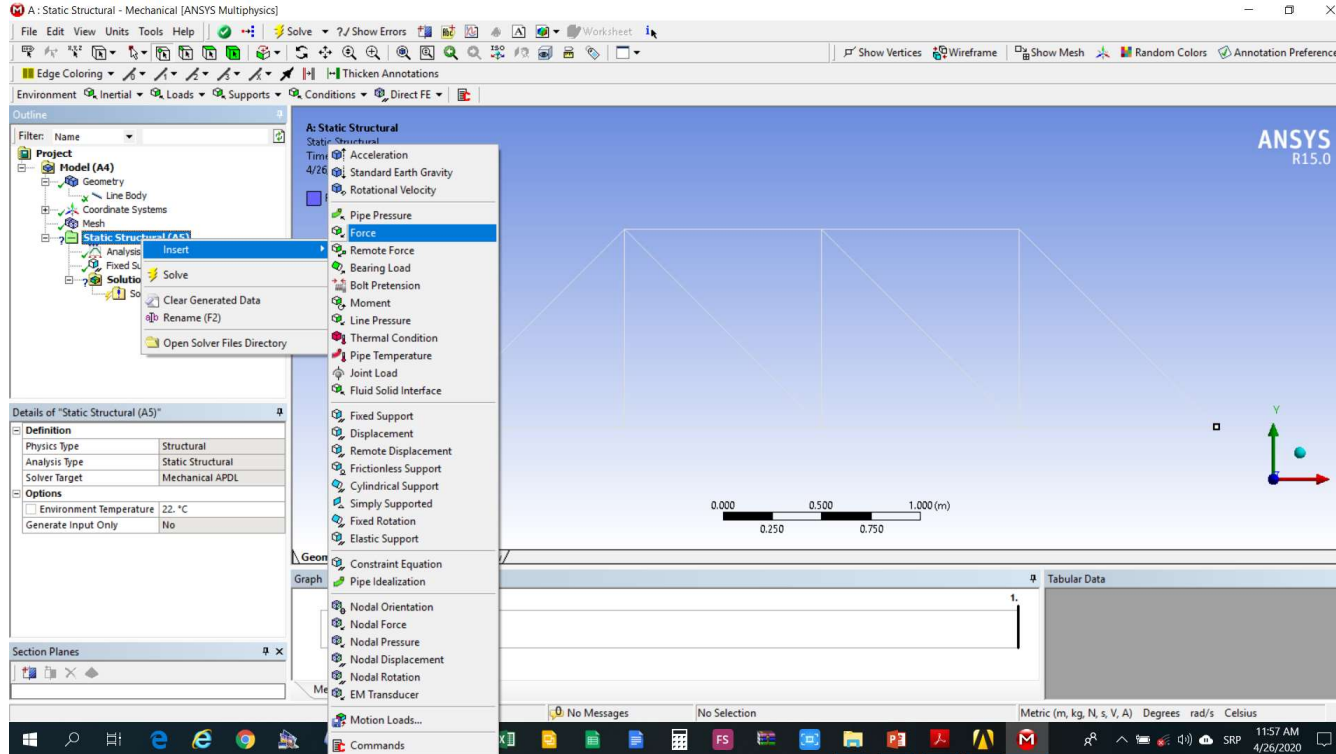
Modeliranje rešetkaste konstrukcije

Izbor položaja nepokretnih oslonaca (*Vertex/Node*) i dugme *Details of Fixed Support* > *Apply*



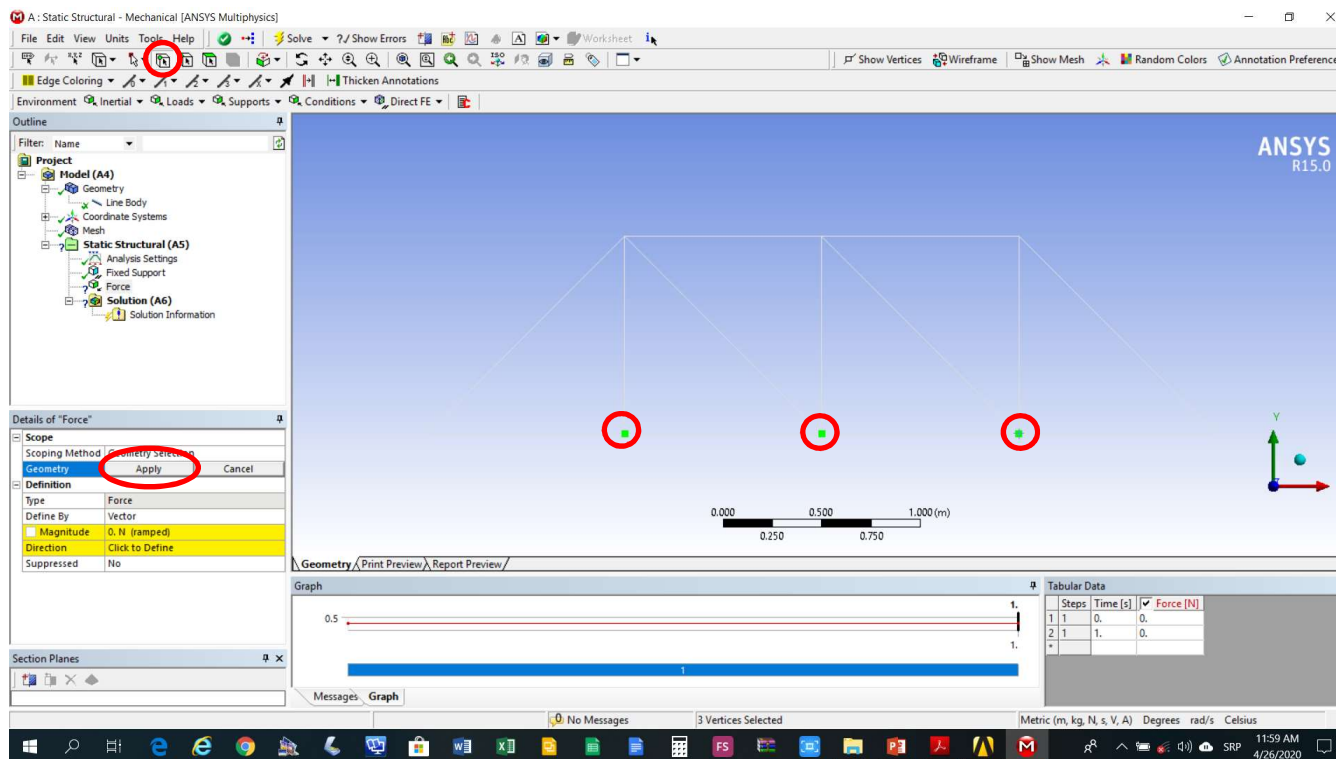
Modeliranje rešetkaste konstrukcije

Dodavanje sila modelu (*Static Structural->Insert->Force*)



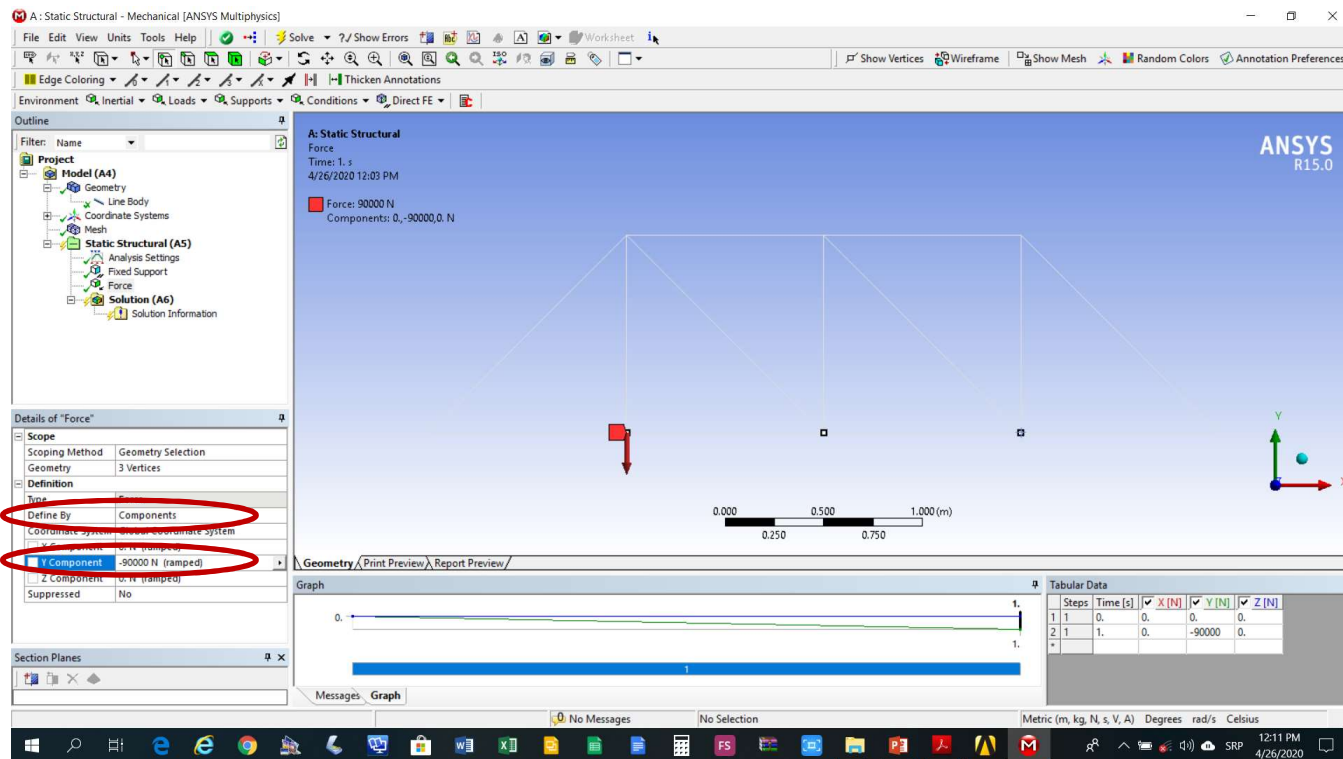
Modeliranje rešetkaste konstrukcije

Izbor položaja napadnih tačaka sila (*Vertex/Node*) i dugme *Details of Force*->*Apply*



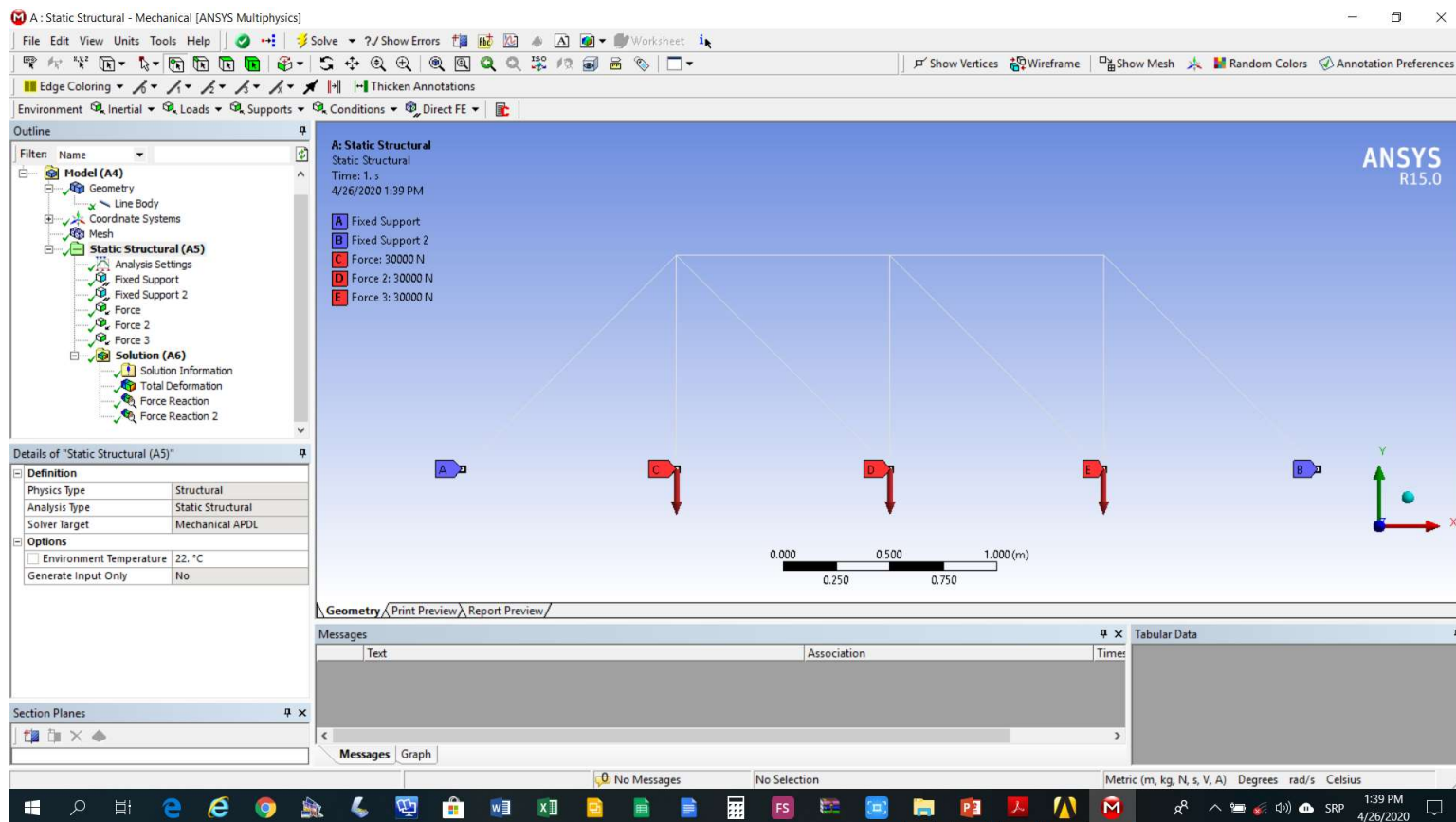
Modeliranje rešetkaste konstrukcije

Zadavanje inteziteta sila: lista *Details of Force* -> *Define by* -> *Components* i polje *Details of Force* -> *Define by* -> *Y Component* = -30000N



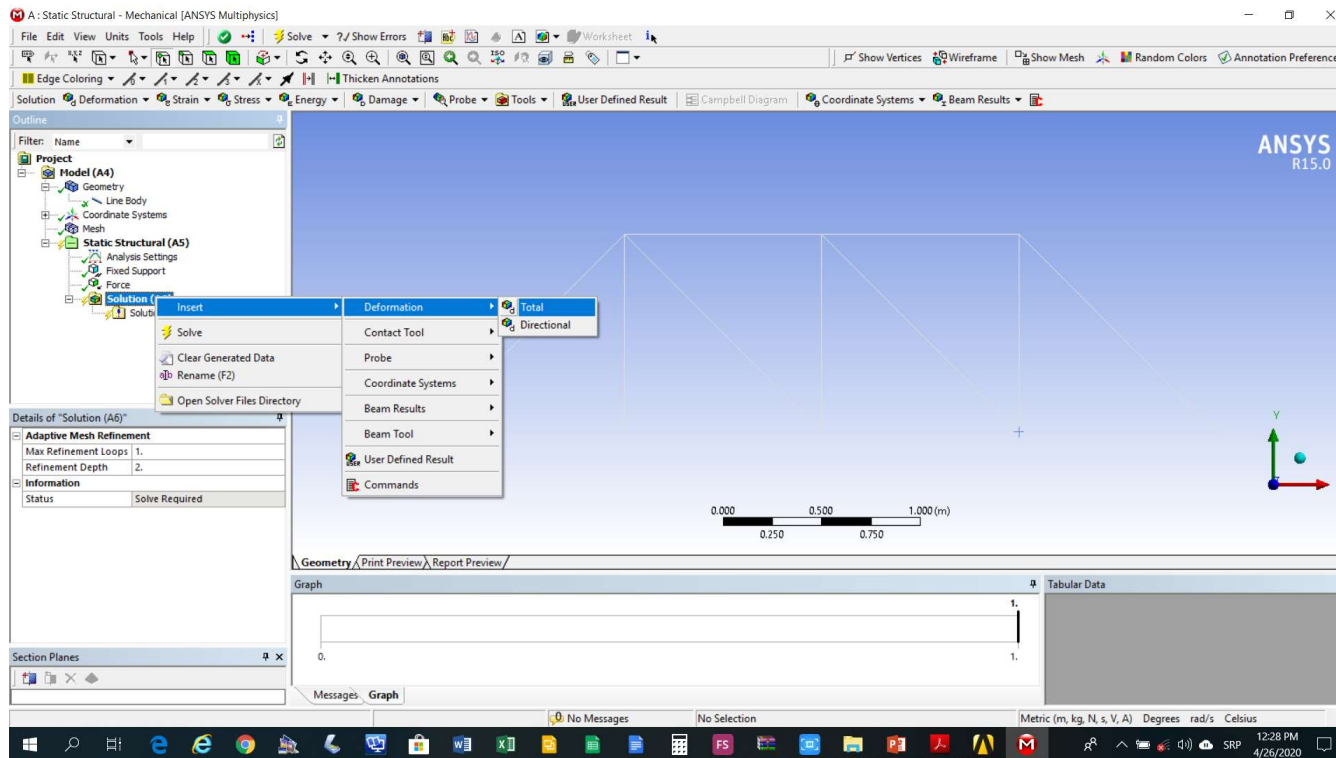
Modeliranje rešetkaste konstrukcije

Oslonci i opterećenje konstrukcije



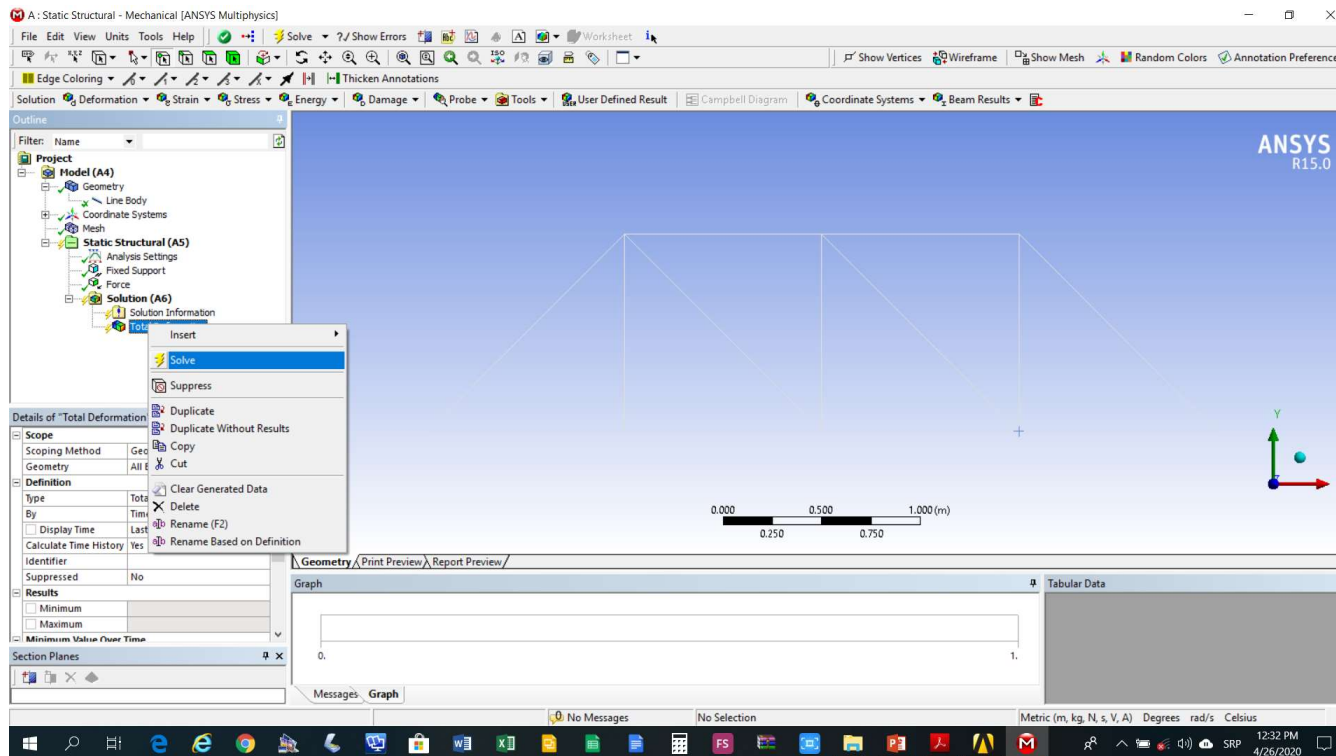
Modeliranje rešetkaste konstrukcije

Izbor analize deformacija konstrukcije (*Solution->Insert->Deformation->Total*)



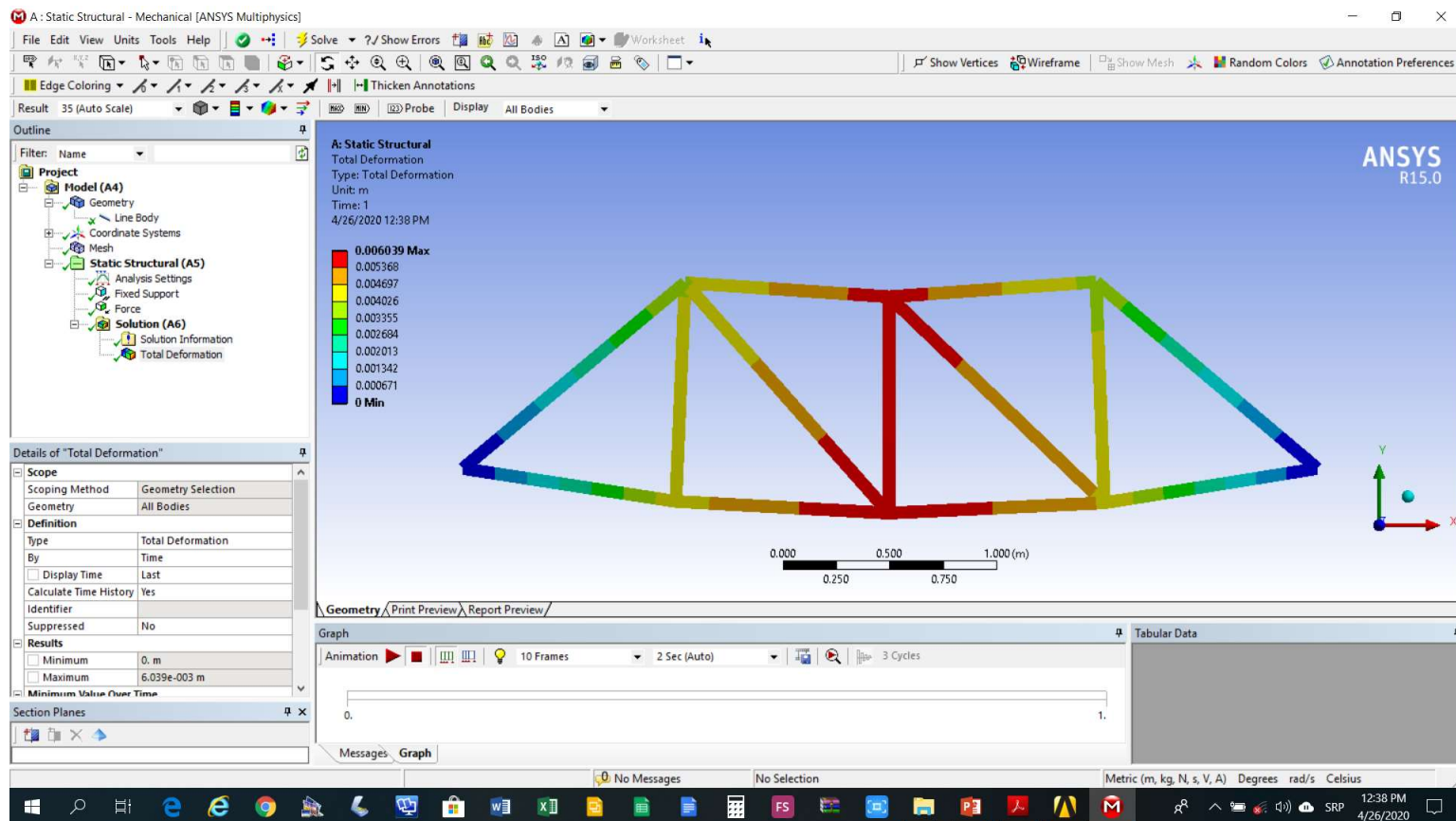
Modeliranje rešetkaste konstrukcije

Aktiviranje analize (*Solution*->*Total Deformation*->*Solve*)



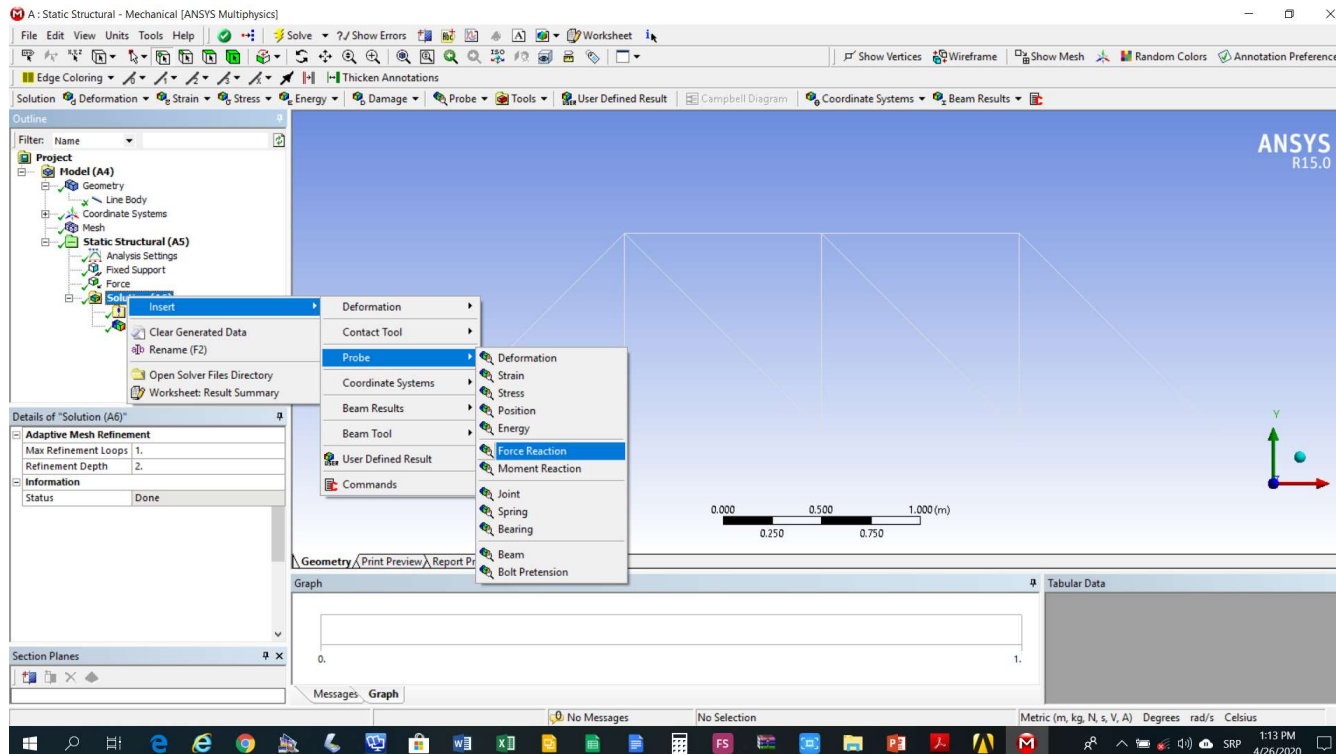
Modeliranje rešetkaste konstrukcije

Rezultati analize deformacija konstrukcije



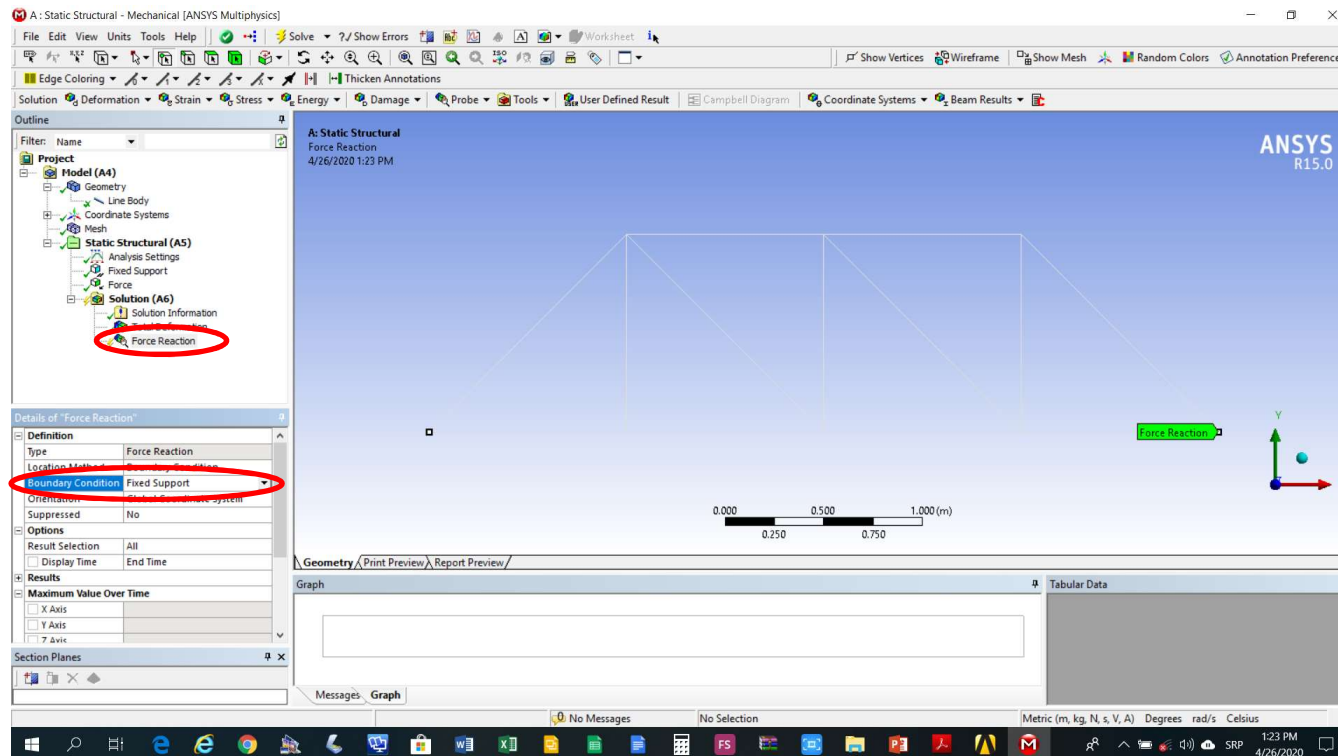
Modeliranje rešetkaste konstrukcije

Očitavanje reakcija oslonaca (*Solution->Insert->Probe->Force Reaction*)



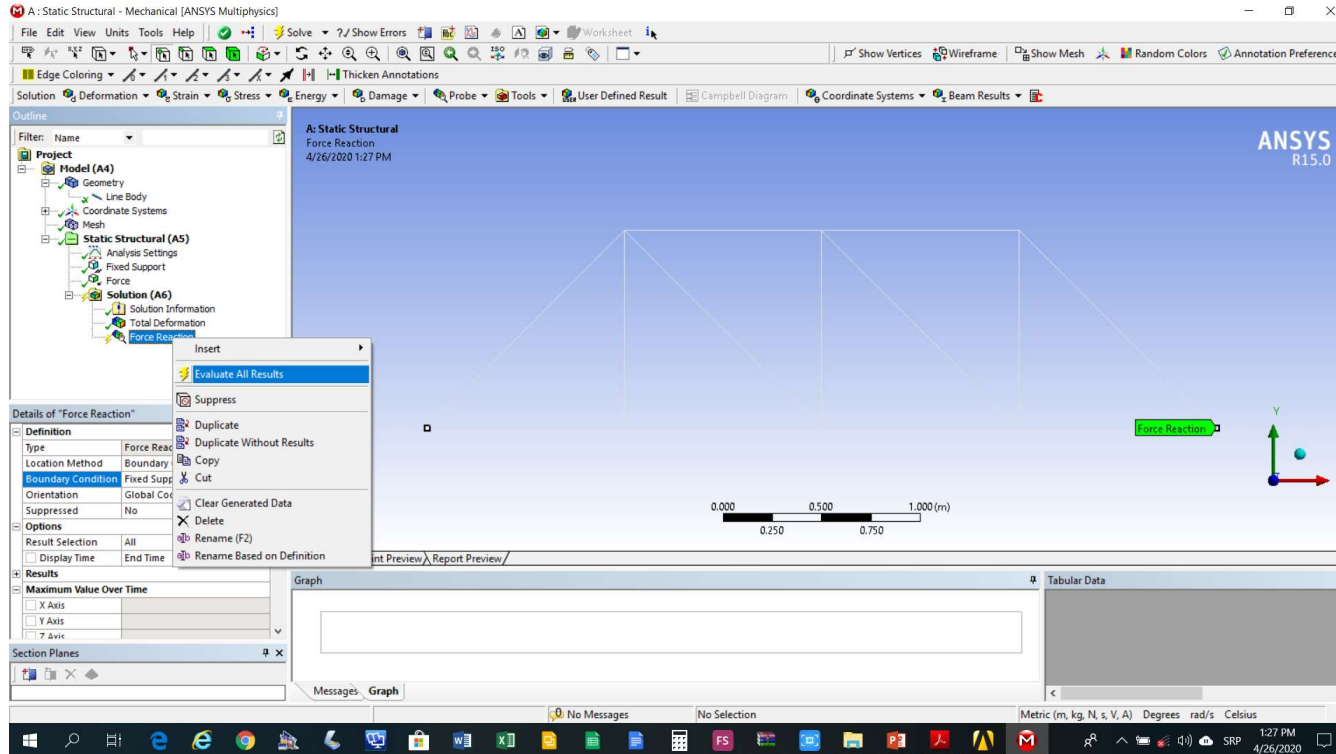
Modeliranje rešetkaste konstrukcije

Izabrati tip oslonca (*Details of Force Reaction->Boundary Condition->Fixed Support*)



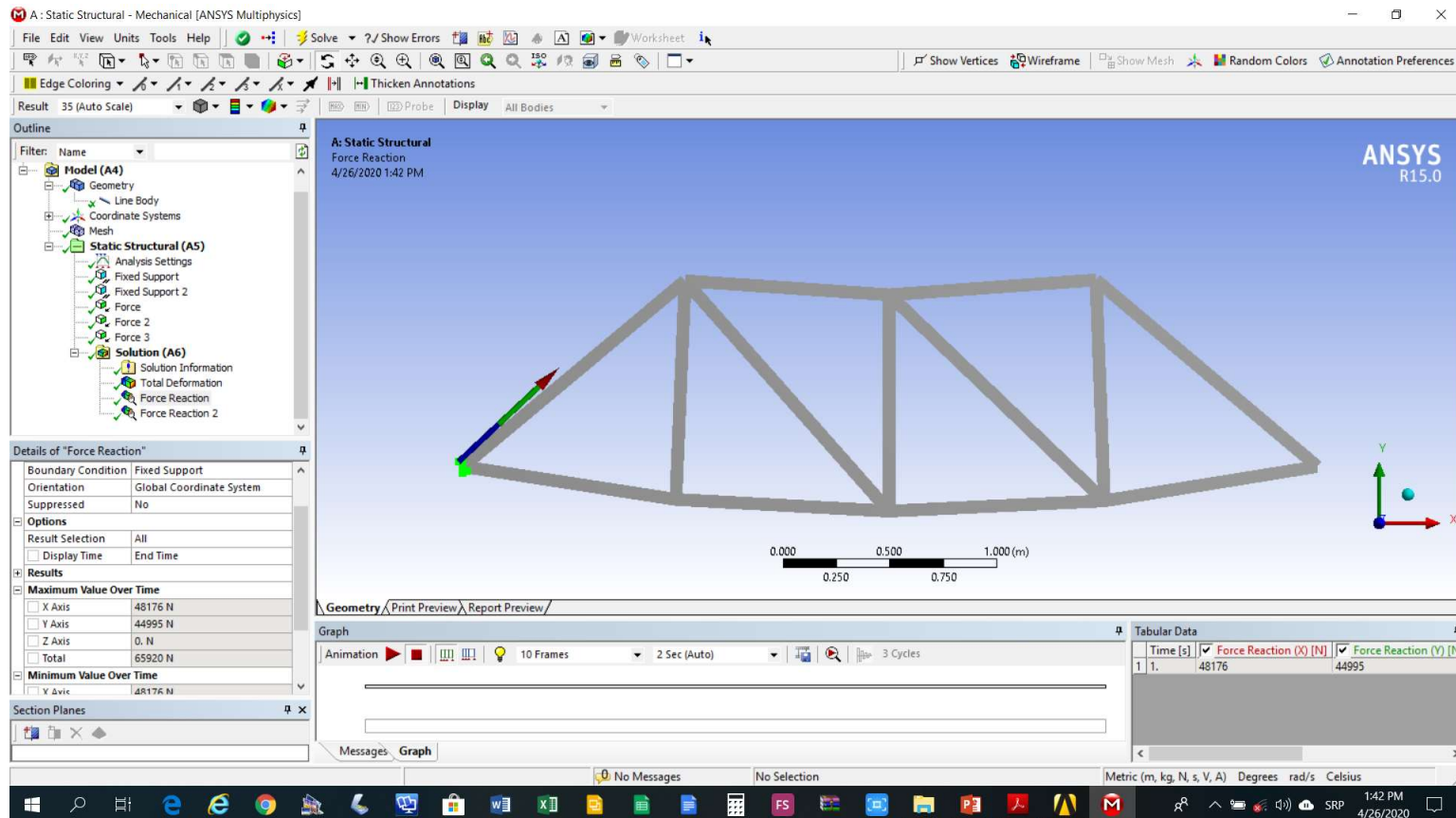
Modeliranje rešetkaste konstrukcije

Aktiviranje očitavanje (*Solution->Force Reaction->Evaluate all Results*)



Modeliranje rešetkaste konstrukcije

Reakcija oslonca



Rešetkaste konstrukcije

