Моделирование состояния биметаллических конструкций

Порядок выполнения работы:

Моделирование биметаллических конструкций при статической нагрузке (Static Structural)

- Создание биметаллической конструкции согласно заданию.
- Задание материалов.
- Генерация сети конечных элементов.
- Задание граничных условий.
- Проведение расчета.
- Интерпретация результатов.

Определение частот и форм собственных колебаний (Modal)

Unsaved Project - Workbench

File View Tools Units Help

New Open... Save Save As... Import... Reconnect Refresh Project Update Project Return to Project Compact Mode

Toolbox

- Physical Properties
- Linear Elastic
- Experimental Stress Strain Data
- Hyperelastic
- Plasticity
- Life
- Strength
- Gasket

View All / Customize...

Outline Filter

	A	B	C	D
1	Data Source		Location	Description
2	Engineering Data		A2	Contents filtered for Static Structural (ANSYS).
3	General Materials			General use material samples for use in various analyses.
4	General Non-linear Materials			General use material samples for use in non-linear analyses.
5	Explicit Materials			Material samples for use in an explicit anaylsis.
6	Hyperelastic Materials			Material stress-strain data samples for curve fitting.

Outline of Schematic A2: Engineering Data

	A	B	C	D
1	Contents of Engineering Data		S..	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
*	Click here to add a new material			

Properties of Outline Row 4:

	A	B	C
1	Property	Value	Unit

	A
1	Static Structural (ANSYS)
2	Engineering Data
3	Geometry
4	Model
5	Setup
6	Solution
7	Results

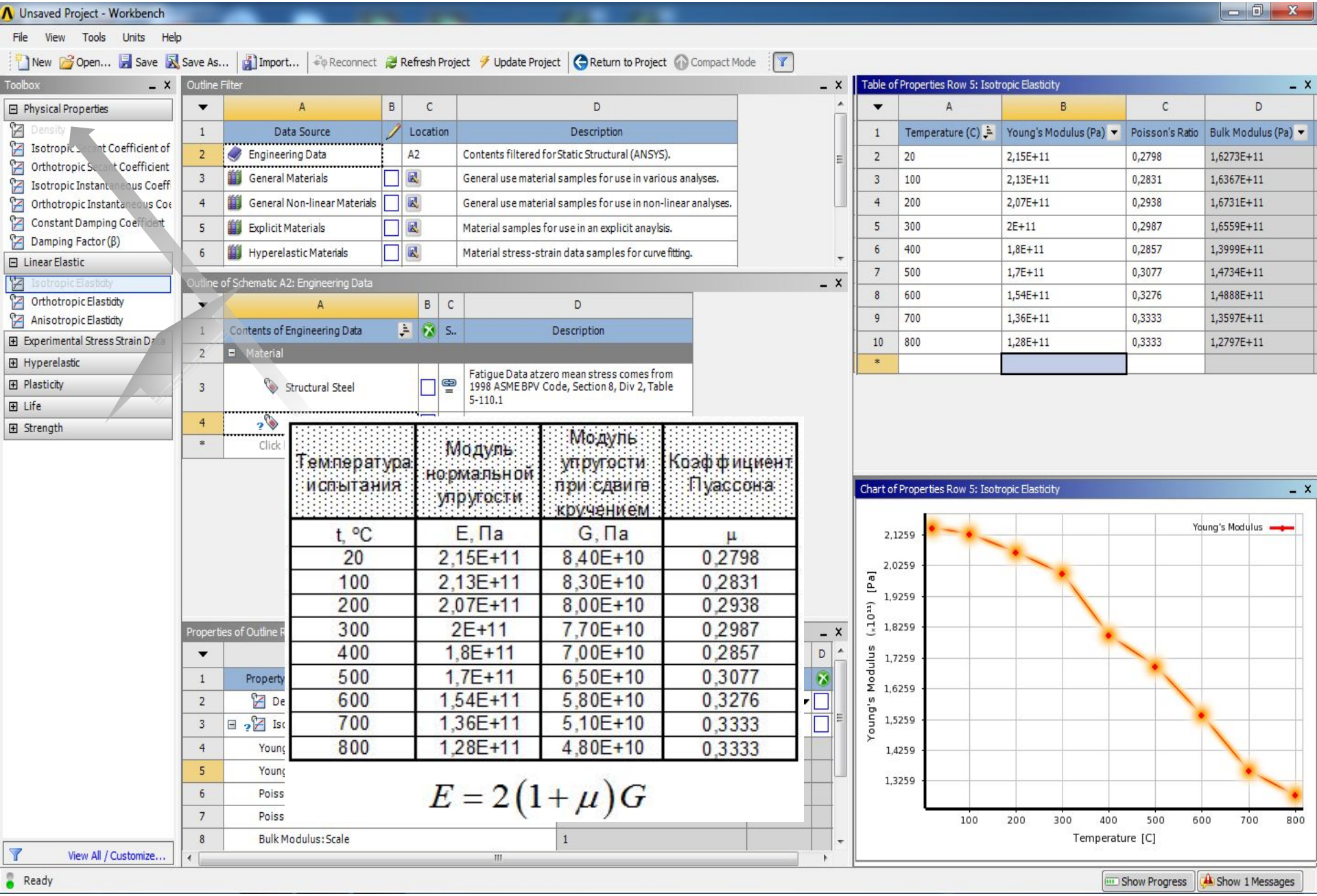
Static Structural (ANSYS)

No data

Ready

Show Progress Show 1 Messages

Шаг 1 Здание свойств нового материала для пластины



Температура испытания	Модуль нормальной упругости	Модуль упругости при сдвиге кручением	Коэффициент Пуассона
t, °C	E, Па	G, Па	μ
20	2,15E+11	8,40E+10	0,2798
100	2,13E+11	8,30E+10	0,2831
200	2,07E+11	8,00E+10	0,2938
300	2E+11	7,70E+10	0,2987
400	1,8E+11	7,00E+10	0,2857
500	1,7E+11	6,50E+10	0,3077
600	1,54E+11	5,80E+10	0,3276
700	1,36E+11	5,10E+10	0,3333
800	1,28E+11	4,80E+10	0,3333

$$E = 2(1+\mu)G$$

Шаг 2 Здание зависимости прочностных свойств от температуры

	A
1	Static Structural (ANSYS)
2	Engineering Data
3	Geometry
4	Model
5	Setup
6	Solution
7	Results

Static Structural (ANSYS)

Outline Filter

	A	B	C	D
1	Data Source		Location	Description
2	Engineering Data		A2	Contents filtered for Static Structural (ANSYS).
3	General Materials			General use material samples for use in various analyses.
4	General Non-linear Materials			General use material samples for use in non-linear analyses.
5	Explicit Materials			Material samples for use in an explicit anaylsis.
6	Hyperelastic Materials			Material stress-strain data samples for curve fitting.

Outline of General Materials

	A	B	C	D	E
1	Contents of General Materials	Add		S..	Description
2	Material				
3	Air				General properties for air.
4	Aluminum Alloy				General aluminum alloy. Fatigue properties come from MIL-HDBK-5H, page 3-277.
5	Concrete				
6	Copper Alloy				
7	Gray Cast Iron				
8	Magnesium Alloy				
9	Polyethylene				
10	Silicon Anisotropic				
11	Stainless Steel				
					Fatigue Data at zero mean stress comes from

Properties of Outline Row 3: Air

	A	B	C
1	Property	Value	Unit

Outline Filter

	A	B	C	D
1	Data Source		Location	Description
2	Engineering Data		A2	Contents filtered for Static Structural (ANSYS).
3	General Materials			General use material samples for use in various analyses.
4	General Non-linear Materials			General use material samples for use in non-linear analyses.
5	Explicit Materials			Material samples for use in an explicit anaylsis.
6	Hyperelastic Materials			Material stress-strain data samples for curve fitting.

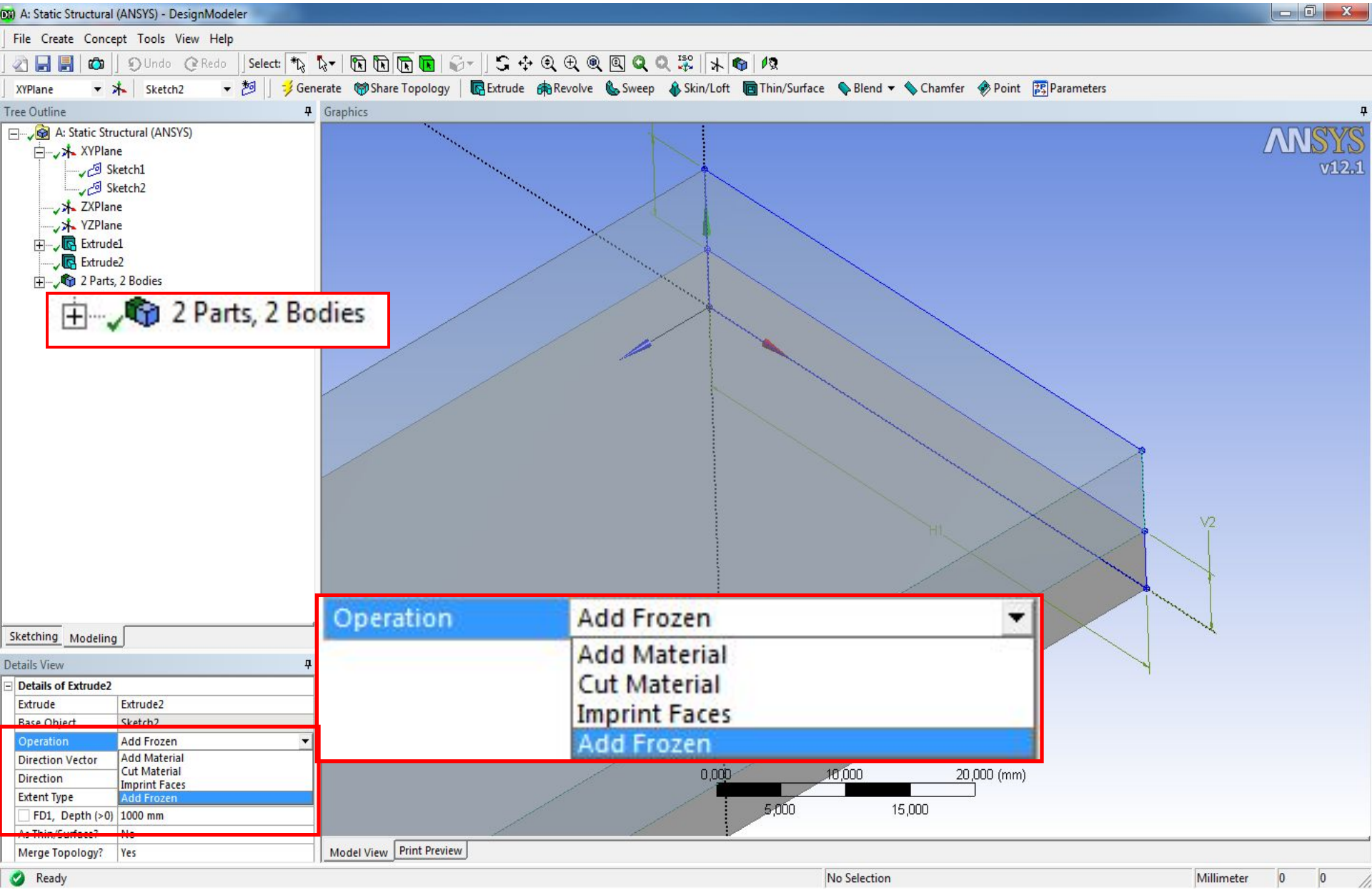
Outline of Schematic A2: Engineering Data

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

Properties of Outline Row 3: Copper Alloy

	A	B	C	D
1	Property	Value	Unit	
2	Density	8300	kg m^-3	
3	Isotropic Secant Coefficient of Thermal Expansion			
4	Coefficient of Thermal Expansion	1,8E-05	C^-1	
5	Reference Temperature	22	C	
6	Isotropic Elasticity			
7	Derive from	Young's Modulus and Poisson's Ratio		
8	Young's Modulus	1,1E+11	Pa	

Шаг 3 Здание свойств нового материала для пластины



Шаг 4 Моделирование геометрии двух биметаллических пластин

A : Static Structural (ANSYS) - Mechanical [ANSYS Multiphysics]

File Edit View Units Tools Help | Solve | Worksheet

Selection | Visibility | Suppression

Mesh | Update | Mesh | Mesh Control | Metric Graph | Options

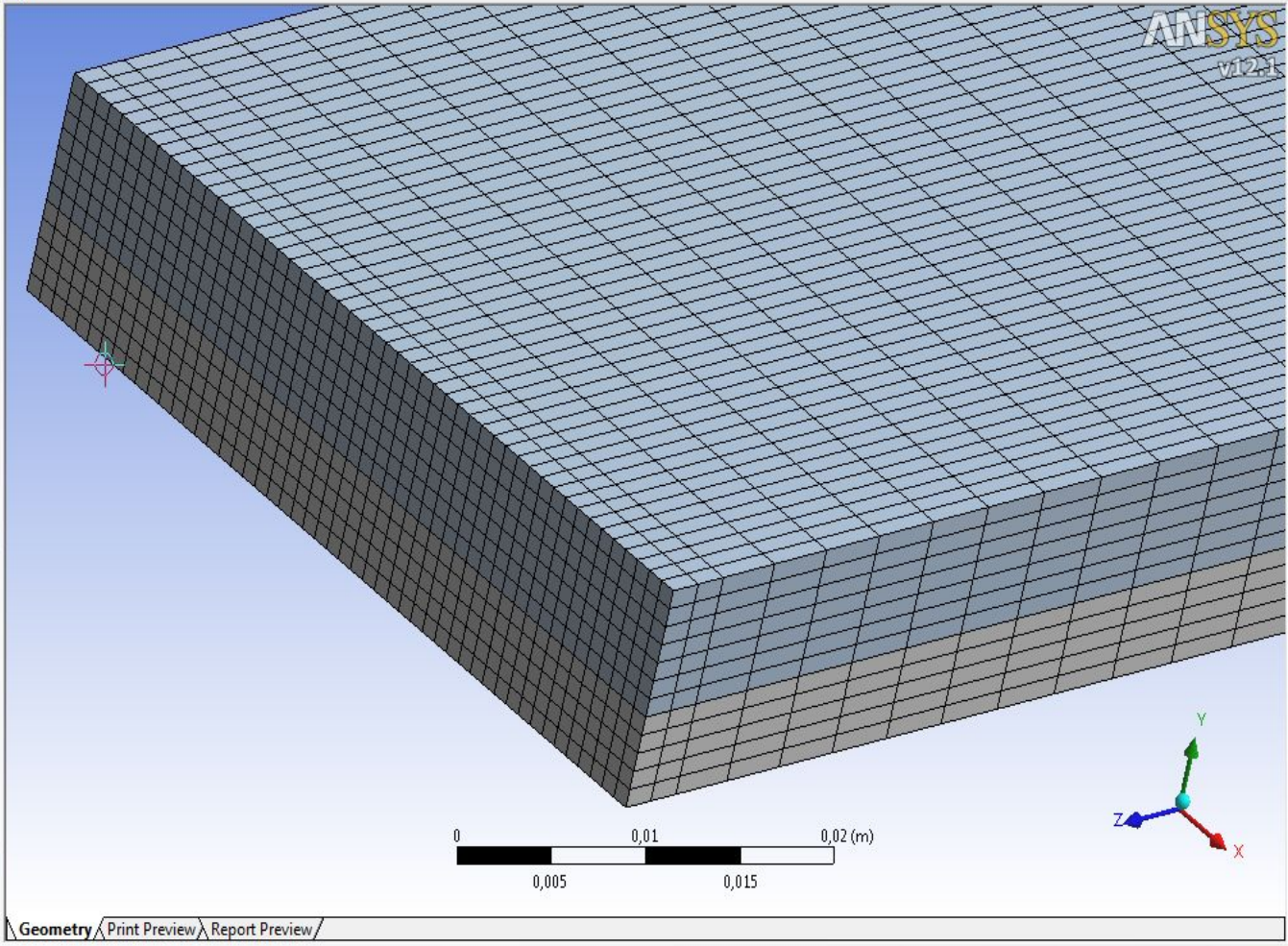
Outline

- Project
  - Model (A4)
    - Geometry
      - Solid
      - Solid
    - Coordinate Systems
    - Connections
    - Mesh
      - Edge Sizing
      - Edge Sizing 2
    - Static Structural (A5)
      - Analysis Settings
      - Solution (A6)
        - Solution Information

Details of "Mesh"

Defaults	
Physics Preference	Mechanical
Relevance	0
Sizing	
Inflation	
Advanced	
Pinch	
Statistics	

Section Planes



Messages

	Text	Association	Timestamp
Warninc	The CFX-Mesh Method has been superseded by the Patch Conforming Tetrahedral Met	Project	9/4/2013 6:28:07 PM

Press F1 for Help | 1 Message | No Selection | Metric (m, kg, N, s, V, A) Degrees rad/s Celsius

Шаг 5 Создание неравномерной расчетной сетки двух биметаллических пластин

Outline

- Project
  - Model (B4, C4)
    - Geometry
    - Coordinate Systems
    - Connections
    - Mesh
    - Steady-State Thermal (B5)
      - Initial Temperature
      - Analysis Settings
      - Temperature
      - Temperature 2
      - Solution (B6)
    - Static Structural (C5)
      - Analysis Settings
      - Fixed Support
      - Imported Load (Solution 1)
        - Imported Body Temperature
      - Solution (C6)
        - Solution Information
        - Total Deformation
        - Equivalent Stress

Insert
Suppress
Import Load
Clean
Delete
Rename

Details of "Imported Body Temperature"

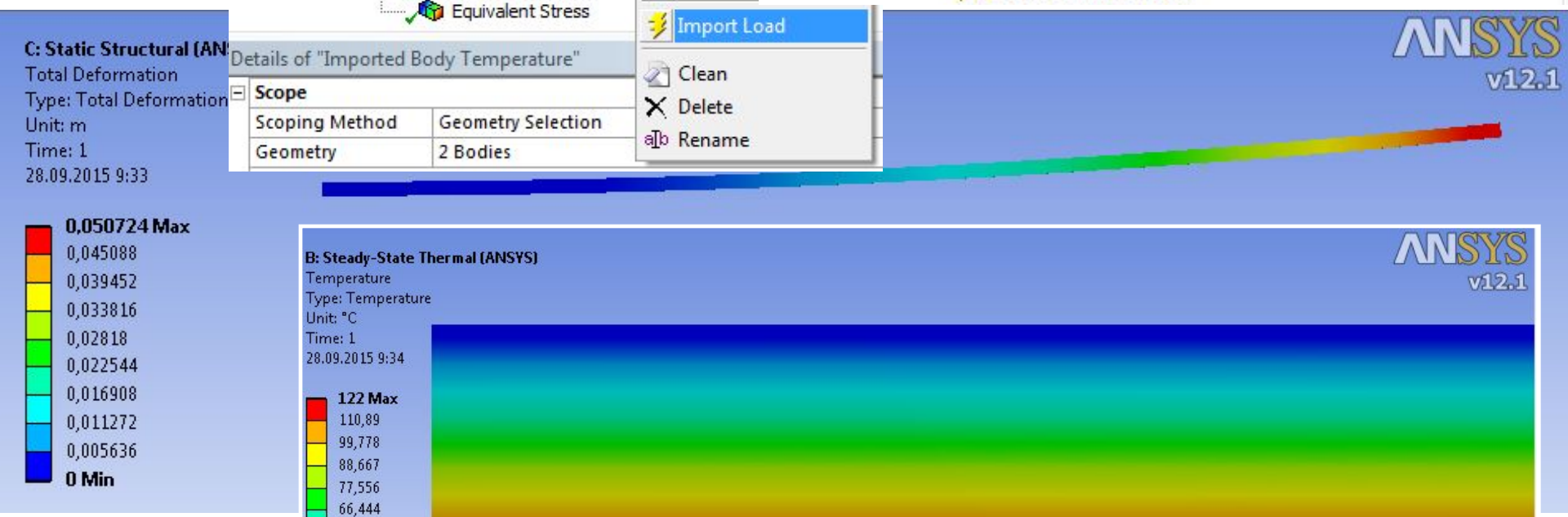
Scope	
Scoping Method	Geometry Selection
Geometry	2 Bodies

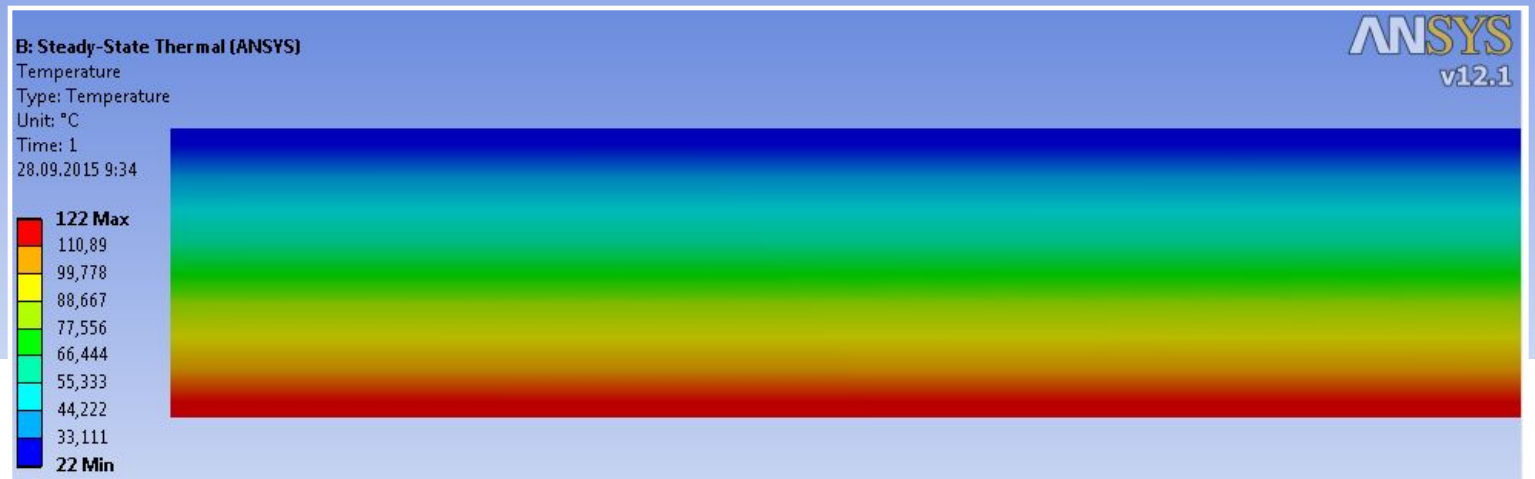
Environment | Inertial | Loads | Supports

Outline

- Project
  - Model (A4)
    - Geometry
      - Solid
      - Solid
    - Coordinate Systems
    - Connections
    - Mesh
      - Edge Sizing
      - Edge Sizing 2
    - Static Structural (A5)
      - Analysis Settings
      - Thermal Condition
      - Thermal Condition 2
      - Solution (A6)
        - Solution Information

Fixed Support
Displacement
Remote Displacement
Velocity
Impedance Boundary
Frictionless Support
Compression Only Support
Cylindrical Support
Simply Supported
Fixed Rotation
Elastic Support
Coupling
Constraint Equation





Применение программного комплекса ANSYS Workbanch для расчета задач стержневых систем

Порядок выполнения работы:

Моделирование неразрезной балки при статической нагрузке (Static Structural)

- Создание схемы балки согласно заданию.
- Задание материалов.
- Генерация сети балочных элементов.
- Задание граничных условий.
- Проведение расчета.
- Интерпретация результатов.

Определение частот и форм собственных колебаний (Modal)

Unsaved Project - Workbench

File View Tools Units Help

New Open... Save Save As... Import... Reconnect Refresh Project Update Project Project Compact Mode

Toolbox

Analysis Systems

- Electric (ANSYS)
- Explicit Dynamics (ANSYS)
- Fluid Flow - BlowMolding (F
- Fluid Flow - Extrusion (POLY
- Fluid Flow (CFX)
- Fluid Flow (FLUENT)
- Fluid Flow (POLYFLOW)
- Harmonic Response (ANSYS
- Hydrodynamic Diffraction (
- Linear Buckling (ANSYS)
- Magnetostatic (ANSYS)
- Modal (ANSYS)
- Modal (Samcef)
- Random Vibration (ANSYS)
- Response Spectrum (ANSYS
- Shape Optimization (ANSYS
- Static Structural (ANSYS)
- Static Structural (Samcef)
- Steady-State Thermal (ANS
- Thermal-Electric (ANSYS)
- Transient Structural (ANSYS
- Transient Structural (MBD)
- Transient Thermal (ANSYS)

Static Structural Analysis using ANSYS solver

Component Systems

- AUTODYN
- BladeGen
- CFX
- Engineering Data
- Explicit Dynamics (LS-DYNA
- External Connection
- Finite Element Modeler
- FLUENT
- Geometry
- Icepak
- Mechanical APDL
- Mechanical Model
- Mesh
- POLYFLOW

View All / Customize...

Project Schematic

	A
1	Static Structural (ANSYS)
2	Engineering Data ✓
3	Geometry ?
4	Model ?
5	Setup ?
6	Solution ?
7	Results ?

Static Structural (ANSYS)

No data

	A	B
1	Property	Value

Messages

	A	B	C
1	Type	Text	Date/Time
2	Warning!	Problematic URL in 'Custom RSS Feed Address' in 'Project Management' options http://www.ansys.com/rss/ansys-news.rss	04.10.2011 19:05:31

Ready

Show Progress Hide 1 Messages

Unsaved Project - Workbench

File View Tools Units Help

New Open... Save Save As... Import... Reconnect Refresh Project Update Project Return to Project Compact Mode

Toolbox

- Physical Properties
- Linear Elastic
- Experimental Stress Strain Data
- Hyperelastic
- Plasticity
- Life
- Strength

View All / Customize...

Outline Filter

	A	B	C	D
1	Data Source		Location	Description
2	Engineering Data		A2	Contents filtered for Static Structural (ANSYS).
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4	General Non-linear Materials			General use material samples for use in non-linear analyses.
5	Explicit Materials			Material samples for use in an explicit anaylsis.
6	Hyperelastic Materials			Material stress-strain data samples for curve fitting.

Outline of Schematic A2: Engineering Data

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

Properties of Outline Row 3: Stainless Steel

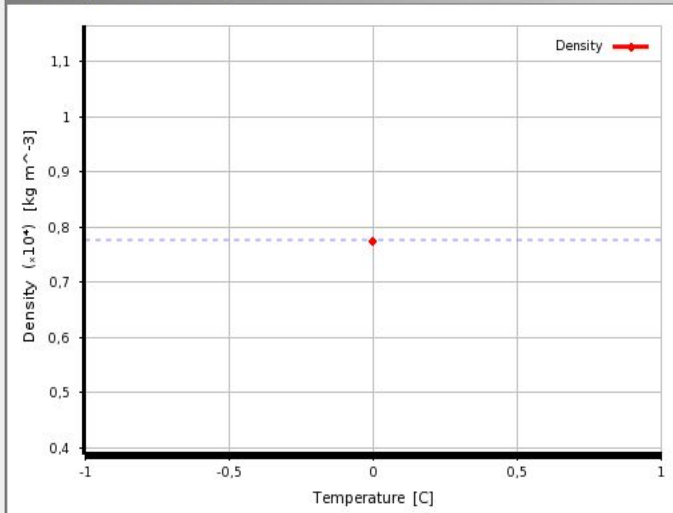
	A	B	C	D
1	Property	Value	Unit	
2	Density	7750	kg m^-3	
3	Isotropic Secant Coefficient of Thermal Expansion			
6	Isotropic Elasticity			
7	Derive from	Young's Modulus and Poisson's Ratio		
8	Young's Modulus	1,93E+11	Pa	
9	Poisson's Ratio	0,31		
10	Bulk Modulus	1,693E+11	Pa	

Table of Properties Row 2: Density

	A	B
1	Temperature (C)	Density (kg m^-3)
2		
*		

Ascending
Descending
Sort Settings...
Cancel sorting
K
C
R
F

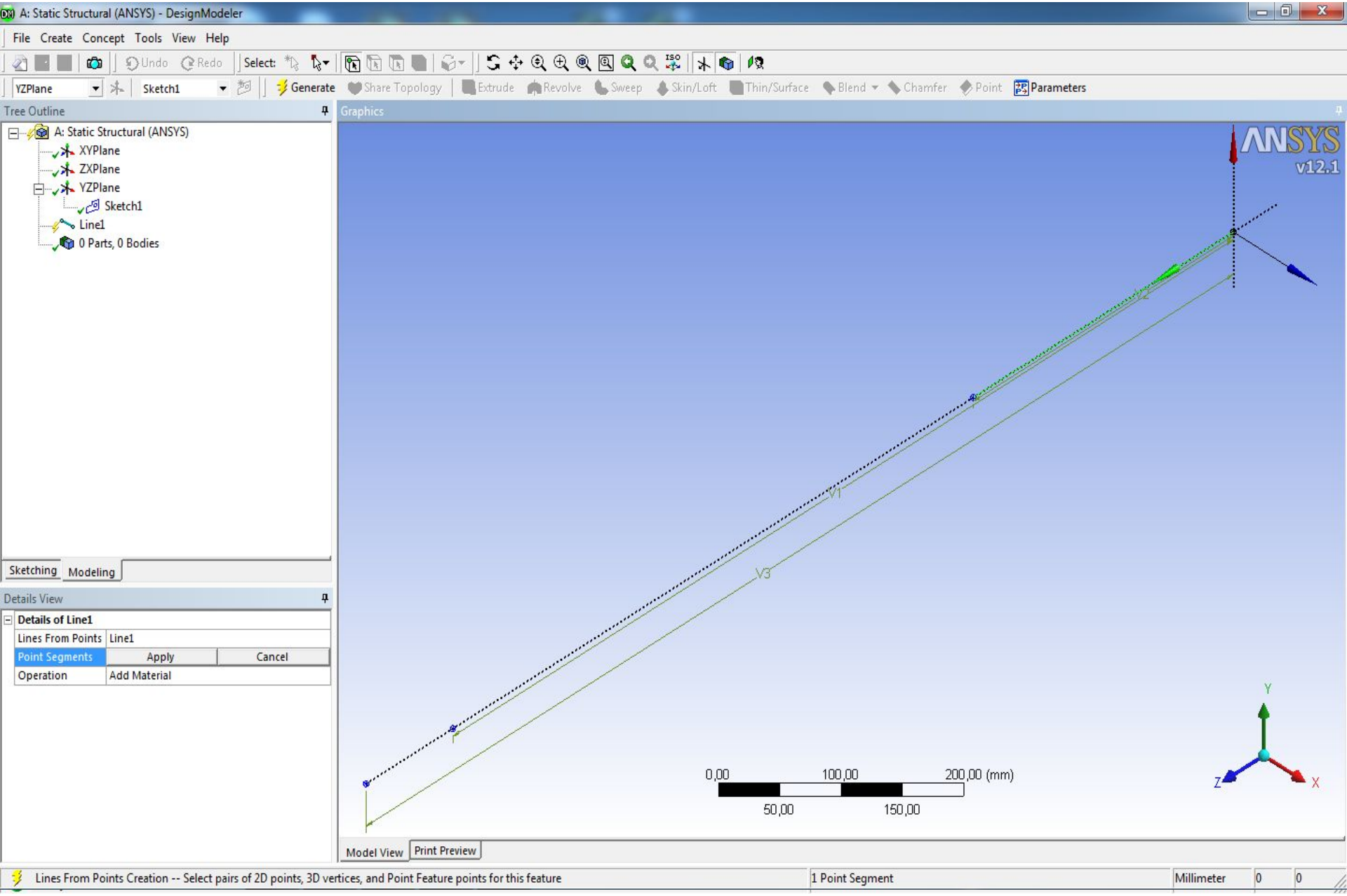
Chart of Properties Row 2: Density



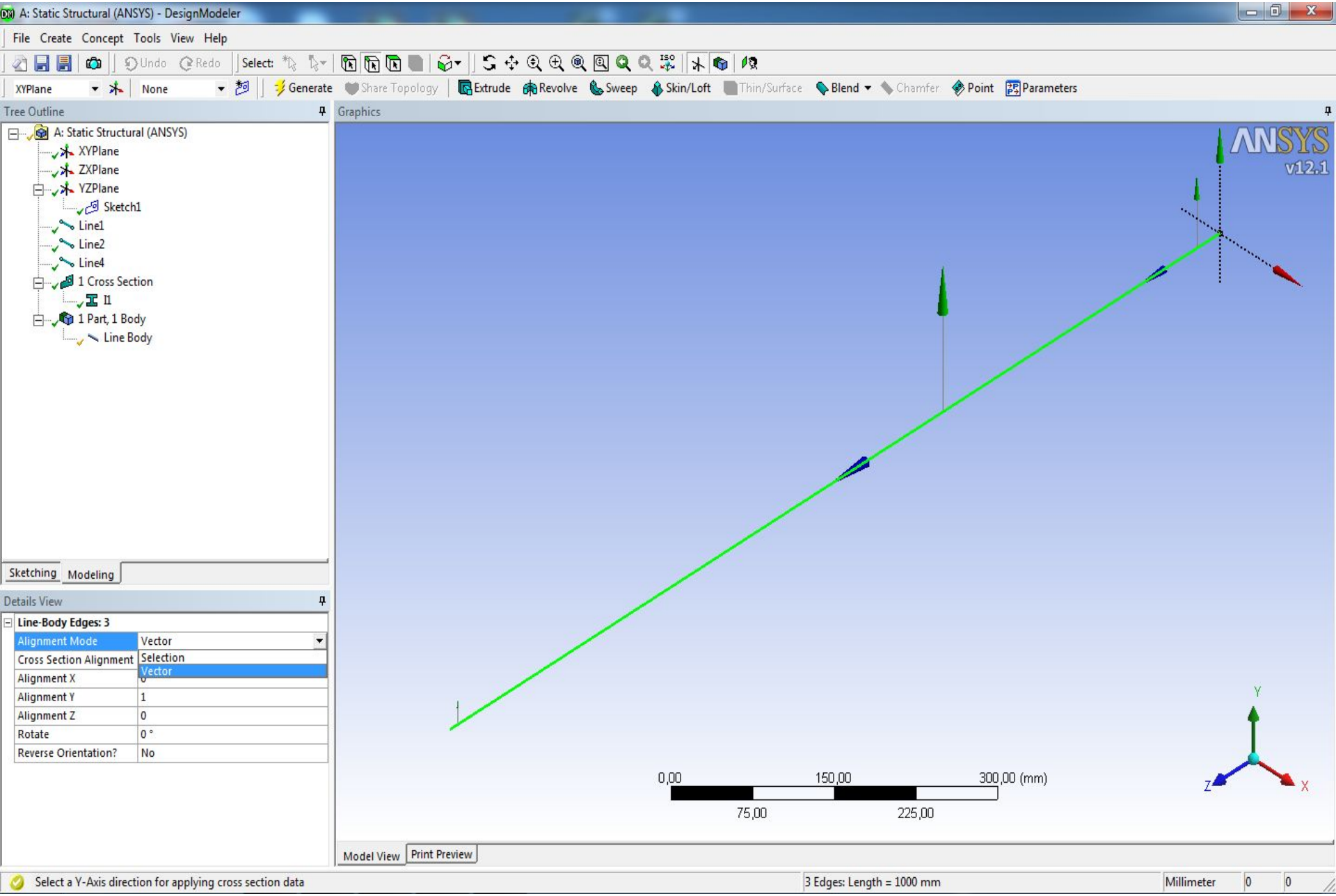
Ready

Show Progress Show 1 Messages

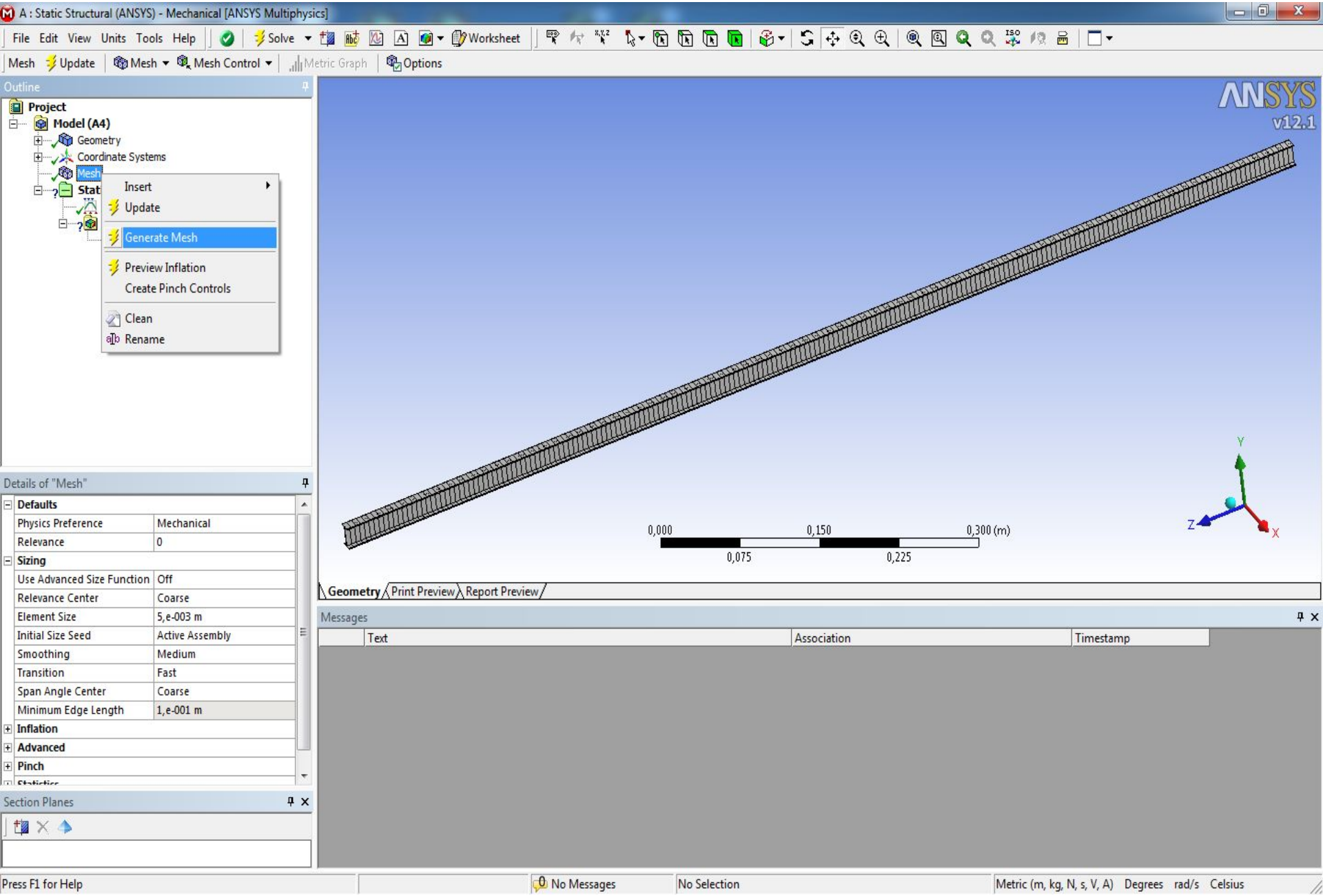
Шаг 1 Здание свойств материала балки



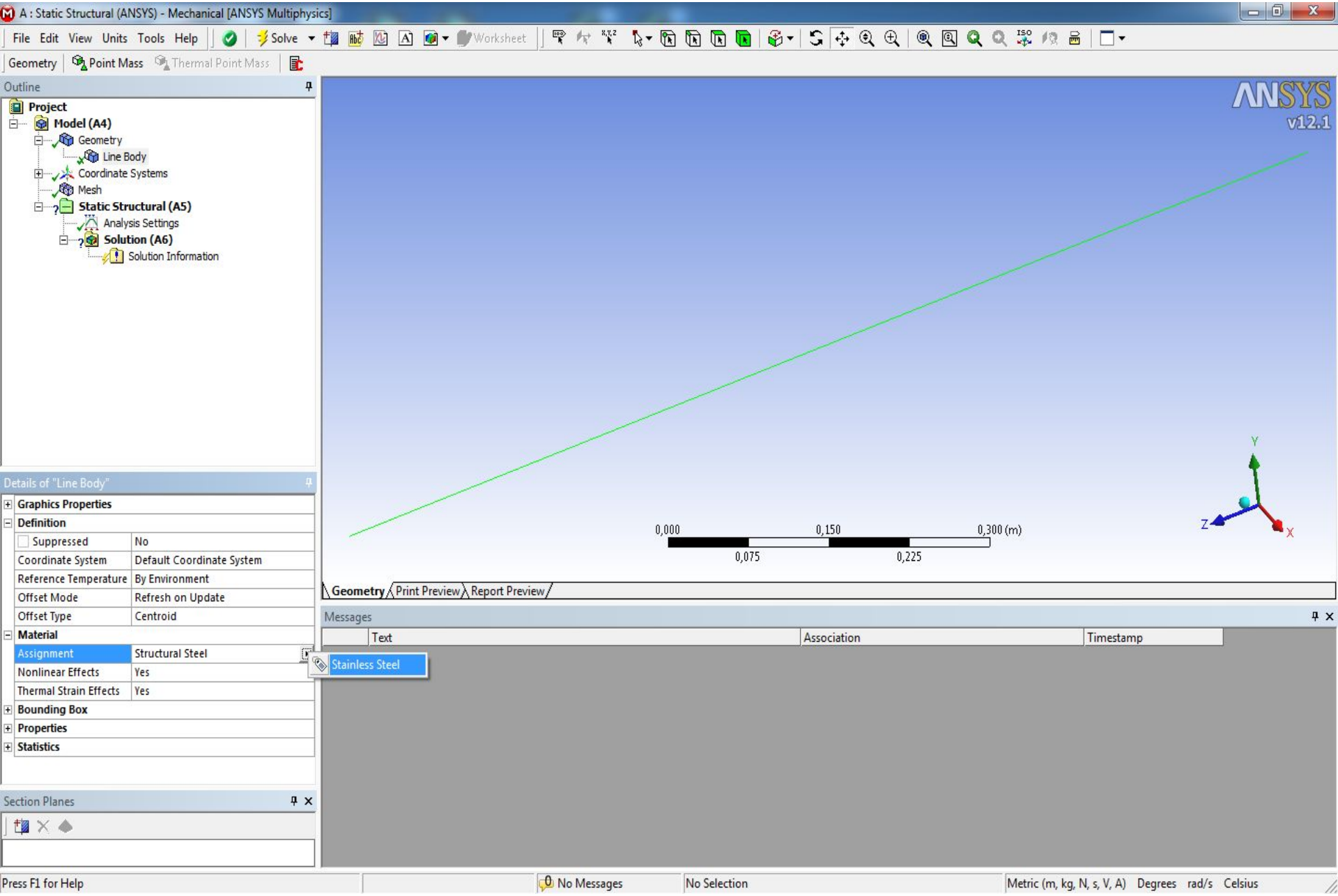
Шаг 2 Создание конструкционных точек и направляющих линий



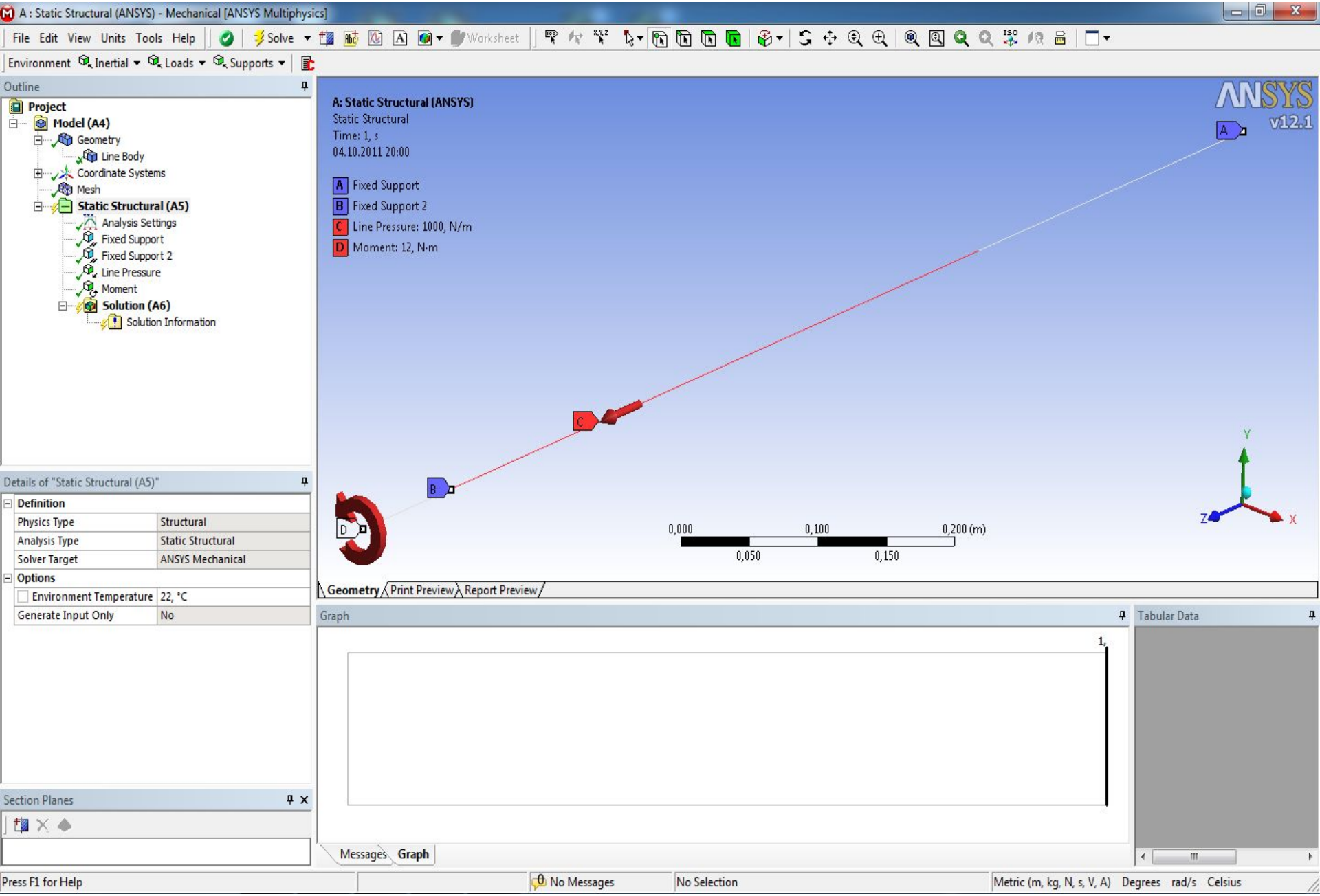
Шаг 3 Здание поперечного сечения балки



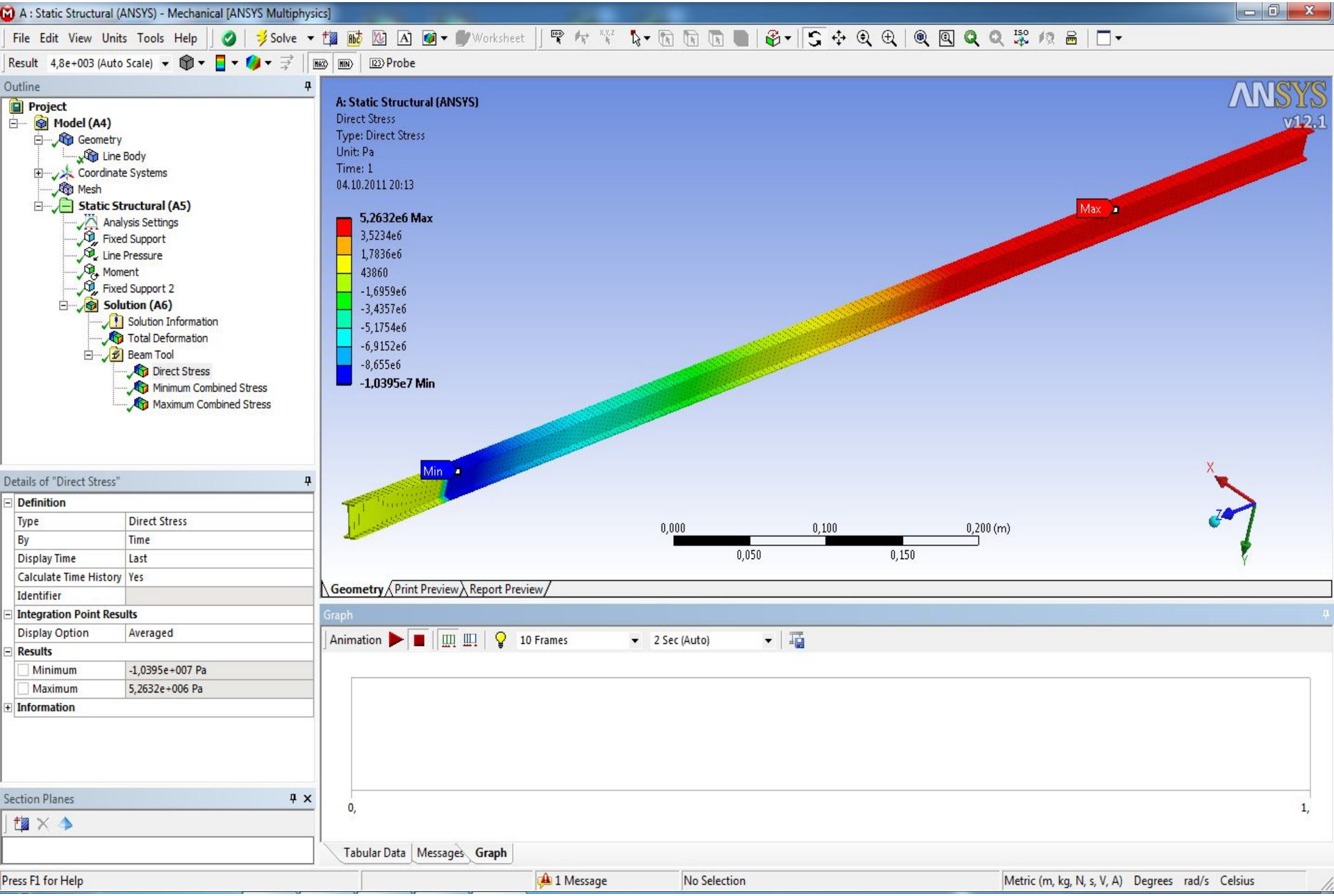
Шаг 4 Построение сети конечных элементов



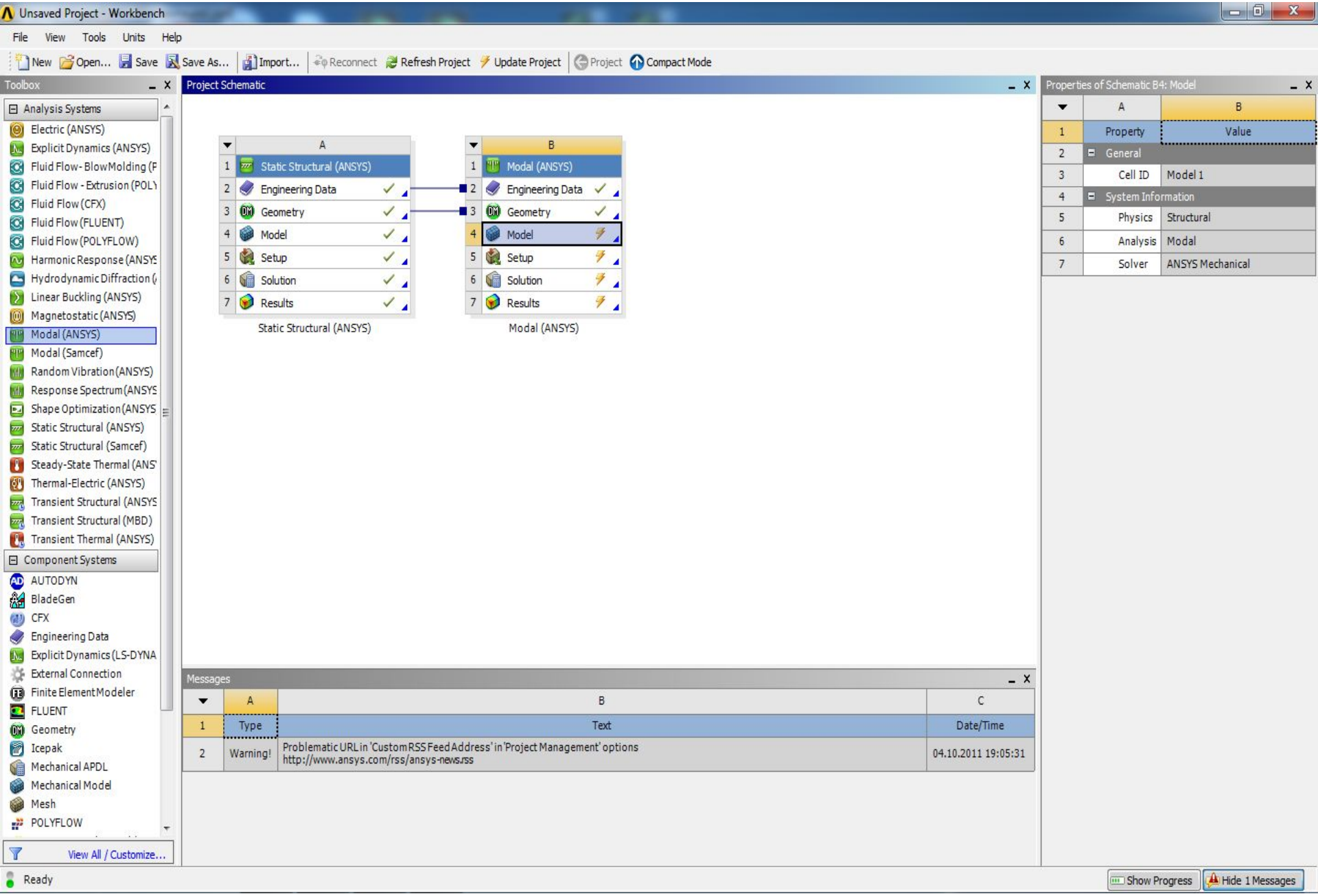
Шаг 5 Задание граничных условий



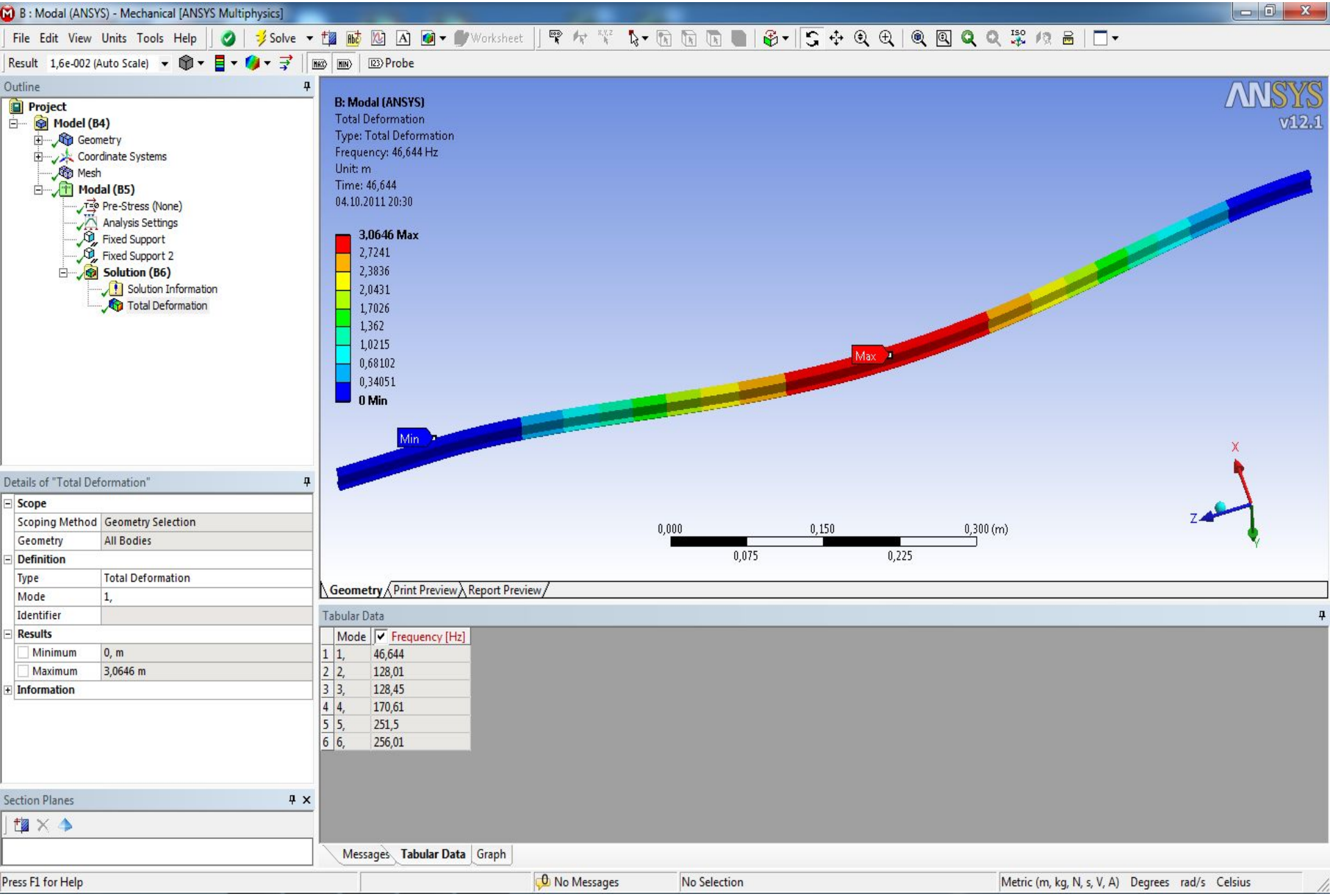
Шаг 6 Задание граничных условий (продолжение)



Шаг 6 Результат решения статической задачи прочности



Шаг 7 Направление данных в модальный анализ



Шаг 8 Результат модального анализа