

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

	A	B	C	D
1	Data Source		Location	Description
2	Engineering Data		A2	Contents filtered for Static Structural (ANSYS).
3	General Materials	<input type="checkbox"/>		General use material samples for use in various analyses.
4	General Non-linear Materials	<input type="checkbox"/>		General use material samples for use in non-linear analyses.
5	Explicit Materials	<input type="checkbox"/>		Material samples for use in an explicit analysis.
6	Hyperelastic Materials	<input type="checkbox"/>		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	<input type="checkbox"/>		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

View All / Customize...

Ready

Show Progress Show 1 Messages

A

- Static Structural (ANSYS)
- Engineering Data ✓
- Geometry ?
- Model ?
- Setup ?
- Solution ?
- Results ?

Static Structural (ANSYS)

Шаг 1

Здание свойств нового материала для пластины

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
 - Density
 - Isotropic Shear Coefficient
 - Orthotropic Shear Coefficient
 - Isotropic Instantaneous Coeff
 - Orthotropic Instantaneous Coef
 - Constant Damping Coefficient
 - Damping Factor (β)
- Linear Elastic
 - Isotropic Elasticity
 - Orthotropic Elasticity
 - Anisotropic Elasticity
- Experimental Stress Strain Data
- Hyperelastic
- Plasticity
- Life
- Strength

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 analysis.
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
4				
*				

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

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

Table of Properties Row 5: Isotropic Elasticity

	A	B	C	D
1	Temperature (C)	Young's Modulus (Pa)	Poisson's Ratio	Bulk Modulus (Pa)
2	20	2,15E+11	0,2798	1,6273E+11
3	100	2,13E+11	0,2831	1,6367E+11
4	200	2,07E+11	0,2938	1,6731E+11
5	300	2E+11	0,2987	1,6559E+11
6	400	1,8E+11	0,2857	1,3999E+11
7	500	1,7E+11	0,3077	1,4734E+11
8	600	1,54E+11	0,3276	1,4888E+11
9	700	1,36E+11	0,3333	1,3597E+11
10	800	1,28E+11	0,3333	1,2797E+11
*				

Chart of Properties Row 5: Isotropic Elasticity

Ready

Show Progress Show 1 Messages

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 analysis.
6	Hyperelastic Materials		Material stress-strain data samples for curve fitting.

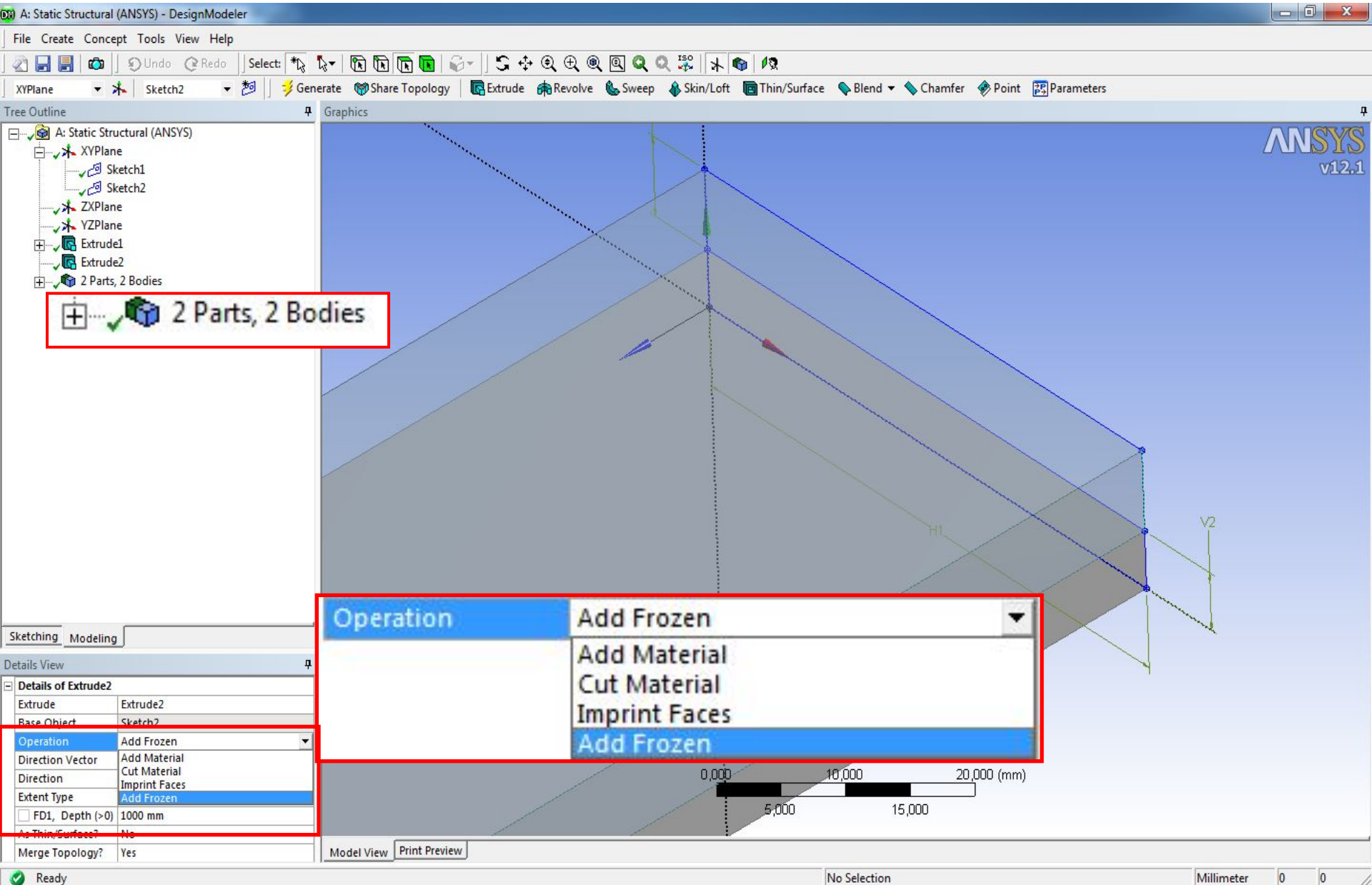
Outline Filter			
A	B	C	D
1	Data Source	Location	Description
2	Engineering Data	A2	Contents filtered for Static Structural (ANSYS).
3	General Materials		General use material samples for use in various analyses.
4	General Non-linear Materials		General use material samples for use in non-linear analyses.
5	Explicit Materials		Material samples for use in an explicit analysis.
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		Fatigue Data at zero mean stress comes from 1998 ASME BPV Code, Section 8, Div 2, Table 5-110.1
4	Structural Steel		
*	Click here to add a new material		

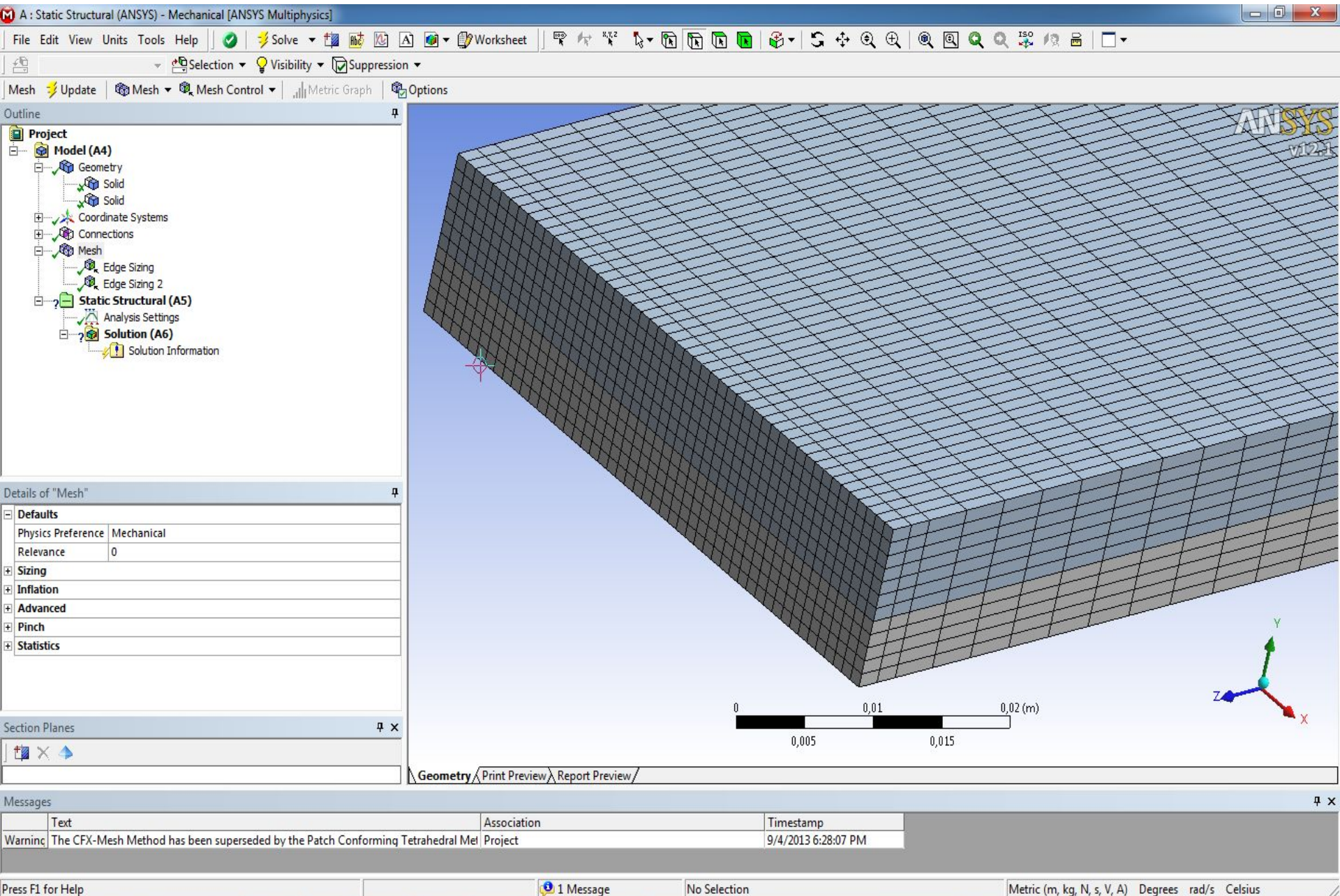
Outline of General Materials				
A	B	C	D	E
1	Contents of General Materials	Add	S..	Description
2	Material			
3	Air			General properties for air.
4	Aluminum Alloy			General aluminum alloy. Fatigue properties come from MIL-HDBK-5H, page 3-277.
5	Concrete			
6	Copper Alloy			
7	Gray Cast Iron			
8	Magnesium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

Properties of Outline Row 3: 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

Properties of Outline Row 3: Air		
A	B	C
1	Property	Unit



Шаг 4 Моделирование геометрии двух биметаллических пластин



Шаг 5 Создание неравномерной расчетной сетки двух биметаллических пластин

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

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

Supports

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

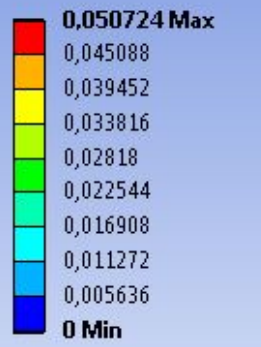
Details of "Imported Body Temperature"

Scope	
Scoping Method	Geometry Selection
Geometry	2 Bodies

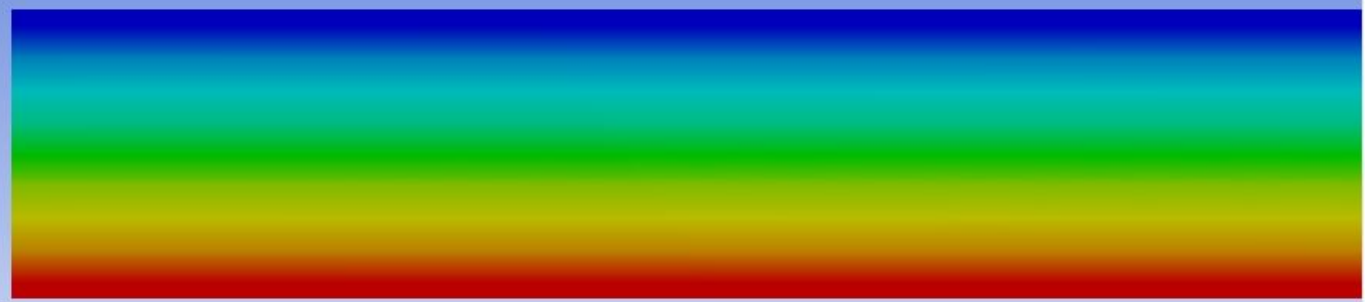
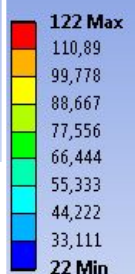
Context Menu:

- Insert
- Suppress
- Import Load
- Clean
- Delete
- Rename

C: Static Structural (ANSYS)
 Total Deformation
 Type: Total Deformation
 Unit: m
 Time: 1
 28.09.2015 9:33



B: Steady-State Thermal (ANSYS)
 Temperature
 Type: Temperature
 Unit: °C
 Time: 1
 28.09.2015 9:34



Применение программного комплекса ANSYS Workbench для расчета задач стержневых систем

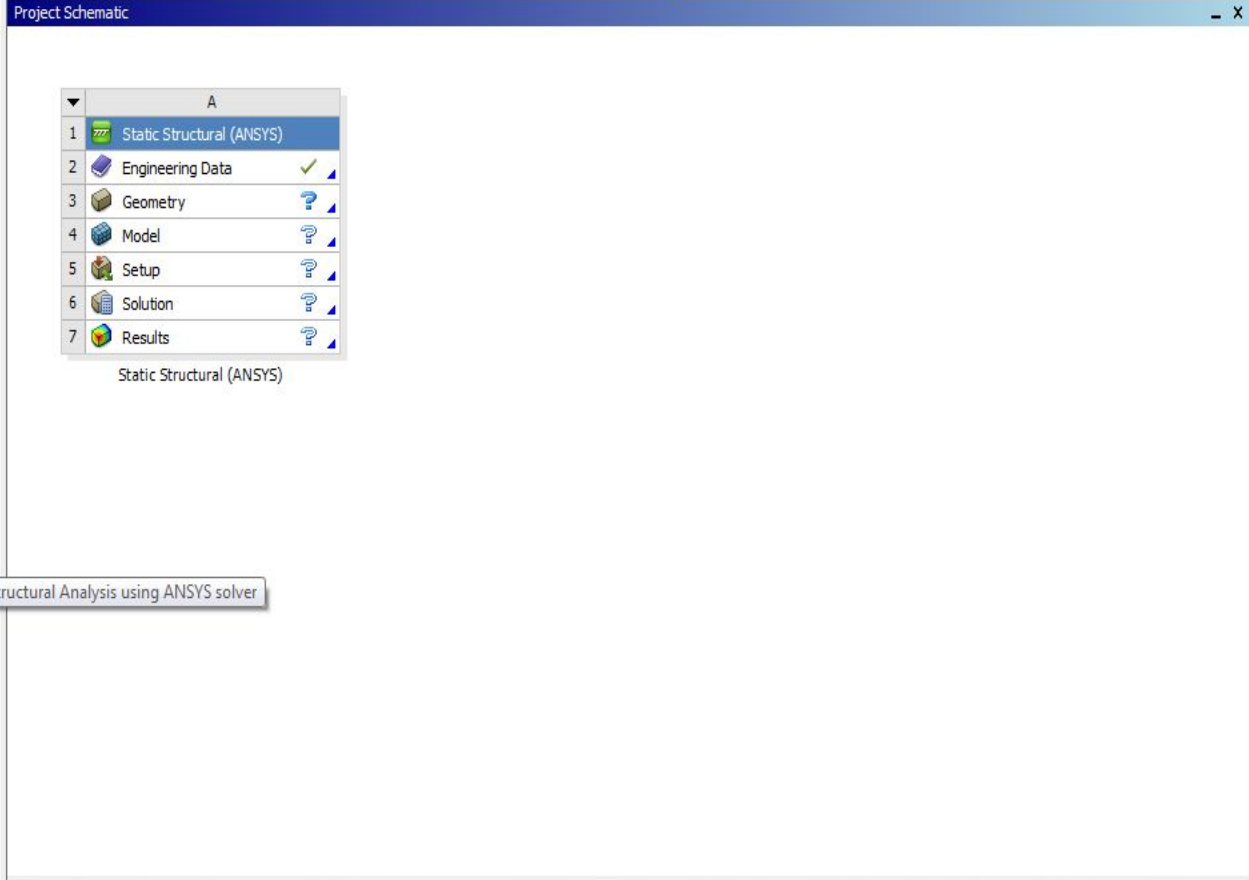
Порядок выполнения работы:

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)

- Analysis Systems
 - Electric (ANSYS)
 - Explicit Dynamics (ANSYS)
 - Fluid Flow - BlowMolding (F)
 - Fluid Flow - Extrusion (POL)
 - Fluid Flow (CFX)
 - Fluid Flow (FLUENT)
 - Fluid Flow (POLYFLOW)
 - Harmonic Response (ANSYS)
 - Hydrodynamic Diffraction (H)
 - 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 (ANSYS)
 - Thermal-Electric (ANSYS)
 - Transient Structural (ANSYS)
 - Transient Structural (MBD)
 - Transient Thermal (ANSYS)
- 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



Static Structural Analysis using ANSYS solver

	A	B
1	Property	Value

	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

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

Outline Filter

	A	B	C	D
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2	Engineering Data		A2	Contents filtered for Static Structural (ANSYS).
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4	General Non-linear Materials	<input type="checkbox"/>		General use material samples for use in non-linear analyses.
5	Explicit Materials	<input type="checkbox"/>		Material samples for use in an explicit analysis.
6	Hyperelastic Materials	<input type="checkbox"/>		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	<input type="checkbox"/>		
4	Structural Steel	<input type="checkbox"/>		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	

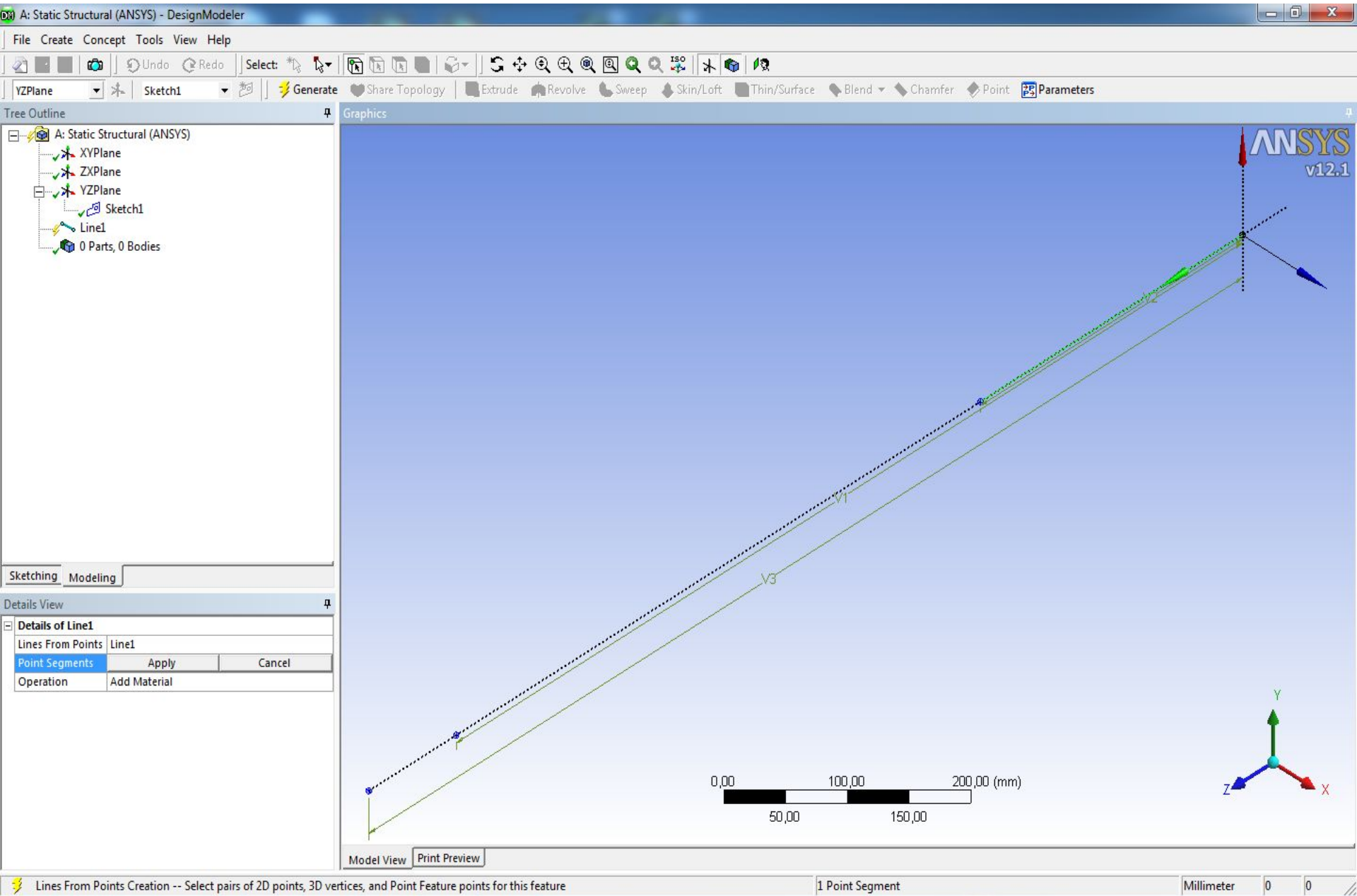
Table of Properties Row 2: Density

	A	B
1	Temperature (C)	Density (kg m^-3)
2		Ascending
		Descending
		Sort Settings...
		Cancel sorting
		K
		<input checked="" type="checkbox"/> C
		R
		F

Chart of Properties Row 2: Density

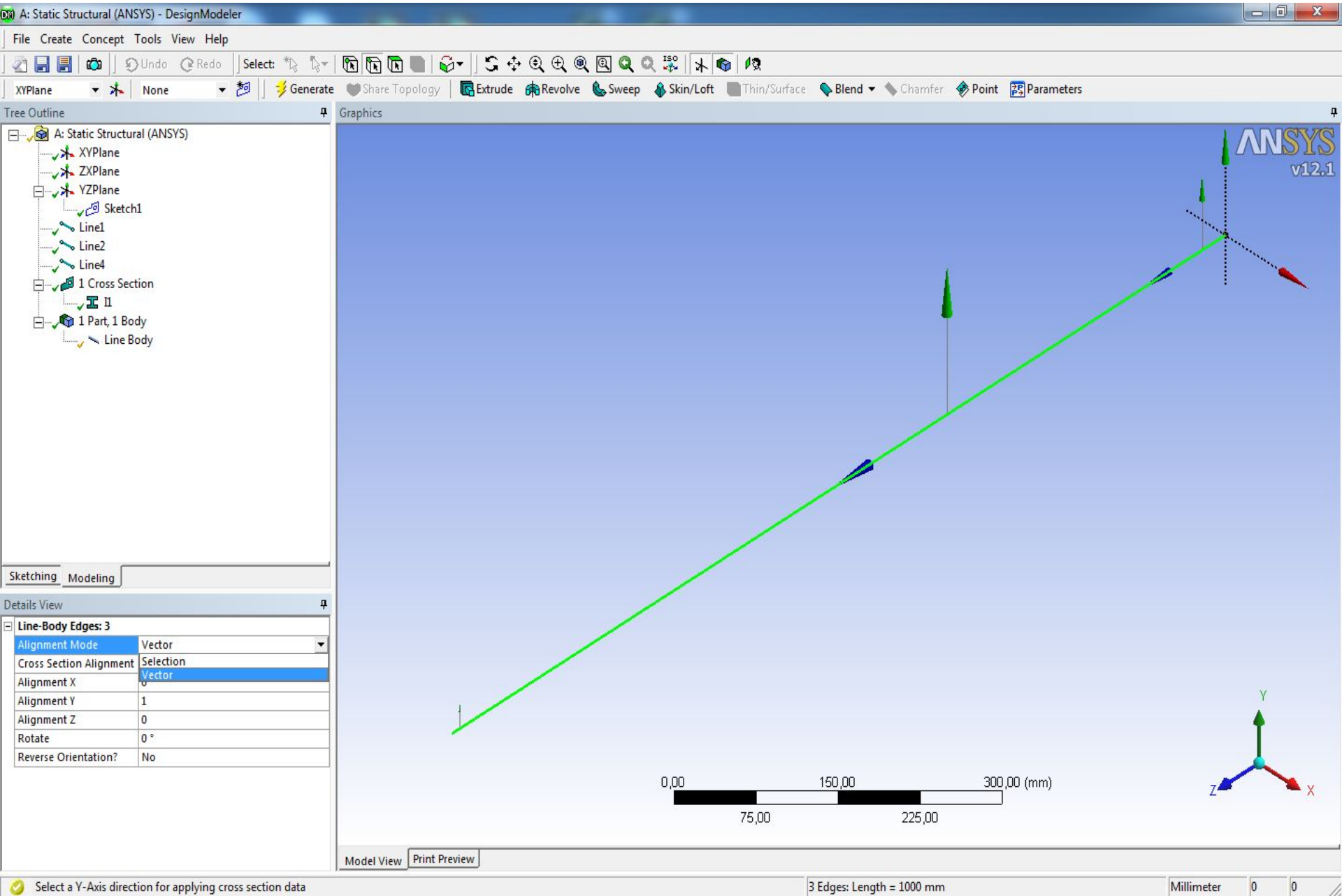
Ready

Show Progress Show 1 Messages



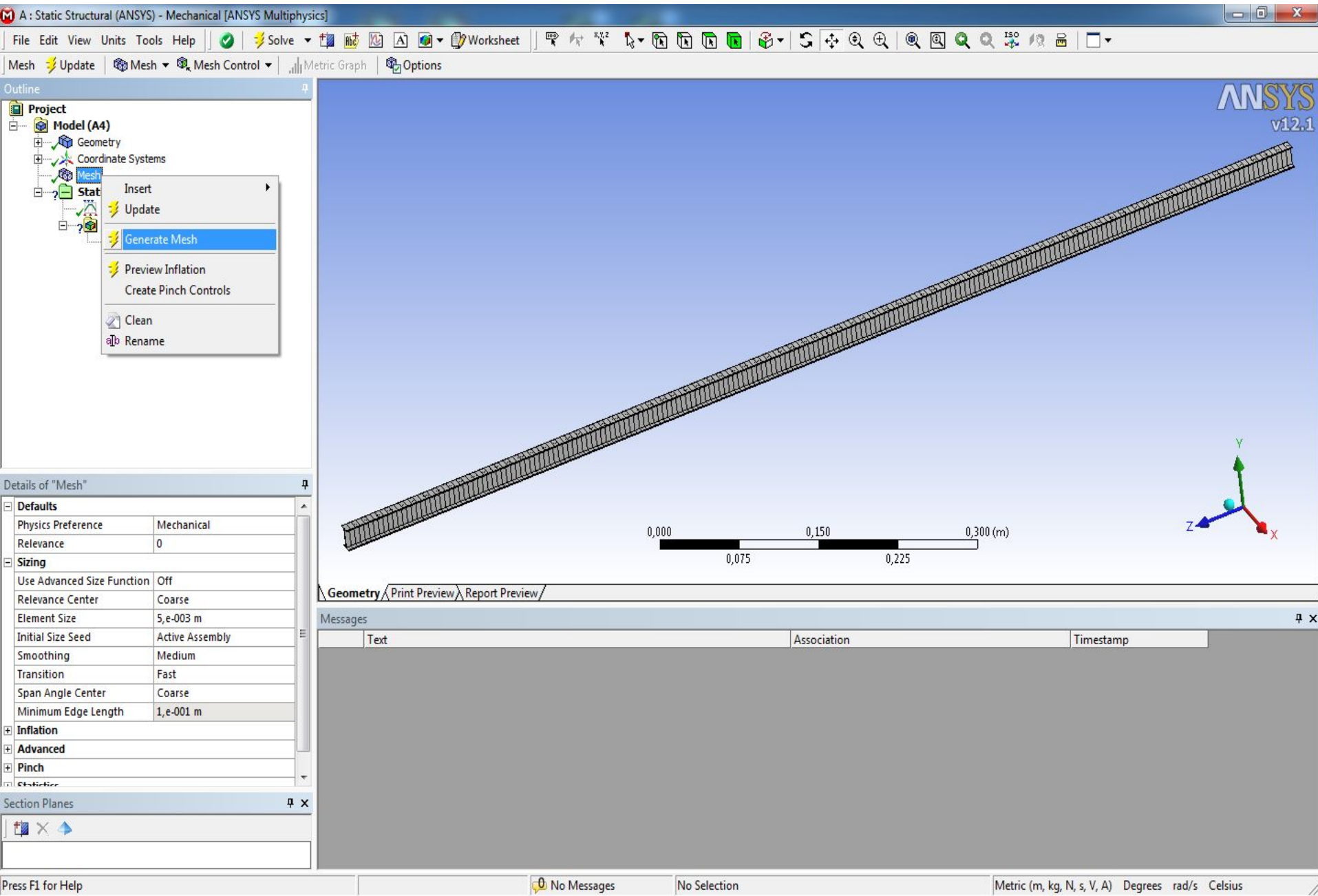
Шаг 2

Создание конструкционных точек и направляющих линий



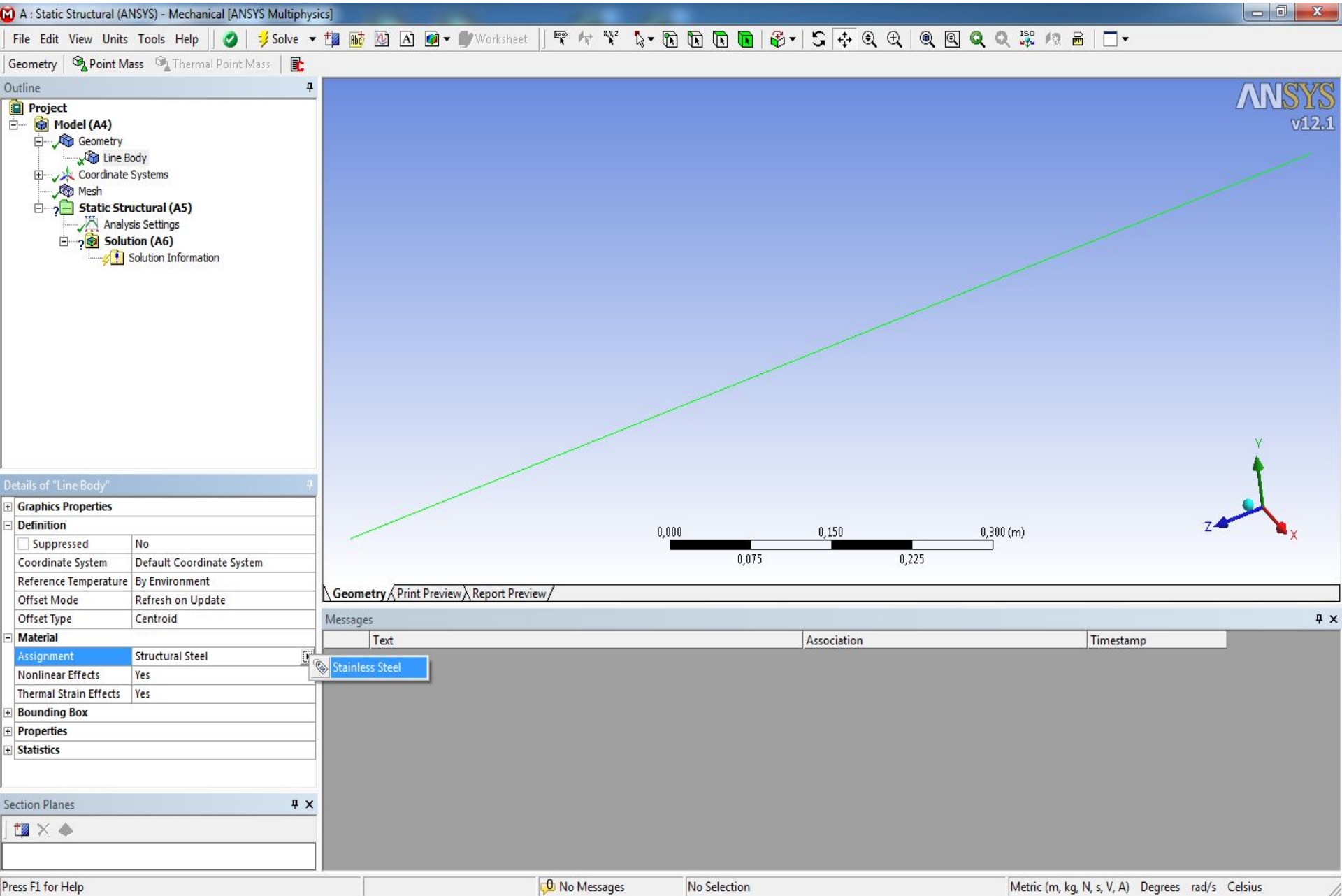
Шаг 3

Здание поперечного сечения балки



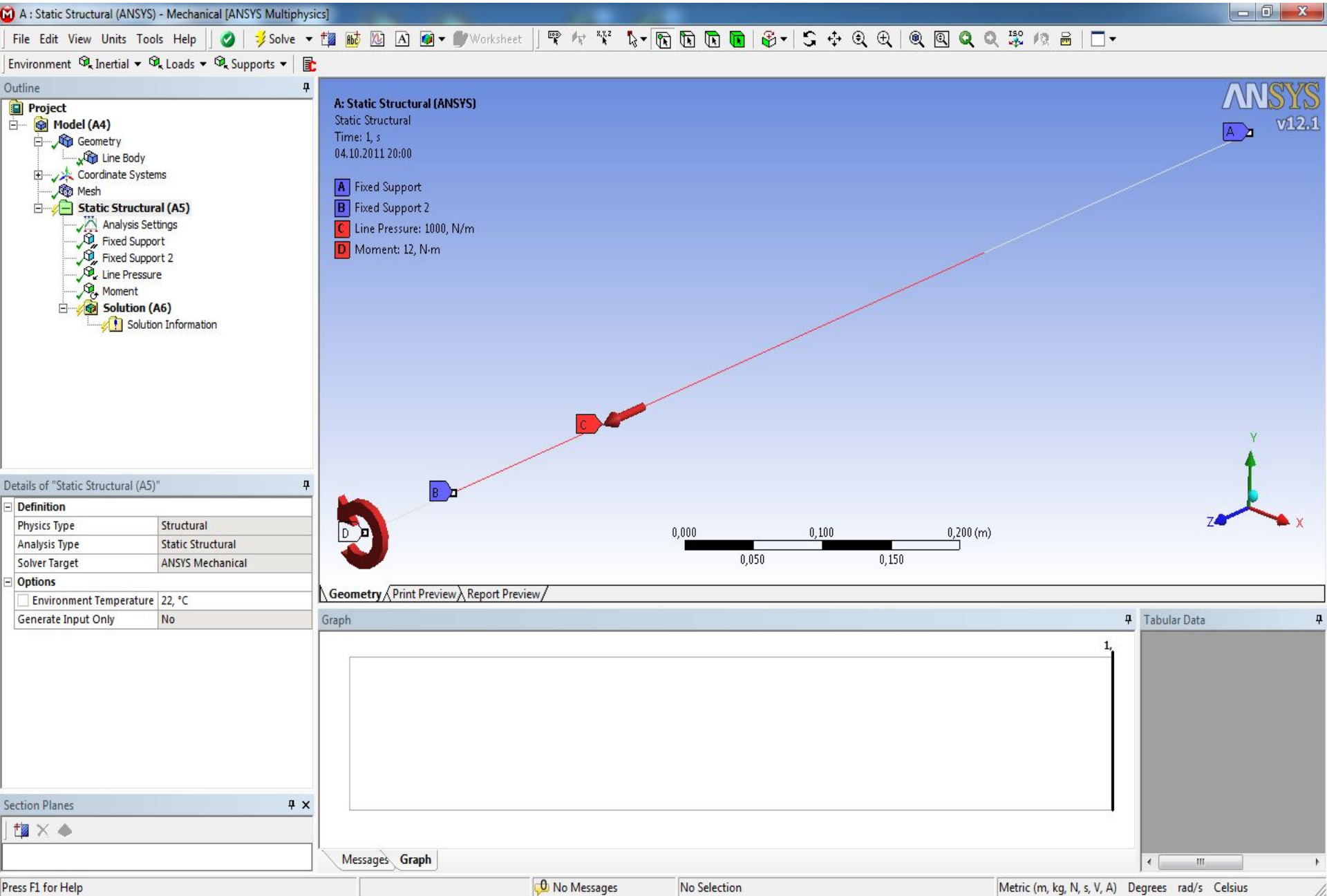
Шаг 4

Построение сети конечных элементов



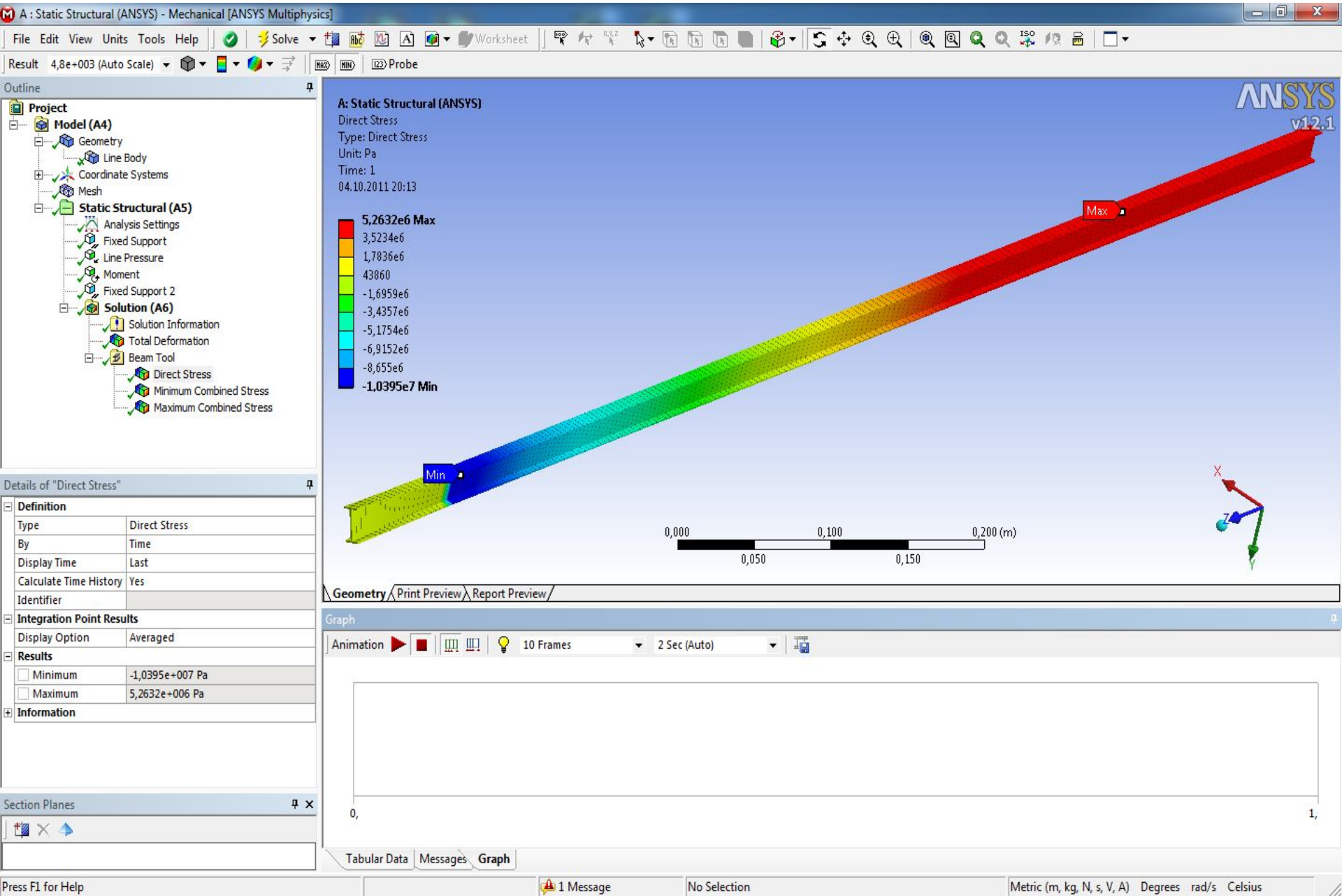
Шаг 5

Задание граничных условий



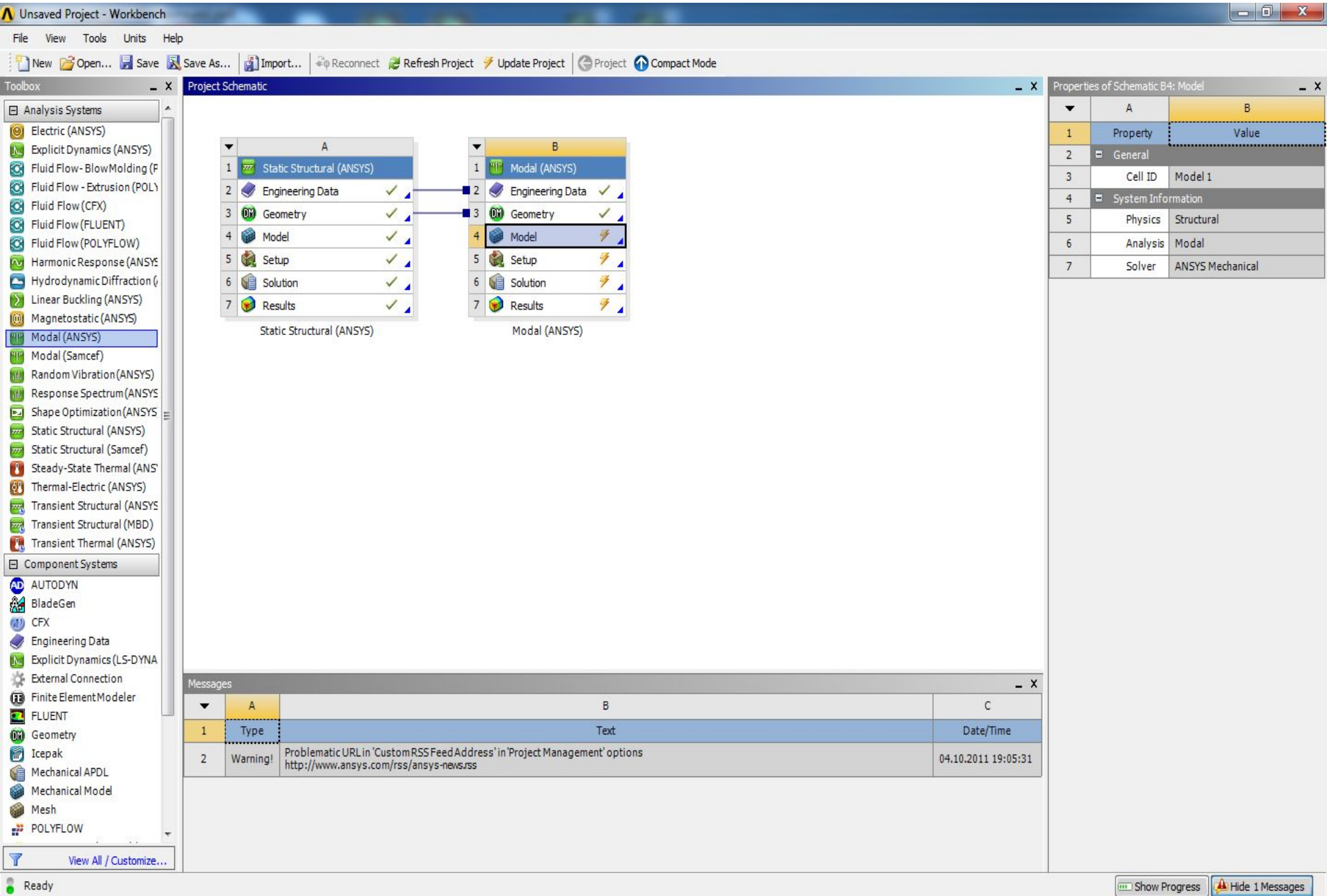
Шаг 6

Задание граничных условий (продолжение)



Шаг 6

Результат решения статической задачи прочности



Properties of Schematic B4: Model

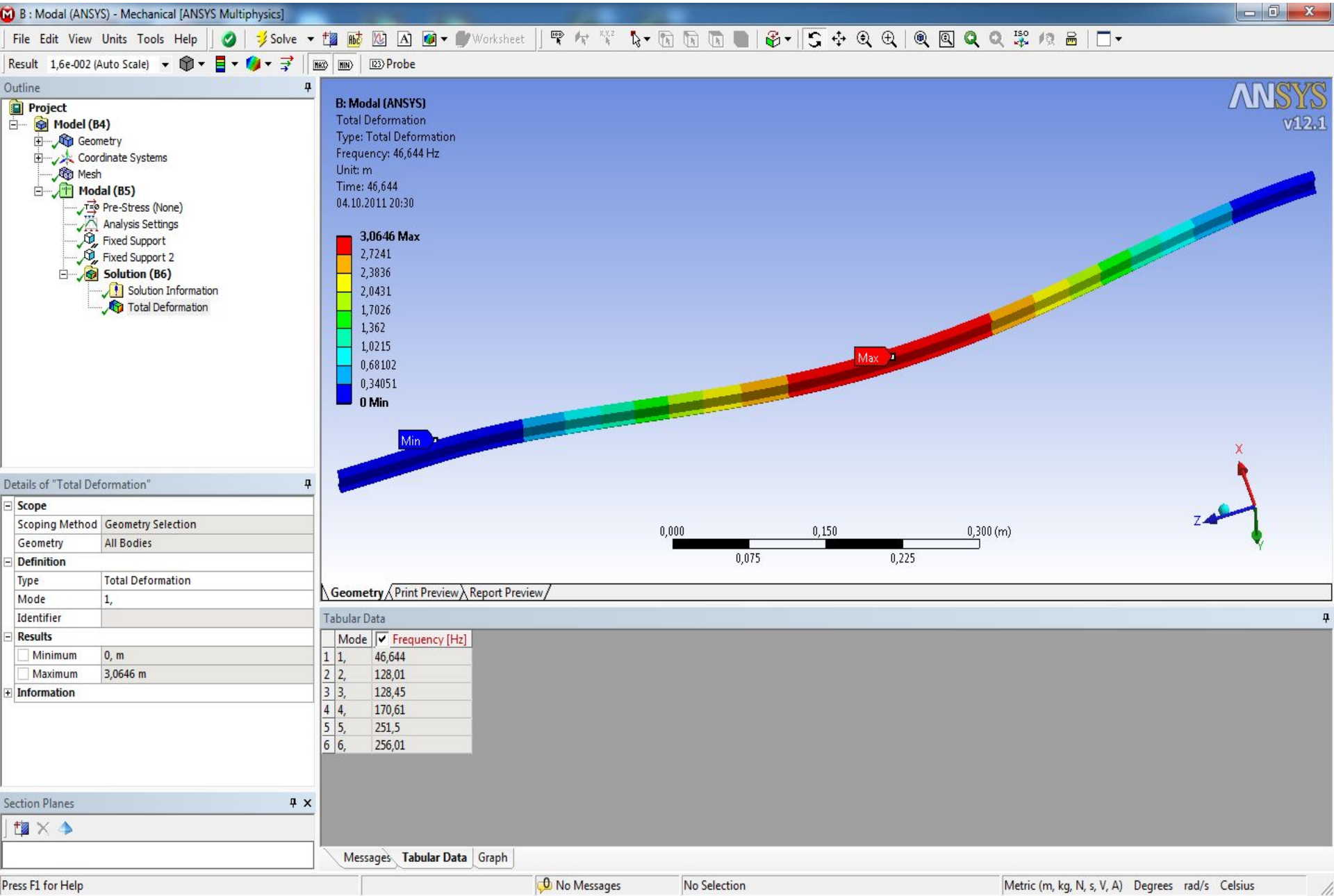
	A	B
1	Property	Value
2	General	
3	Cell ID	Model 1
4	System Information	
5	Physics	Structural
6	Analysis	Modal
7	Solver	ANSYS Mechanical

Messages

	A	B	C
1	Type	Text	
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

Шаг 7

Направление данных в модальный анализ



Шаг 8

Результат модального анализа