

*Расчет опорной конструкции  
котельного агрегата*

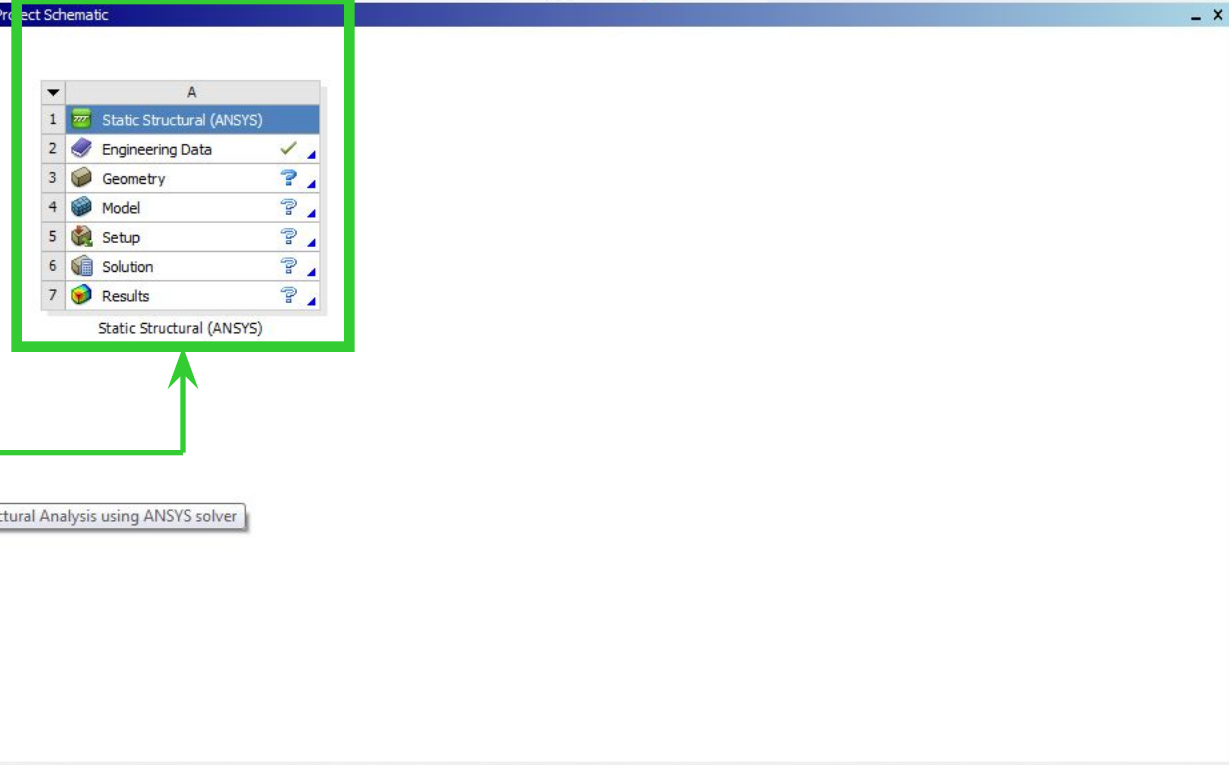
# Порядок выполнения работы:

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 (
  - 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

Messages			
	A	B	C
1	Type	Text	Date/Time
2	Warning!	Problematic URL in 'Custom RSS FeedAddress' in 'Project Management' options <a href="http://www.ansys.com/rss/ansys-news.rss">http://www.ansys.com/rss/ansys-news.rss</a>	04.10.2011 19:05:31

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

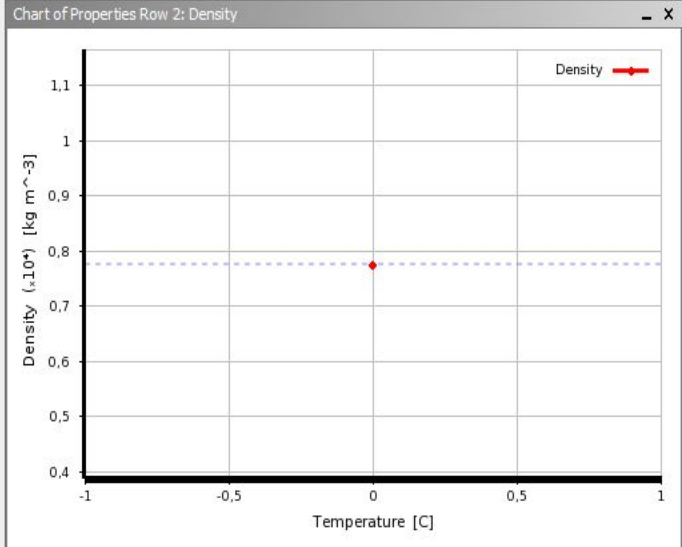
	A	B	C	D
1	Data Source	Location		Description
2	Engineering Data	A2		Contents filtered for Static Structural (ANSYS).
3	General Materials			General use material samples for use in various analyses.
4	General Non-linear Materials			General use material samples for use in non-linear analyses.
5	Explicit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

	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			

	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	

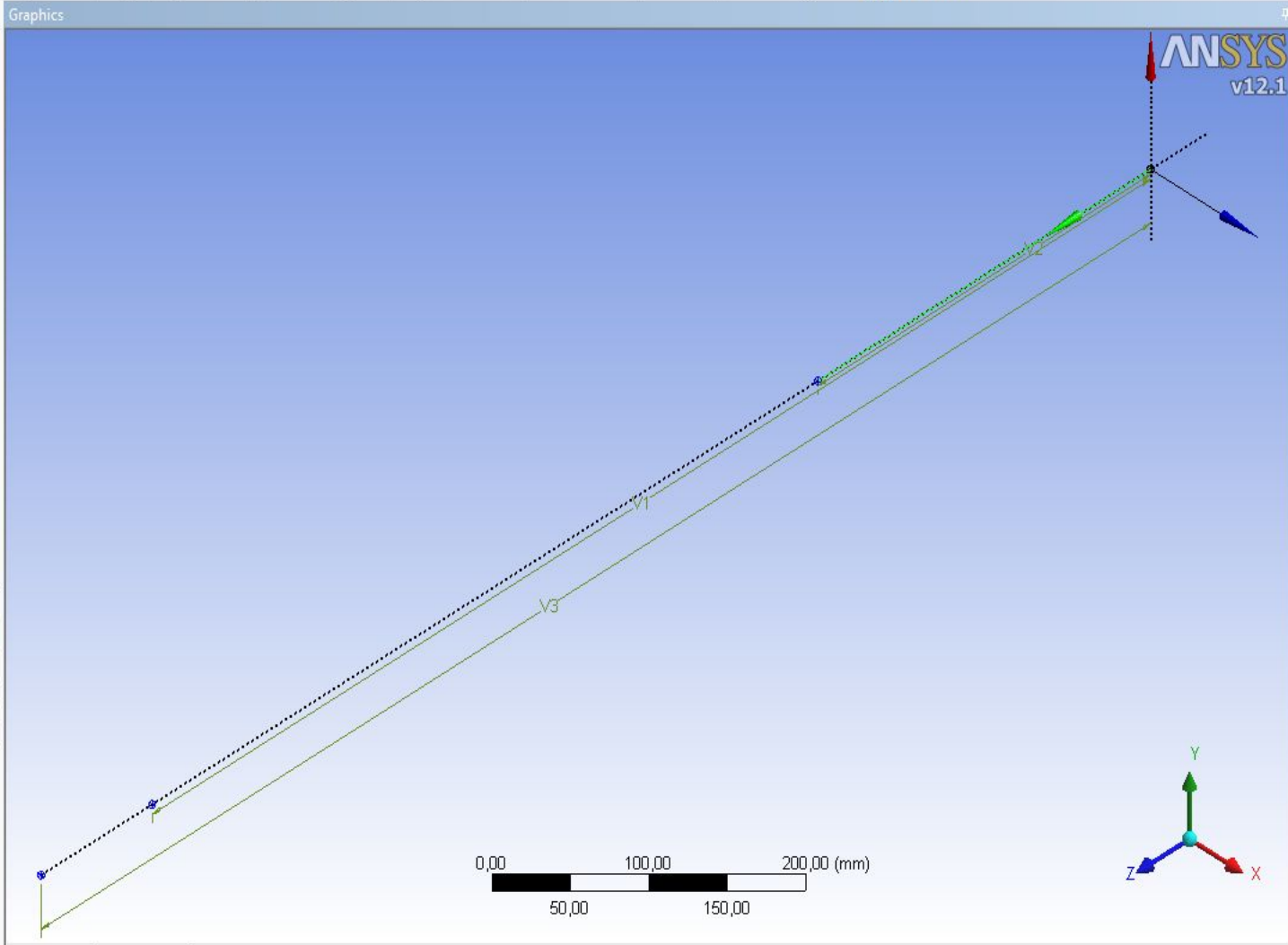
	A	B
1	Temperature (C)	Density (kg m^-3)
2		
*		

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



Tree Outline

- A: Static Structural (ANSYS)
  - XYPlane
  - ZXPlane
  - YZPlane
  - Sketch1
  - Line1
  - 0 Parts, 0 Bodies



Sketching Modeling

Details View

Details of Line1	
Lines From Points	Line1
Point Segments	Apply Cancel
Operation	Add Material

Model View Print Preview

Tree Outline

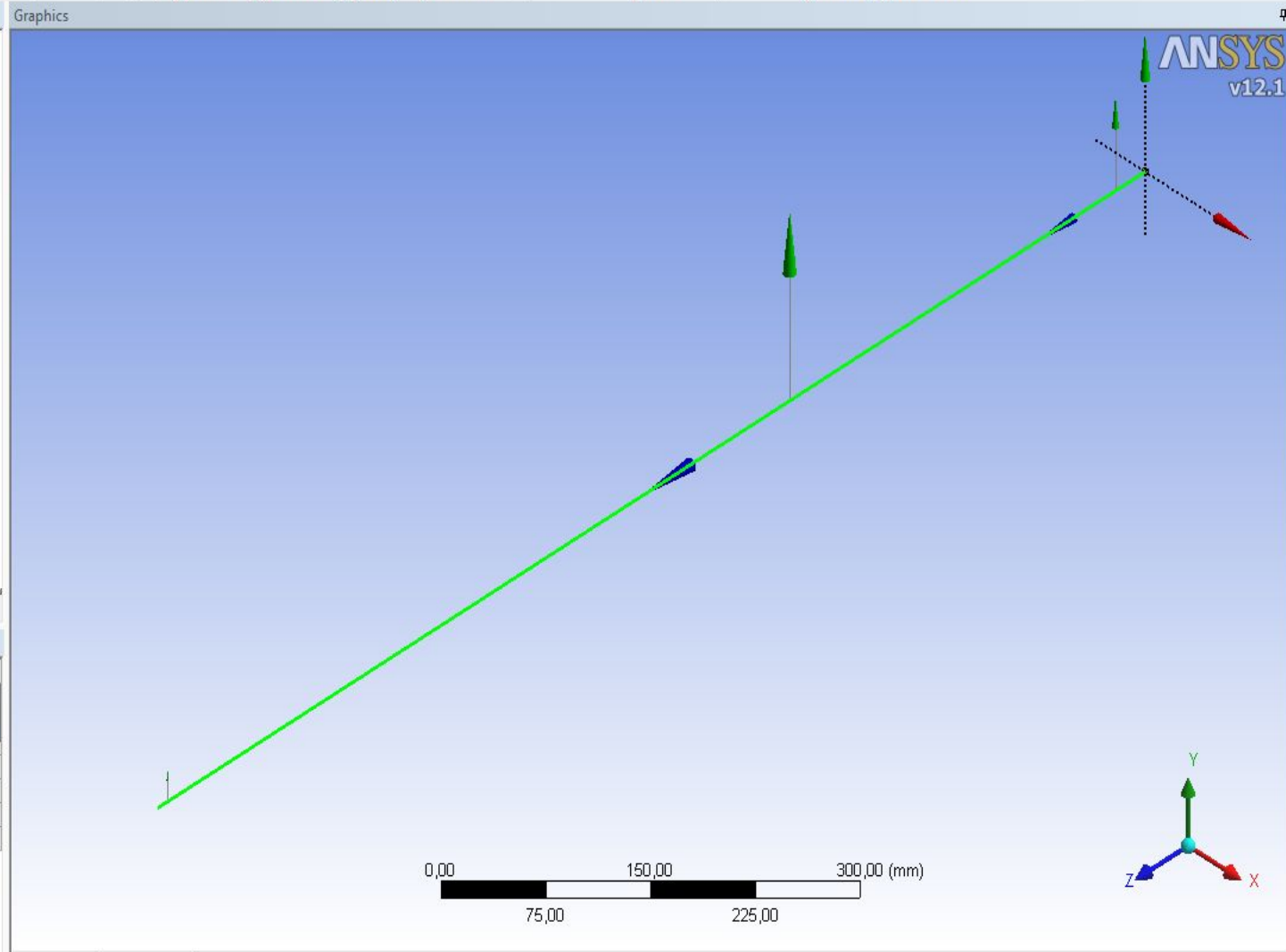
- A: Static Structural (ANSYS)
  - XYPlane
  - ZXPlane
  - YZPlane
  - Sketch1
    - Line1
    - Line2
    - Line4
  - 1 Cross Section
    - II
  - 1 Part, 1 Body
    - Line Body

Sketching Modeling

Details View

Line-Body Edges: 3

Alignment Mode	Vector
Cross Section Alignment	Selection
Alignment X	Vector
Alignment Y	1
Alignment Z	0
Rotate	0°
Reverse Orientation?	No



Model View Print Preview

Select a Y-Axis direction for applying cross section data

3 Edges: Length = 1000 mm

Millimeter 0 0

Outline

**Project**

- Model (A4)
  - Geometry
  - Coordinate Systems
  - Mesh
  - Stat
    - Insert
    - Update
    - Generate Mesh**
    - Preview Inflation
    - Create Pinch Controls
    - Clean
    - Rename

Details of "Mesh"

**Defaults**

Physics Preference	Mechanical
Relevance	0

**Sizing**

Use Advanced Size Function	Off
Relevance Center	Coarse
Element Size	5,e-003 m
Initial Size Seed	Active Assembly
Smoothing	Medium
Transition	Fast
Span Angle Center	Coarse
Minimum Edge Length	1,e-001 m

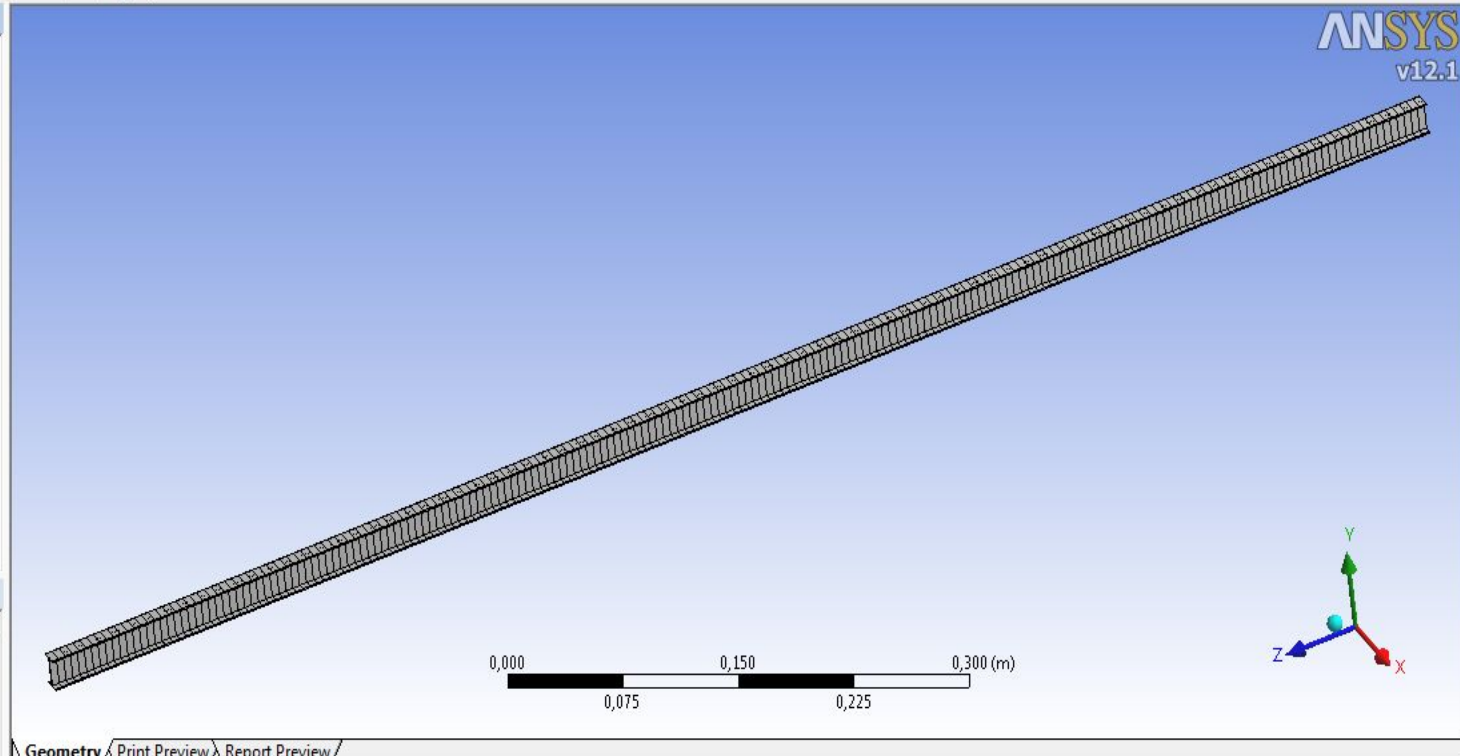
**Inflation**

**Advanced**

**Pinch**

Section Planes

Section Planes toolbar with icons for creating and deleting planes.



Geometry | Print Preview | Report Preview

Messages

Text	Association	Timestamp

- Project
  - Model (A4)
    - Geometry
      - Line Body
      - Coordinate Systems
      - Mesh
    - Static Structural (A5)
      - Analysis Settings
      - Solution (A6)
        - Solution Information

**Graphics Properties**

**Definition**

Suppressed	No
Coordinate System	Default Coordinate System
Reference Temperature	By Environment
Offset Mode	Refresh on Update
Offset Type	Centroid

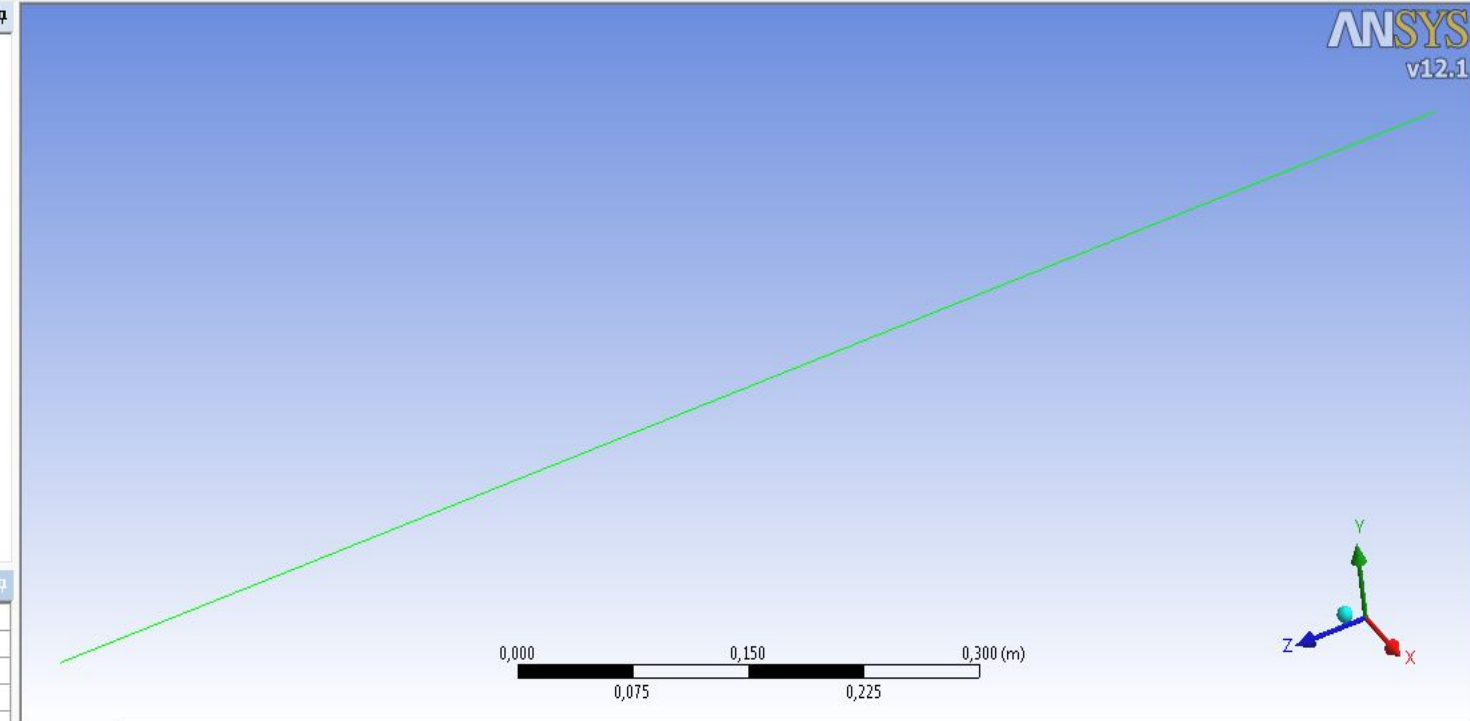
**Material**

Assignment	Structural Steel
Nonlinear Effects	Yes
Thermal Strain Effects	Yes

**Bounding Box**

**Properties**

**Statistics**



Text	Association	Timestamp
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Stainless Steel

Section Planes toolbar with icons for creating and deleting planes.



**Project**

- Model (A4)
  - Geometry
    - Line Body
    - Coordinate Systems
    - Mesh
  - Static Structural (A5)
    - Analysis Settings
    - Fixed Support
    - Fixed Support 2
    - Line Pressure
    - Moment
  - Solution (A6)
    - Solution Information

**Definition**

Physics Type	Structural
Analysis Type	Static Structural
Solver Target	ANSYS Mechanical

**Options**

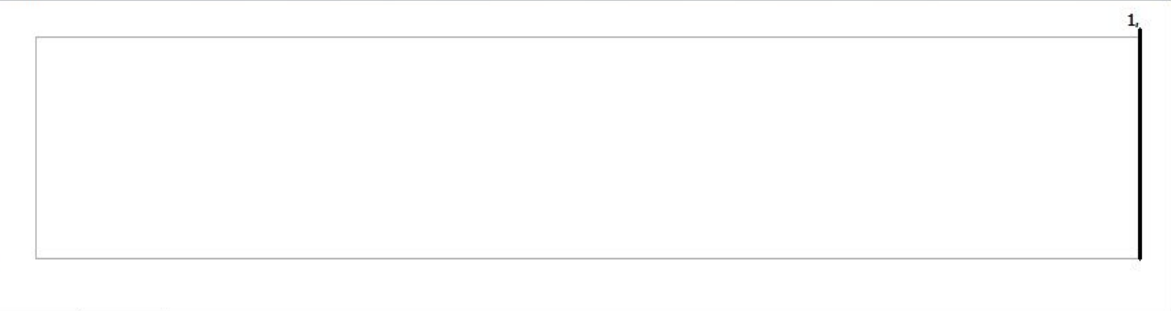
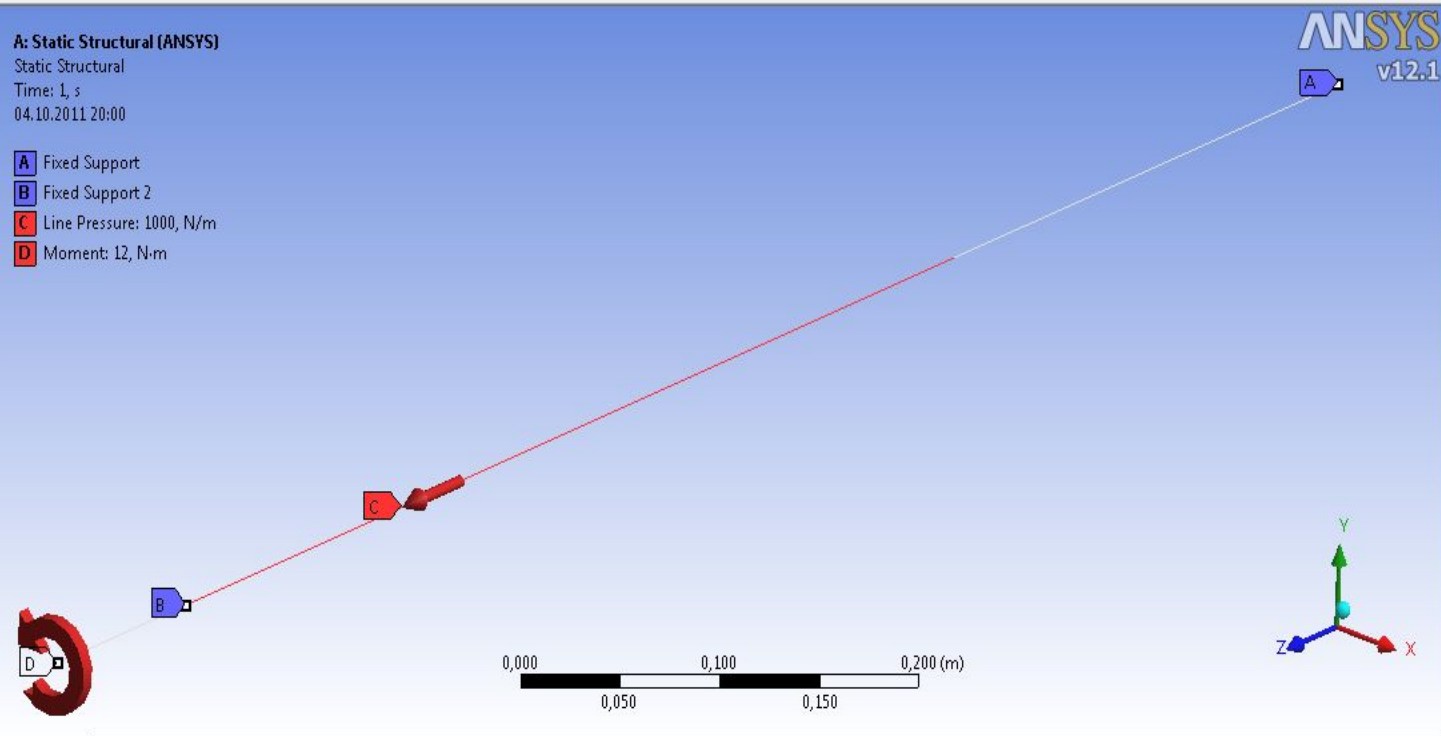
<input type="checkbox"/> Environment Temperature	22, °C
<input type="checkbox"/> Generate Input Only	No

Section Planes toolbar with icons for creating and deleting planes.

**A: Static Structural (ANSYS)**

Static Structural  
Time: 1, s  
04.10.2011 20:00

- A** Fixed Support
- B** Fixed Support 2
- C** Line Pressure: 1000, N/m
- D** Moment: 12, N-m

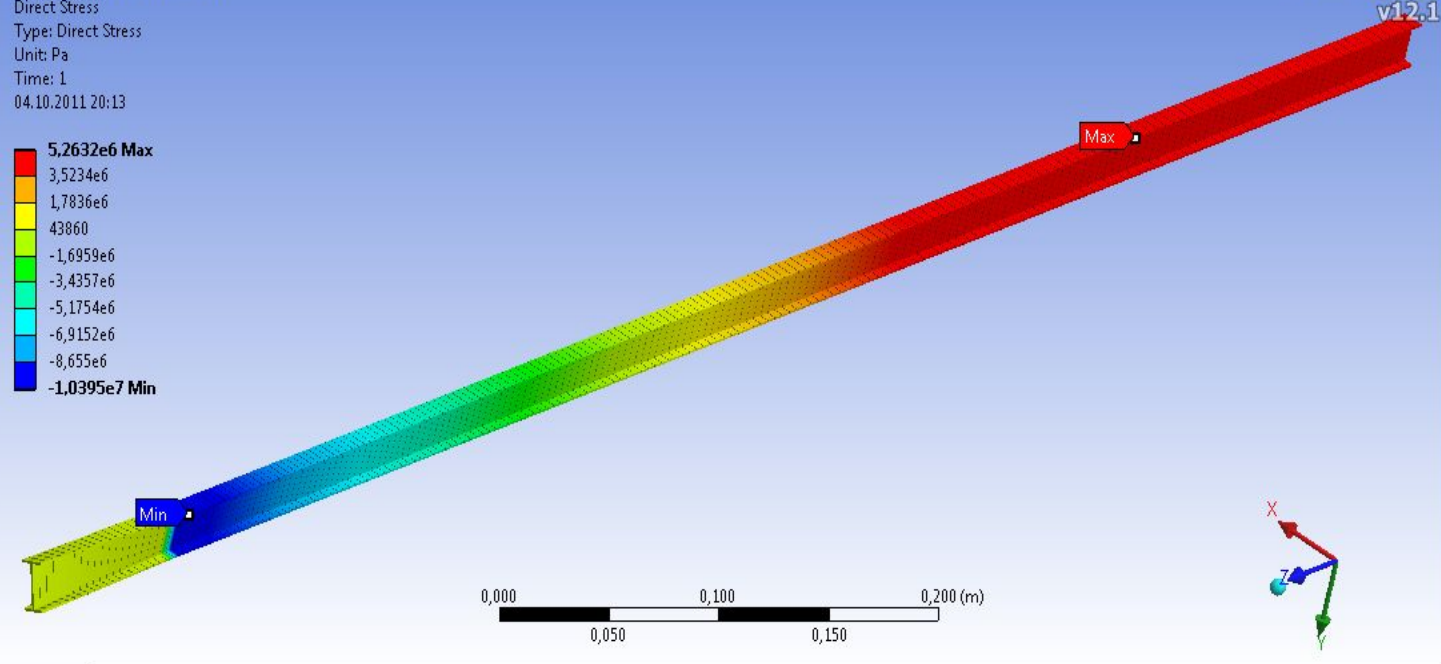
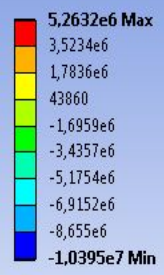


Outline

- Project
  - Model (A4)
    - Geometry
      - Line Body
      - Coordinate Systems
      - Mesh
    - Static Structural (A5)
      - Analysis Settings
      - Fixed Support
      - Line Pressure
      - Moment
      - Fixed Support 2
    - Solution (A6)
      - Solution Information
      - Total Deformation
      - Beam Tool
      - Direct Stress
      - Minimum Combined Stress
      - Maximum Combined Stress

A: Static Structural (ANSYS)

Direct Stress  
Type: Direct Stress  
Unit: Pa  
Time: 1  
04.10.2011 20:13



Details of "Direct Stress"

Definition	
Type	Direct Stress
By	Time
Display Time	Last
Calculate Time History	Yes
Identifier	

Integration Point Results	
Display Option	Averaged

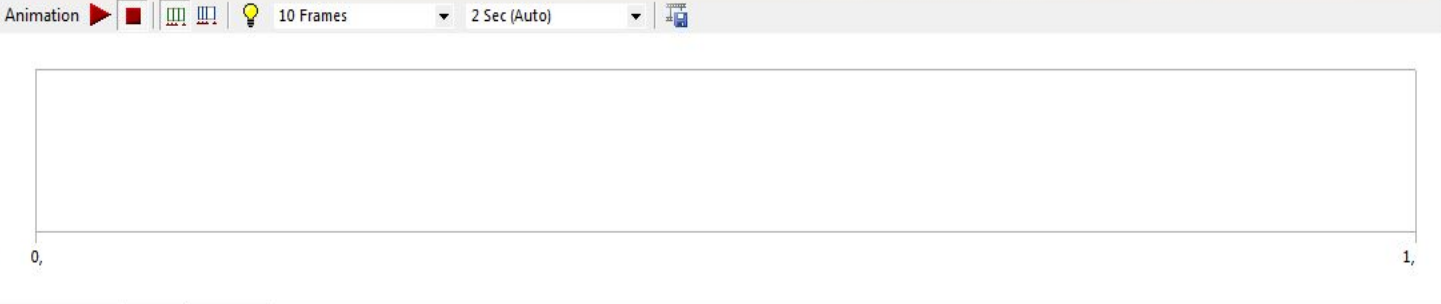
Results	
<input type="checkbox"/> Minimum	-1,0395e+007 Pa
<input type="checkbox"/> Maximum	5,2632e+006 Pa

Information	
-------------	--

Geometry / Print Preview / Report Preview

Graph

Animation 10 Frames 2 Sec (Auto)

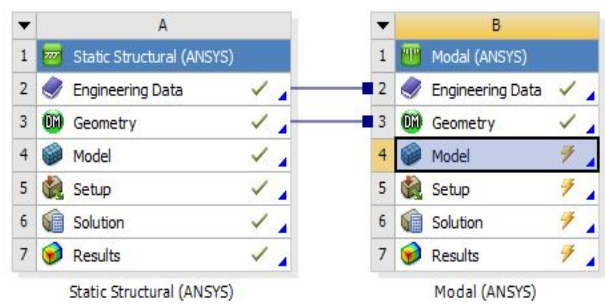


Tabular Data Messages Graph

Toolbox

- Analysis Systems
    - Electric (ANSYS)
    - Explicit Dynamics (ANSYS)
    - Fluid Flow - BlowMolding (F)
    - Fluid Flow - Extrusion (POL)
    - Fluid Flow (CFX)
    - Fluid Flow (FLUENT)
    - Fluid Flow (POLYFLOW)
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    - Explicit Dynamics (LS-DYNA)
    - External Connection
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    - FLUENT
    - Geometry
    - Icepak
    - Mechanical APDL
    - Mechanical Model
    - Mesh
    - POLYFLOW
- View All / Customize...

Project Schematic



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

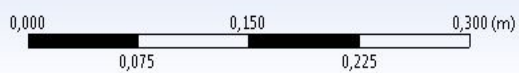
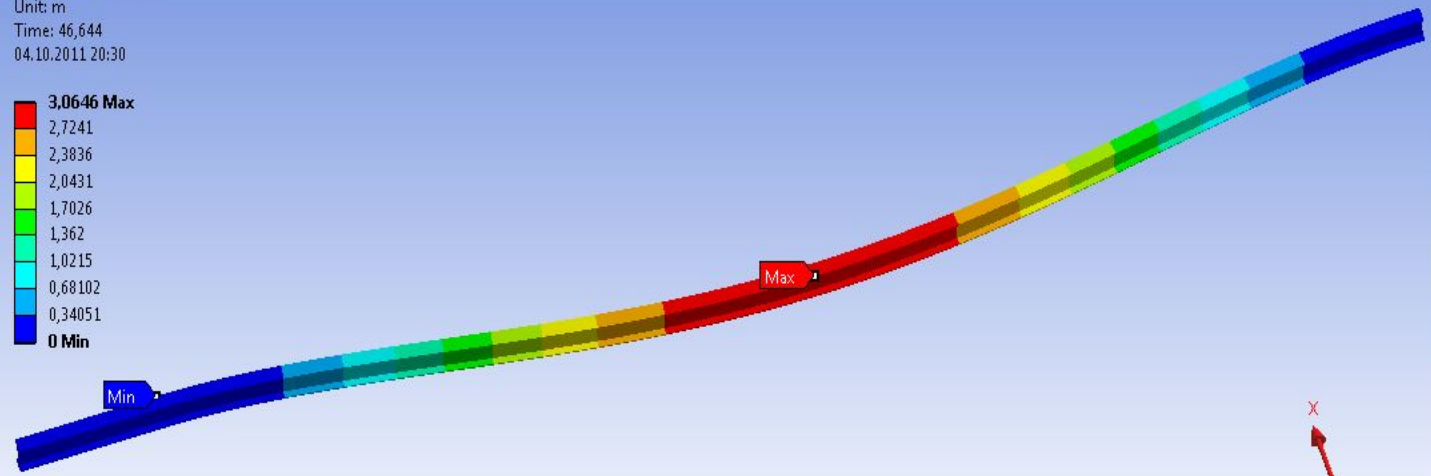
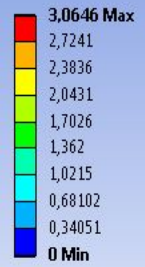
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Outline

- Project
  - Model (B4)
    - Geometry
    - Coordinate Systems
    - Mesh
  - Modal (B5)
    - Pre-Stress (None)
    - Analysis Settings
    - Fixed Support
    - Fixed Support 2
  - Solution (B6)
    - Solution Information
    - Total Deformation

**B: Modal (ANSYS)**  
 Total Deformation  
 Type: Total Deformation  
 Frequency: 46,644 Hz  
 Unit: m  
 Time: 46,644  
 04.10.2011 20:30



Details of "Total Deformation"

Scope

Scoping Method	Geometry Selection
Geometry	All Bodies

Definition

Type	Total Deformation
Mode	1,
Identifier	

Results

<input type="checkbox"/> Minimum	0, m
<input type="checkbox"/> Maximum	3,0646 m

Information

Geometry Print Preview Report Preview

Tabular Data

Mode	Frequency [Hz]
1 1,	46,644
2 2,	128,01
3 3,	128,45
4 4,	170,61
5 5,	251,5
6 6,	256,01

Section Planes

Section Planes toolbar with icons for creating and deleting planes.

Messages Tabular Data Graph