



Mechanics and Machines, Lecture 12

Overview of Strength of Materials

Possible course names



In Russian

1. Сопротивление материалов
(Сопромат)
2. Техническая механика

In English

1. Strength of Materials
2. Mechanics of Materials
3. Strengths
4. Solids
5. Mechanics II
6. Deformable Bodies
7. Engineering Materials



Difference between theoretical mechanics and strength of material

Stress and Strain. Normal stress

Video



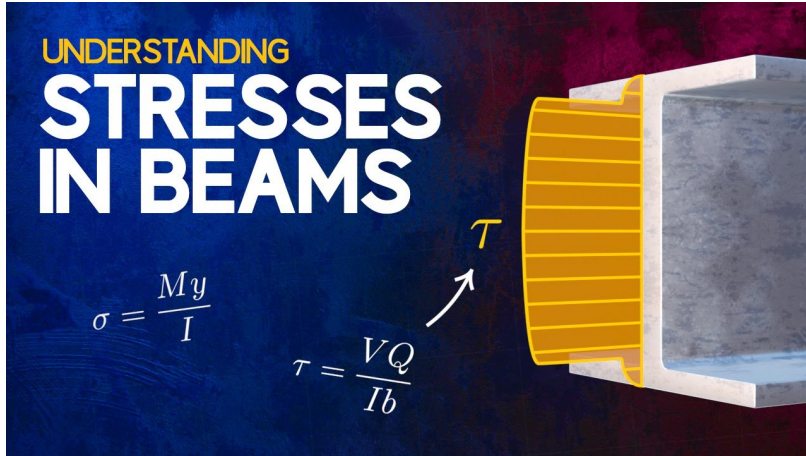
Stress and Strain material



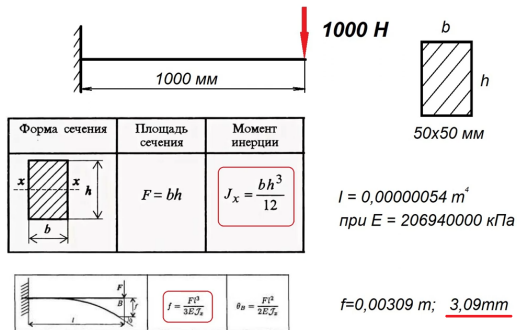
1. Lesson 2 - Normal Stress
2. Normal stress notes
3. Simple stress and strain
4. Strength of Materials I: Normal and Shear Stresses (2 of 20)
5. Основы сопромата. Напряжения

Bending moment

Video

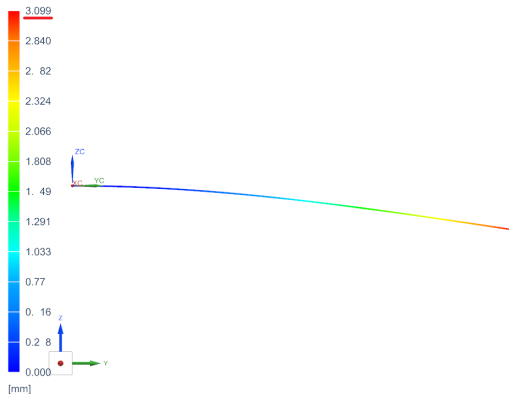


Bending moment. Case study



Analytical solution

bending_ex_sim1 : Solution 1 Result
Subcase - Statics 1, Static Step 1
Yisplacement - Nodal, Magnitude
Min : 0.000, Max : 3.099, Units = mm
Yeformation : Yisplacement - Nodal Magnitude



Numerical solution in NX

Bending moment



1. Bending stress
2. Sign Convention For Shear Force and Bending Moment
3. Beam bending, Shear Moment

Shear force

Video



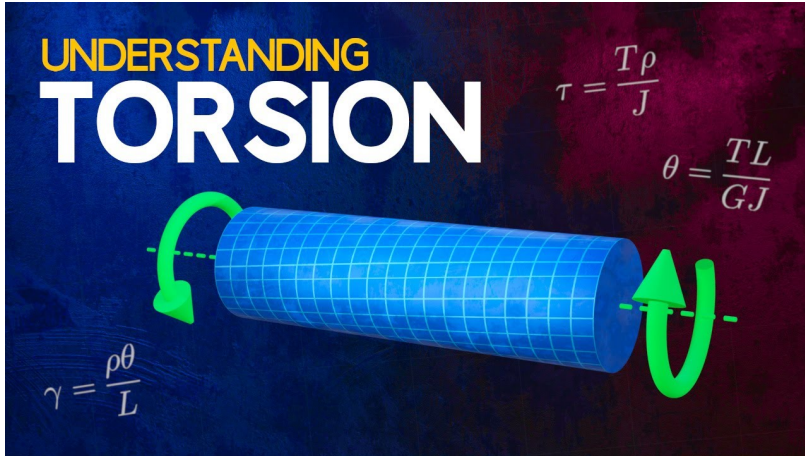
Shear force material



1. Intro to shear
2. Important concept of shear stress

Torsion

Video



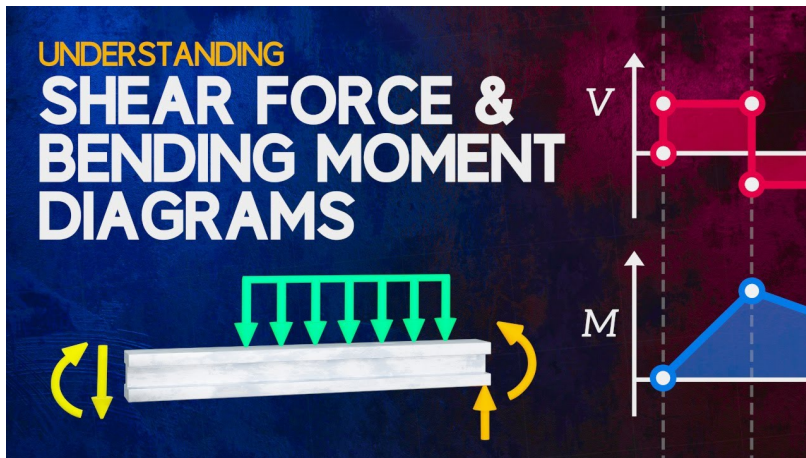
Torsion material



1. Torsion in circular shaft (10 of 20)
2. Shear stress due to torsion
3. Torsion

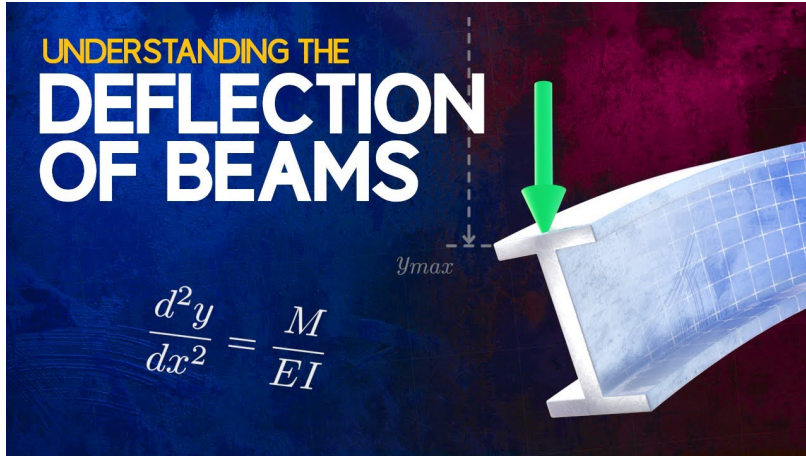
Diargams (Эпюры), Part 1

Video

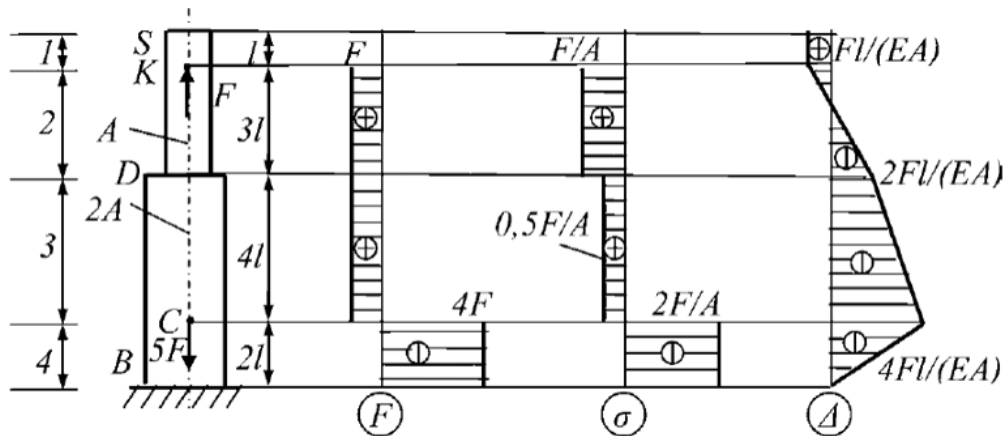


Diagrams, Part 2

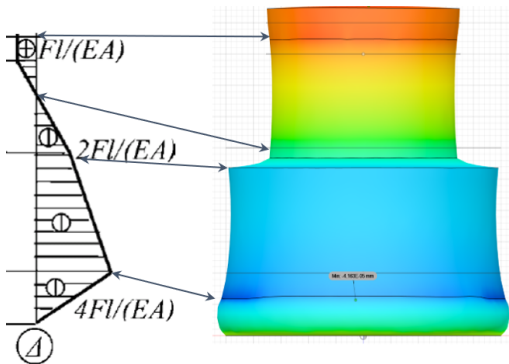
Video



Diagrams. Case study. Part 1

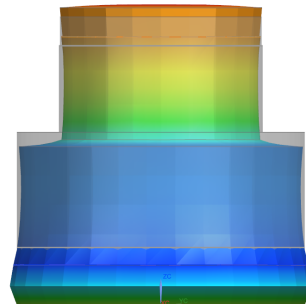
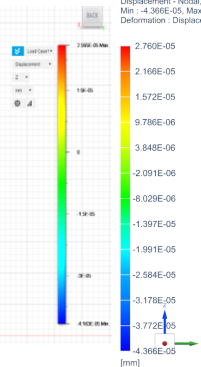


Diagrams. Case study. Part 2



Analytical + Fusion 360

Static_stress_case_study v2_step_sim1 : Solution 1 Result
Subcase - Statics 1, Static Step 1
Displacement - Nodal, Z
Min : -4.366E-05, Max : 2.760E-05, Units = mm
Deformation - Displacement - Nodal Magnitude



Siemens NX

Diagrams material



1. Shear and bending diagrams example
2. Эпюры
3. How to calculate Shear Force and Bending Moment diagram ? Explained with Animation and numerical

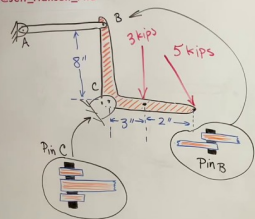
Safety factor

Video

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Factor of SAFETY



Pin C

Pin B

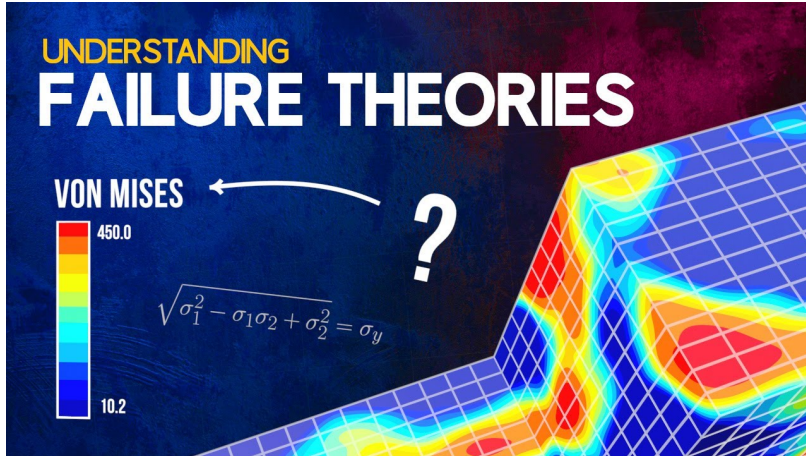
Goal: Find the minimum pin diameter at B is c to the nearest $\frac{1}{8}$ "
If using a factor of safety of 1.5
 $\tau_{all} = 12 \text{ ksi}$

$\sigma_N = \frac{N}{A}$ Normal Stress
 $\tau = \frac{V}{A}$, $\tau_c = \frac{V}{zA}$
 $F.S. = \frac{\sigma_{allowable}}{\sigma_{actual}}$

Jeff Hanson YouTube

Failure Theories (von Mises!)

Video



Failure Theories material



1. Lesson 55 - Tresca, Von Mises, and Rankine Failure Theories Explained

Reference Material (playlist)



1. Mechanics of Material (math) (video)
2. Strength of Materials (lecture-like)
3. Mechanics of Solids (small whiteboard videos)
4. Mechanics of Materials (fancy animation)
5. Strength of Materials Dr. IZadi
6. Основы сопромата
7. "Mechanics of Materials" by Russell C Hibbeler
8. Писаренко Г.С., Яковлев А.П., Матвеев В.В. Справочник по сопротивлению материалов 1988
9. Тимошенко С.П. Сопротивление материалов. 1965

Deserve "A" grade!

– Oleg Bulichev

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📍 @Lupasic

🏢 Room 105 (Underground robotics lab)