Information about the Lecture
Engineering Mechanics II

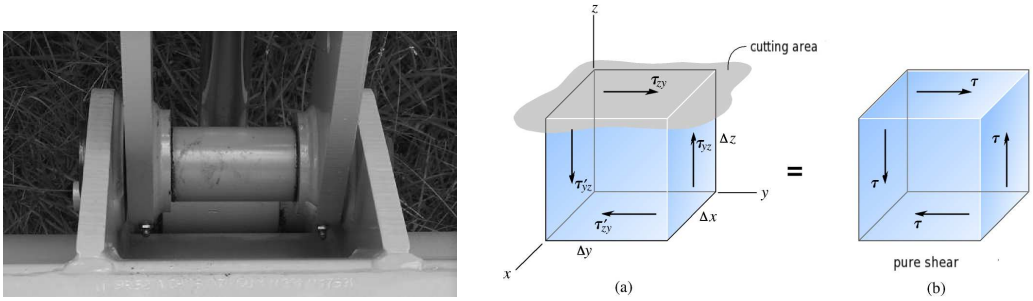

Fig.: Joint bolt (left); Shear stresses (right) [1]

Content of the lecture

At the beginning of the term, elementary bending, torsion and shear theories of the straight beam will be discussed. Thereafter follows an introduction to the three-dimensional theory of elasticity. Hereby, it will be especially focused on multiaxial stress and strain states and Hooke's law which will be followed up by a depiction of energy methods and the approximation procedures of elastostatics. The lectures conclude with a discussion of the stability of elastic structures.

Dates, exam, lecture notes

Lecture dates	Mo., 09:45-11:15, Redtenbacher HS, bldg 10.91
	Wed., 11:30-13:00, Redtenbacher HS, bldg 10.91
First lecture	Wed., 23.04.2025
Tutorial	Fri., 14:00-15:30 Messtechnik HS, bldg 30.33
First tutorial	Fri., 25.04.2025
Lecture notes	available at Skriptenverkauf, Studentenhaus, Adenauerring 7
Contact	Dr.-Ing. Tom-Alexander Langhoff,
	M.Sc. Johannes Gisy/ M.Sc. Nicola Lalović
Course material	available under ILIAS, subscription from 14.04. on

Literature

[1] R. C. Hibbeler: Mechanics of materials, Pearson 2017

[2] D. Gross, W. Hauger, J. Schröder, W. Wall and J. Bonet: Engineering Mechanics 2 – Mechanics of Materials, Springer, 2011

[3] C. Mittelstedt, Engineering Mechanics 2, 1st edition, Springer Berlin, Heidelberg, 2023, (available as full-text: DOI: 10.1007/978-3-662-66590-9)

[4] P. L. Gould: Introduction to linear elasticity, 2nd ed., Springer, 1994.

Content of the lectures

- **Beam bending**
  Bernoulli hypotheses; straight and unsymmetric bending of the straight beam; strains and stresses in the beam; moments of inertia of area; principle axes; technical bending theory; statically indeterminate problems; notch effect

- **Theory of torsion**
  Circular cross sections; thin-walled closed cross sections; thin-walled open cross sections; shear stress distribution; shear flow; twisting; polar moment of inertia of area; section modulus; notch effect

- **Shear force**
  Timoshenko-beam; estimation of the shear deformation and shear strain in the beam as a result of shear forces, statistical moment of an area; shear center

- **Three-dimensional stress and strain measures**
  Normal and shear stresses, stress tensor; principal stresses and their directions; effective stresses; normal and shear strains; strain tensor; principal strains and their directions; effective strains; strain measurement

- **The three-dimensional Hooke's law**
  Elastic and inelastic material behaviour; isotropy and anisotropy; elasticity and hyperelasticity; linear and nonlinear elastic material behaviour; Hooke's law; strain energy; complementary energy; stress theories

- **Basic equations of the three-dimensional elastostatics**
  Distributed forces and resulting forces; Gauss theorem; global and local equilibrium conditions; differential equation for displacements of linear elastostatic; stress and displacement boundary conditions

- **Energy methods of elastostatics**
  Theorems of Maxwell and Betti; theorems of Castigliano; principle of virtual displacements; principle of virtual forces

- **Approximation methods**
  Method of Ritz and Galerkin; introduction to the Finite-Element-method

- **Stability of elastic bars**
  Introduction to the theory of stability; bifurcation points; Euler's buckling theory