

## Information to the Lecture

# Engineering Mechanics I

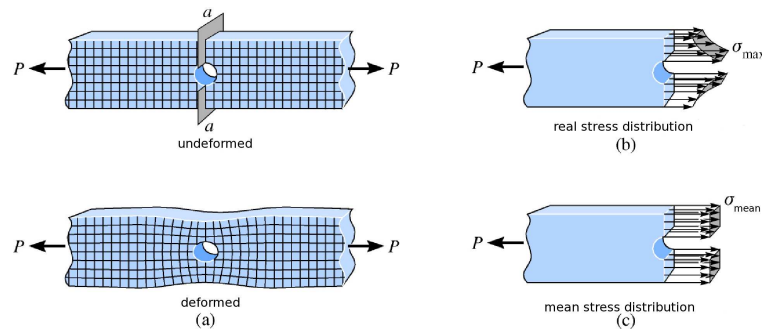


Fig.: Stress concentration [1]

### Content of the lecture

The lecture provides the basic knowledge for the calculation of static mechanical systems in Engineering Mechanics. Based on the notion of force, different equilibrium states are analyzed such as plane and spatial force systems on solid bodies. The calculation of internal reaction forces and moments of plane and space trusses will be discussed. In addition to the equilibrium axiom, the principle of virtual displacements of analytical mechanics is introduced. Within the framework of the statics of straight rods, the calculation of inner forces will be discussed under consideration of elastic and elasto-plastic material laws.

### Dates, exam, lecture notes

Lecture date	Mon, 09:45-11:15, Grashof HS, bldg 10.91, and Tue, 11:30-13:00, Engesser HS, bldg 10.81
<b>First lecture</b>	<b>Fri, 27.10.2023, 09:45-11:15, Engesser HS, bldg 10.81</b>
Tutorial	Fri, 09:45-11:15, Engesser HS, bldg 10.81
<b>First Tutorial</b>	<b>Fri, 27.10.2023, 15:45-17:15, Grashof HS, bldg 10.91</b>
Exam	in written (90 minutes)
Credits	5 SWS, 7 LP
Lecture notes	available at Studentenhaus, Adenauerring 7
Contact	Dr.-Ing. T.-A. Langhoff, M.Sc. J. Gisy, M.Sc. C. Klein

### Literature

- [1] Hibbeler, R.C: Engineering Mechanics - Statics, 11th edition. Prentice Hall Pearson Study (2007).
- [2] Gross, D. et al.: Engineering Mechanics 1: Statics. Springer, Berlin (2009).
- [3] Anthony M. Bedford, Wallace Fowler: Engineering Mechanics: Statics, 5th edition. Prentice Hall Pearson Study 2007

## Content of the lectures

- **Basic vector calculations**  
Vectors; linear dependency; scalar product; cross product; scalar triple product; applications of vector calculus
- **Force systems**  
Forces; torsional moment; equivalent force systems; special force systems; force densities; normal stress; shear stress; resulting moment of force densities; line of action of resultant forces; equilibrium systems
- **Statics of rigid bodies**  
Equivalent systems of rigid bodies; free body diagram; support types and support reactions; reaction forces and external loadings; static and kinematic determinacy
- **Internal forces and moments in rods and beams**  
Differential equation of internal reactions; internal reactions in straight rods and beams; trusses
- **Adhesion and Friction**  
Adhesion; friction; friction of belts
- **Center of gravity and mass center point**  
Mass density; mass; law of gravitation; gravitational force; center of mass; center of volume; center of gravity
- **Work, energy, principle of virtual displacements**  
Work; energy; principle of virtual displacements; stability of equilibria
- **Static of inextensible cables**  
Differential equations of cable forces and cable deflection curve; basic types of cable loadings; exact solutions; approximation solutions
- **Elastostatics of tension rods and struts**  
Stresses; strains; Hooke's law; statically indeterminate problems; notch effect; dimensioning and material selection; elastic trusses; admissible stresses; elasto-plastic rods