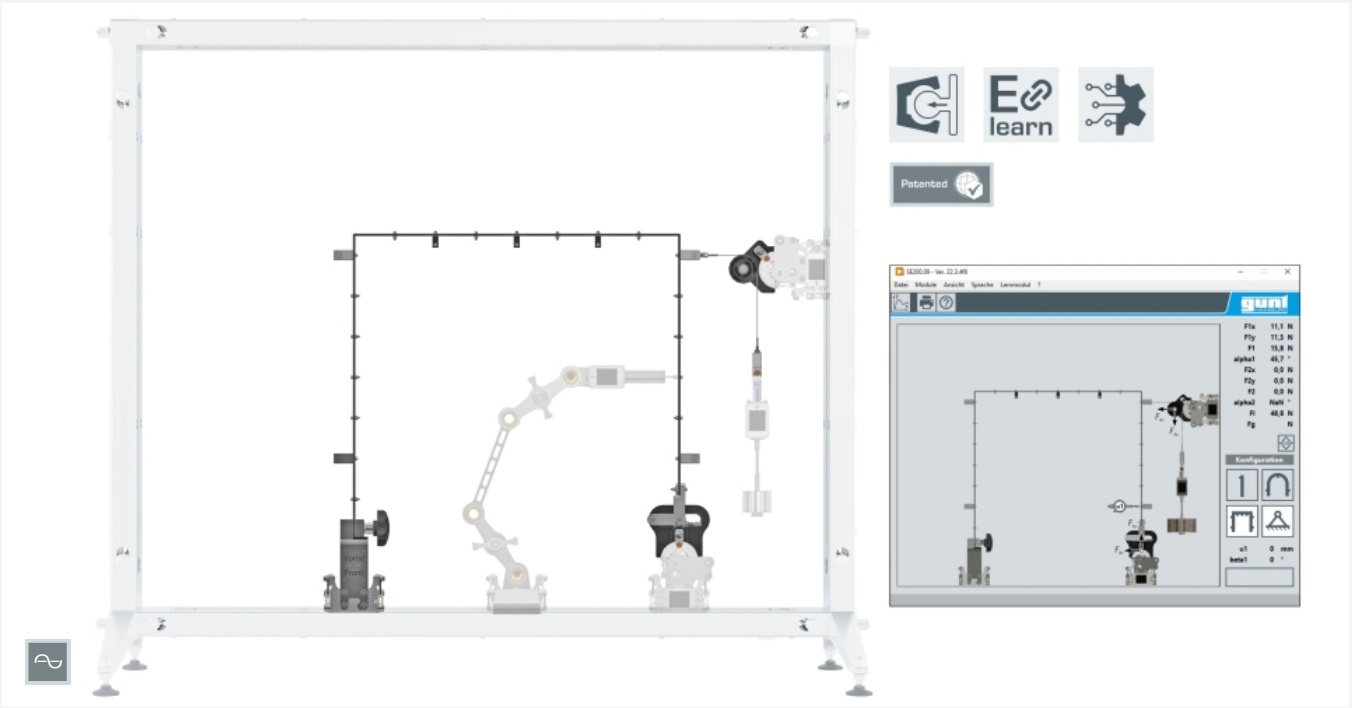
SE 200.09
MEC - Deformation of frames



Description

- **wireless setup together with smart, communication-enabled accessories**
- **elastic deformation of a statically indeterminate frame under point load**
- **U-shaped and arched frame made of stainless steel**
- **cantilever beam for determining the material properties**
- **click system for easy setup and reconfiguration**
- **automatic identification in GUNT software**

A frame is a buckled or curved beam with rigid corners that forms a so-called clearance profile. Frames are used in various shapes and can be made of different materials, e.g. metal, wood or composite materials.

SE 200.09, in combination with other accessories of the MEC Line, enables the smart, digitally supported experimental setup for investigating frames made of stainless steel. The material properties are determined on a cantilever beam. A typical U-shaped frame, as used in hall construction, and an arched frame are available for the experiments. Statically indeterminate bearings can be analysed on both frame shapes.

The load on the frame is applied via a vertical load SE 200.24 or the load unit SE 200.22. There are multiple load application points. Deformations can be recorded with one digital distance measurement, SE 200.23.

The theoretical analysis of deformation behaviour is based on energy-based approaches from the field of strength of materials. The starting point is the strain energy, which describes the internal energy stored in an elastically deformed frame. On this basis, the principle of virtual work enables a systematic derivation of the relationships between external forces and resulting displacements. Castigliano's theorem allows the deformations at any point in the system to be determined directly from the strain energy. The combination of theoretical approach and experimental measurement enables a deep understanding of real structural behaviour. This allows the deformations and forces of overdetermined frames to be precisely predicted and experimentally verified.

The GUNT software identifies the components used and reacts dynamically to changes. The measured values are analysed in real time.

Learning objectives/experiments

- relationship between load and deformation on the frame
- theory of elasticity, Castigliano's theorem
- application of the principle of virtual work on statically determinate cantilever beam and statically indeterminate frames
- accessories of the modular MEC Line can be combined for any setup and extension of the experiments

GUNT Media Center, develop digital skills
- retrieve information from digital networks
- E-Learning course with fundamental knowledge and detailed presentation of the experiment procedure and engaging animations
- assured learning success through digital worksheets

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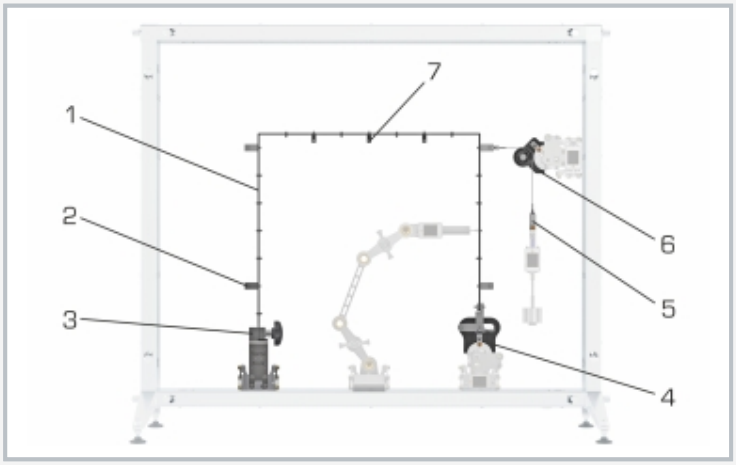
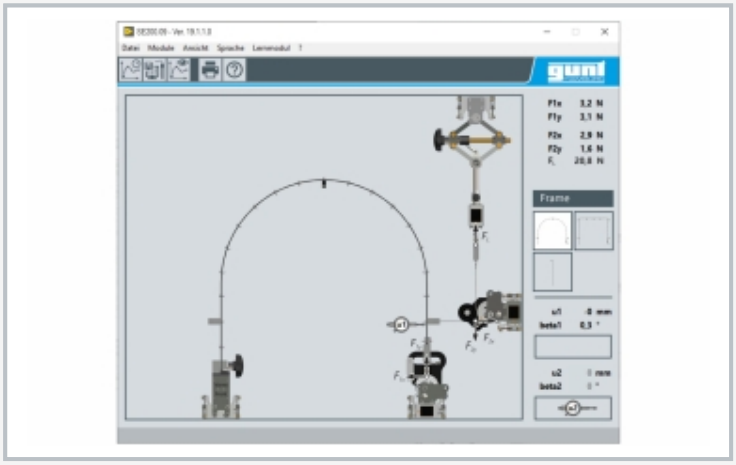
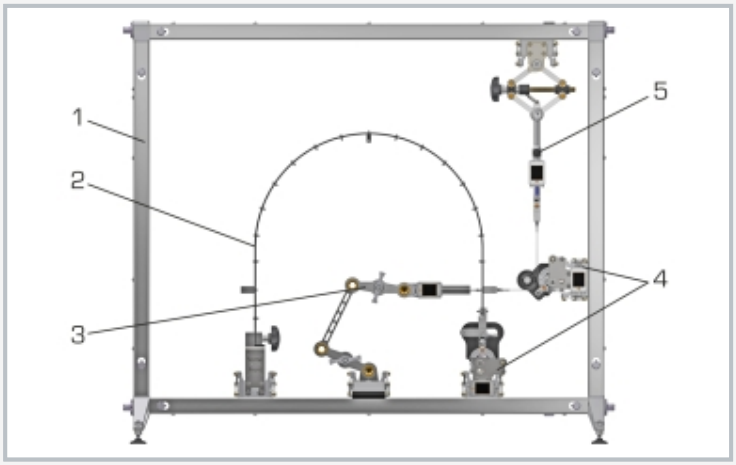


1 U-shaped frame, 2 load application point, 3 clamp, 4 floating or fixed bearing, 5 holder for vertical load, 6 deflection, 7 load application point for vertical load



Software screenshot



Setup example: 1 mounting frame SE 200, 2 curved frame, 3 distance measurement SE 200.23, 4 support SE 200.21, 5 vertical load SE 200.24

Specification

[1] elastic deformation of a statically indeterminate frame under point load
[2] setup of the entire experiment arrangement in the mounting frame SE 200
[3] click system for simple, fast experimental setup without cabling
[4] cantilever beam for determining material and shape properties
[5] frame shapes: 1x U-shaped, 1x curved
[6] load via load unit SE 200.22 or vertical load SE 200.24
[7] multiple load application points possible
[8] automatic identification and assignment of accessories during setup and while conducting the experiment
[9] display of measured values in the GUNT software
[10] GUNT software via USB under Windows 11
[11] digital multimedia teaching material online in the GUNT Media Center: E-Learning course, worksheets

Technical data

Frame
- U-shaped
- curved
- cantilever beam, determination of material and shape properties
- material: flat profiles made of stainless steel, 4mm

Bearings
- fixed bearing
- floating bearing
- rigid clamping

Deformation path in floating bearing: up to 25mm

LxWxH: 800x600x200mm (storage system)
Weight: approx. 19kg (total)

Required for operation

Accessories from the GUNT MEC Line series, PC with Windows recommended

Scope of delivery

2 frames
1 cantilever beam
1 set of instructional material
1 online access to the GUNT Media Center
1 storage system with foam inlay

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Required accessories

SE 200	MEC - Frame digital & smart
2x	
SE 200.21	MEC - Support
1x	
SE 200.22	MEC - Load unit
1x	
SE 200.23	MEC - Distance measurement
1x	
SE 200.24	MEC - Vertical load