

# WP 121

## Demonstration of Euler buckling



### Description

- demonstration of all buckling cases of Euler buckling
- buckling length clearly visible with various methods of support
- test bars made of spring steel
- set of finely graduated weights

In stability theory, the four cases of Euler buckling represent the elastic flexural buckling of straight bars. Above a specific load – the buckling load – a loss of stability occurs and the bar increasingly changes shape. The axis of the bar is deflected laterally. Euler describes four cases for the buckling of an elastic bar with central application of compressive force and various methods of support.

WP 121 demonstrates the four cases of Euler buckling. Depending on the end conditions, different weights are required until the buckling load is reached and the axes of the bars are laterally deflected. The buckling length is clearly visible against the white backing wall with the grid patterning.

The test bars are made of stainless spring steel, and remain within the elastic range during the experiment.

The test bars are either fixed or pinned (free to rotate), depending on the chosen support method. This enables all buckling cases according to Euler to be set up with the various support conditions. Mounts are provided in the top supports to hold the weights. Load is gradually applied to the test bars in small increments. This enables the sudden loss of stability – the buckling – to be clearly shown.

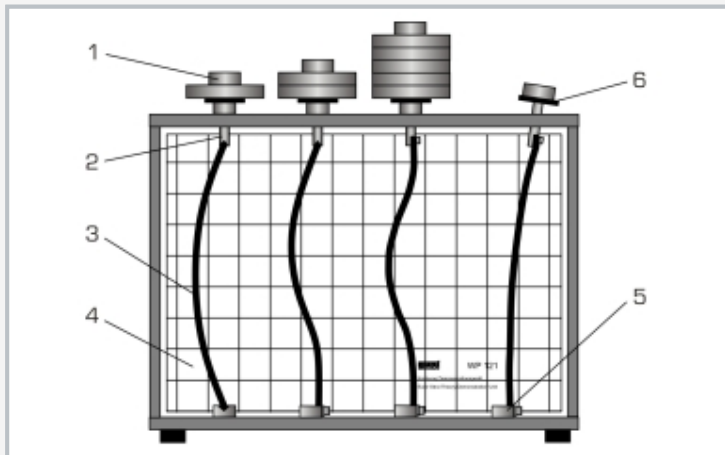
The various elements of the experiment are clearly laid-out and housed securely in a storage system.

### Learning objectives/experiments

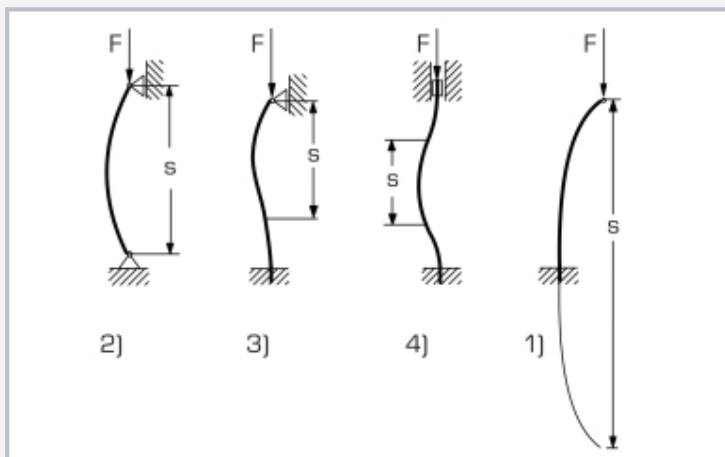
- demonstration of various buckling problems
  - ▶ Euler case 1 – fixed-free bar
  - ▶ Euler case 2 – pinned-pinned bar
  - ▶ Euler case 3 – fixed-pinned bar
  - ▶ Euler case 4 – fixed-fixed bar
- familiarisation with the correlation between buckling length, buckling load and various methods of support

# WP 121

## Demonstration of Euler buckling



1 weight, 2 pinned support, 3 bar, 4 backing wall with grid pattern, 5 fixed support, 6 mount for weight



Buckling length dependent on end conditions of bars:

- 1) Euler case 1: fixed-free bar
  - 2) Euler case 2: pinned-pinned bar
  - 3) Euler case 3: fixed-pinned bar (pinned at the top)
  - 4) Euler case 4: fixed-fixed bar;
- F applied buckling load, s buckling length



storage system

### Specification

- [1] demonstration of elastic buckling
- [2] representation of 4 cases of Euler buckling
- [3] 4 steel test bars
- [4] test bar ends pinned or fixed
- [5] test bars cannot be overloaded
- [6] white backing wall with grid patterning
- [7] storage system to house the components

### Technical data

#### Test bars

- quantity: 4
- bar length: 180mm
- bar cross-section: 0,5x12mm
- material: steel 1.4310 cold-worked
- buckling loads: approx. 2...32N

#### Weights

- 10x 5N
- 5x 1N

LxWxH: 380x110x270mm

Weight: approx. 10kg

LxWxH: 720x480x178mm (storage system)

Weight: approx. 10kg (storage system)

### Scope of delivery

- 1 experimental unit
- 1 set of specimens
- 1 set of weights
- 1 storage system with foam inlay
- 1 set of instructional material

## **WP 121**

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Optional accessories

WP 300.09      Laboratory trolley