

# GL 210

## Dynamic behaviour of multistage spur gears



### Learning objectives/experiments

- determining the angular acceleration on gears
- determining the mass moment of inertia of the gear
- determining the friction
- determining the gear efficiency

### Description

- **single-stage, two-stage or three-stage spur gear with distributed rotational inertia**
- **drive via cable drum and variable set of weights**
- **inductive speed sensors on all shafts**

Gears are employed as a link between driving machine and driven machine. They are used to vary torque and speed and to change direction. The aim of dynamic gear analysis is an understanding of the motion sequences and the influence of inertia.

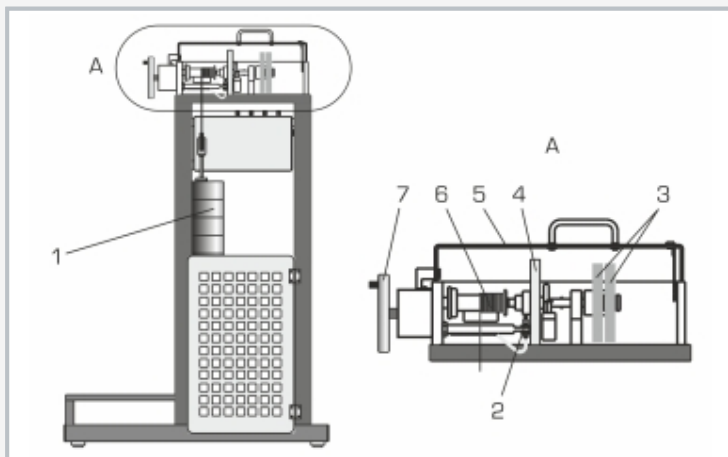
The GL 210 unit is used to study the dynamic behaviour in single-stage, two-stage and three-stage spur gears during transient operation.

The trainer includes four parallel shafts, three drive wheels and three drive gears. Coupling pins can be used to couple the shafts such that different gear stages can be realised. A flywheel may be attached to each shaft in order to increase the rotational inertia. The gear is accelerated via a cable drum and a variable set of weights. The set of weights is raised via a handwheel. A ratchet prevents the weight from accidentally escaping. A clamping roller free-wheel enables free further rotation after the weight has been released. A hand brake allows smooth deceleration. The transparent protective cover with safety lock prevents accidental contact with the rotating parts.

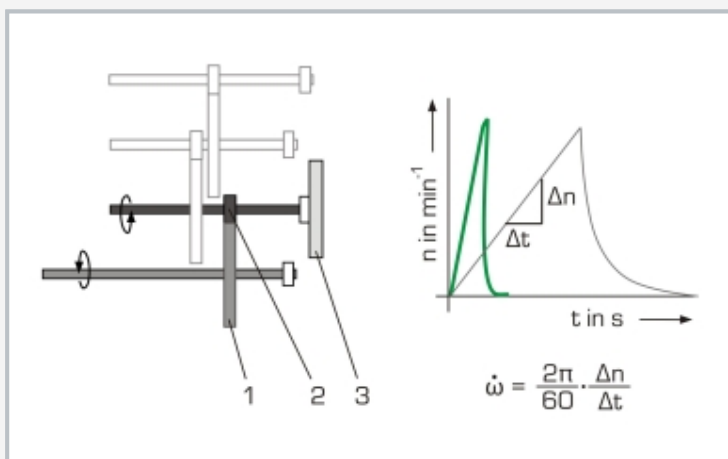
Inductive speed sensors on all drive gears allow the speeds to be measured. The measured values are transmitted directly to a PC via USB. The data acquisition software is included. The angular acceleration can be read from the diagrams.

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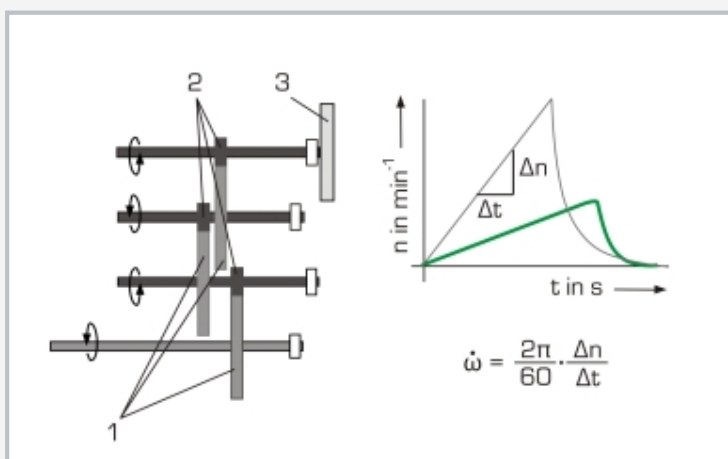
## Dynamic behaviour of multistage spur gears



1 set of weights, 2 speed sensor, 3 flywheels, 4 driven gear, 5 protective cover, 6 cable drum, 7 handwheel



Determining the angular acceleration: 1 driving gear, 2 driven gear, 3 flywheel; speed-time diagram: determining the angular acceleration from the gradient of the curve, green curve for 1-stage gear



Determining the angular acceleration: 1 driving gears, 2 driven gears, 3 flywheel; speed-time diagram: determining the angular acceleration from the gradient of the curve

### Specification

- [1] investigation of the dynamic behaviour of 1-stage, 2-stage or 3-stage spur gears
- [2] 4 shafts, 3 driving and 3 driven gears
- [3] shafts can be coupled by coupling pins
- [4] optional attachable flywheels to increase the rotational inertia on each shaft
- [5] gear is accelerated via cable drum and variable set of weights
- [6] weight raised by handwheel; ratchet prevents accidental release
- [7] clamping roller freewheel enables free further rotation after the weight has been released
- [8] gear decelerated via hand-operated brake
- [9] safety devices: transparent protective cover with safety lock and protective grill for the set of weights
- [10] inductive speed sensors on all driven gears
- [11] GUNT software for data acquisition via USB under Windows 10

### Technical data

- 3-stage gear with 4 shafts
- transmission ratio per stage:  $i = 4:1$
  - overall transmission ratio:  $i = 64:1$

Gear width: 16mm, module 2mm

Drive

- set of weights: 5...50kg
- drop height: max. 0,65m
- max. potential energy: 320Nm

Measuring ranges

- speed: 0...2000min<sup>-1</sup>

LxWxH: 990x640x1550mm

Weight: approx. 150kg

### Required for operation

PC with Windows

### Scope of delivery

- 1 trainer
- 1 set of weights
- 1 GUNT software + USB cable
- 1 set of instructional material