

TM 155

Free and forced vibrations



Description

- demonstration of basic fundamentals of mechanical vibration theory
- damping and resonance in forced vibrations
- two different principles of vibrational excitation

Forced vibrations occur in a variety of ways in engineering. While they are desirable in vibrating screens or vibrating conveyors, they are often unwanted in engines or other rotating machines. The TM 155 experimental unit clearly demonstrates the fundamentals needed to deal with free and forced vibrations. The differences between the two main types of excitation for forced vibrations can be shown on a simple vibration model.

The central element of the experimental unit is a sturdy aluminium profile frame to which the different experimental setups are attached. A bar-type oscillator is used as the vibration system. This offers easy and flexible configuration.

The spring, damper and vibration exciter can be mounted in any position. An imbalance exciter and a displacement exciter are available for spring base-point excitation.

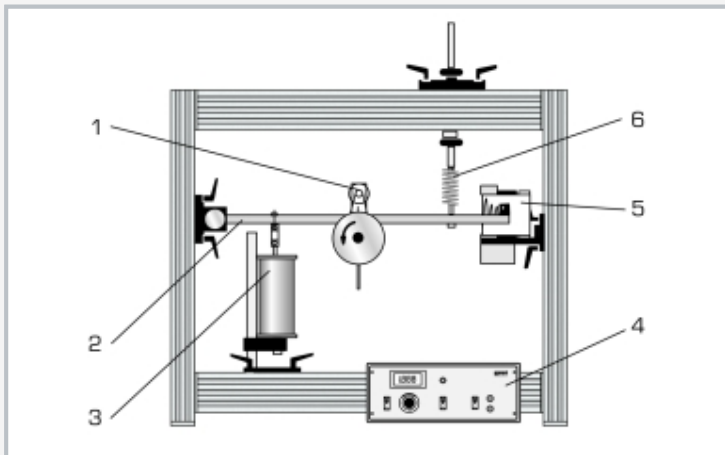
The excitation frequency is set and displayed on a control unit. An oil hydraulic damper allows damped vibrations with adjustable damping level. A mechanical drum recorder offers the option of recording the vibrations. The measured values can be displayed and analysed on a PC using the optional TM 155.20 unit for data acquisition. A demonstration unit for torsional vibrations (TM 150.02) is available as an accessory.

Learning objectives/experiments

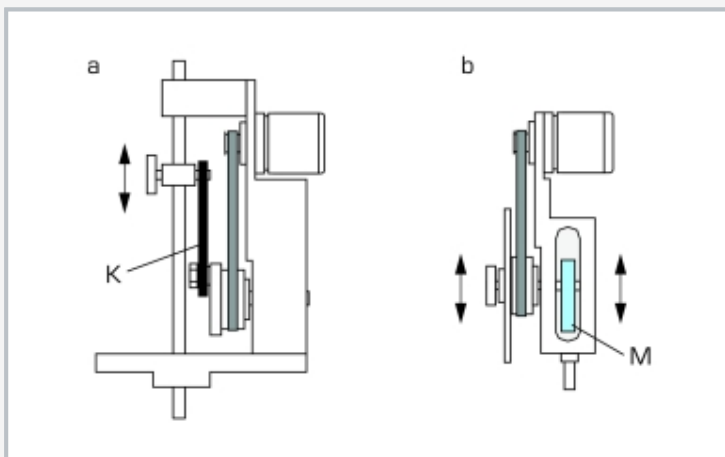
- free vibrations
- damped vibrations
- inertia force and displacement excitation
- forced vibrations
- resonance
- amplitude response and phase response

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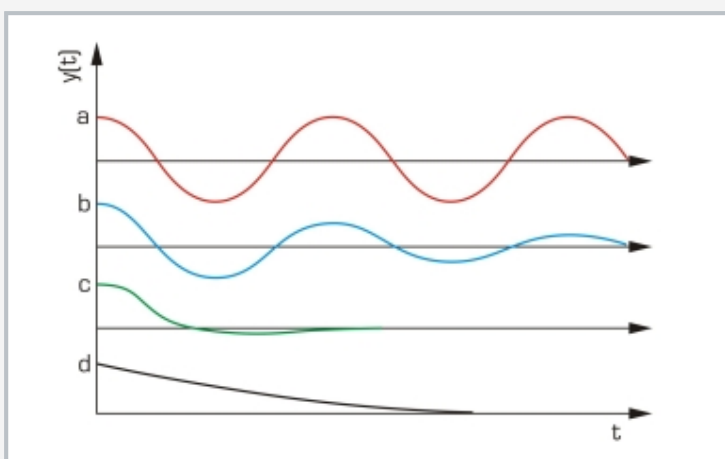
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1 imbalance exciter, 2 rigid bar as discrete oscillator, 3 damper, 4 control unit for imbalance exciter, 5 drum recorder for recording vibrations, 6 suspension and vibration spring



a) displacement exciter with rigid coupling rod K, b) imbalance exciter with eccentrically mounted flywheel disk M



Modes of vibration for varying damping D : a) no damping, $D = 0$, continuous vibration, b) low damping, $0 < D < 1$, c) $D=1$, aperiodic limit case, d) strong damping, $D > 1$, creep case; y elongation, t time

Specification

- [1] fundamentals of mechanical vibration theory; free, damped and forced vibrations
- [2] bar-type oscillator
- [3] 3 coil springs
- [4] imbalance exciter with DC motor
- [5] displacement exciter with DC motor
- [6] electronic control unit with digital display, adjustable excitation frequency
- [7] damper with oil fill
- [8] electrically driven drum recorder
- [9] amplitude meter with electrical contact for triggering devices
- [10] storage system for parts

Technical data

Bar-type oscillator: LxWxH: 700x25x12mm, 1,6kg

Coil springs

- 0,75N/mm
- 1,5N/mm
- 3,0N/mm

Exciter frequency: 0...50Hz, electronically controlled

Imbalance of the imbalance exciter: 0...1000mmg

Stroke of the displacement exciter: 20mm

Damper constant: 5...15Ns/m, oil-filled

Mechanical drum recorder

- feed: 20mm/s
- paper width: 100mm

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 1000x420x900mm

Frame opening WxH: 870x650mm

Weight: approx. 52kg

Storage system:

LxWxH: 1170x480x237mm

Weight: approx. 12kg

Scope of delivery

- 1 experimental unit
- 1 bar-type oscillator
- 3 coil springs
- 1 imbalance exciter
- 1 displacement exciter
- 1 control unit for imbalance exciter
- 1 damper
- 1 amplitude meter
- 1 drum recorder
- 1 storage system with foam inlay
- 1 set of instructional material

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Optional accessories

TM 155.20	System for data acquisition
TM 150.02	Free and damped torsional vibrations