

HM 150.14

Vortex formation



The illustration shows the experimental unit on the work surface of the HM 150 base module and the GUNT Science Media Center, tablet not included

Description

- generation and investigation of free and forced vortices
- different inserts for the water drain
- surface profile visualisation using CFD technology
- multimedia teaching material on-line in the GUNT Science Media Center: E-Learning course, prepared CFD simulations, worksheets, videos

In fluid dynamics, a vortex is a circular flow of a fluid caused by sufficiently large velocity gradients. In practice, this can be observed, e.g. when water flows out of a basin into a pipe.

The HM 150.14 experimental unit allows you to produce and study free and forced vortices.

The experimental unit has a transparent tank with nozzles, various inserts on the water drain, an impeller and a point gauge for detecting the vortex profiles.

To form the free vortex, water is introduced radially into the tank and flows through a ring to slow down. The vortex is created by the flow out of the tank. There are four easily replaceable inserts of various diameters available for the drain.

To form a forced vortex, the water is introduced tangentially. The vortex is generated via an impeller driven by a water jet.

The point gauges are used to measure the surface profiles of the vortices. The rotational speed is determined using a measuring ring.

The experimental unit is positioned easily and securely on the work surface of the HM 150 base module. The water is supplied and the flow measured by HM 150. Alternatively, the experimental unit can be operated by the laboratory supply.

In order to perform a virtual analysis of flow behaviour, CFD simulations are often used in practice. Such simulations allow, for example, flow visualisations in areas that cannot be visualised experimentally. In the GUNT Science Media Center, surface profile visualisations based on CFD calculations are available online. There are also multimedia teaching materials including E-Learning courses on basic knowledge and calculations. Videos show a complete experiment with preparation, execution and evaluation. Worksheets with solutions supplement the teaching material.

Learning objectives/experiments

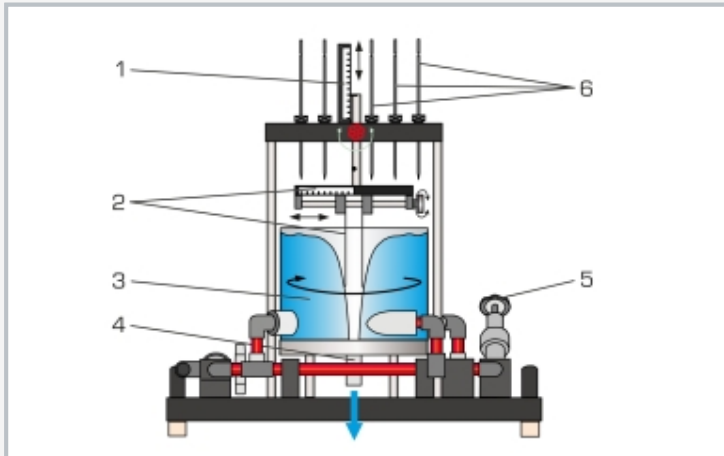
- visualisation of various vortices
- investigation of free and forced vortices
- representation of surface profiles
- comparison between measured and calculated profiles
- determination of rotational speed

GUNT Science Media Center, develop digital skills

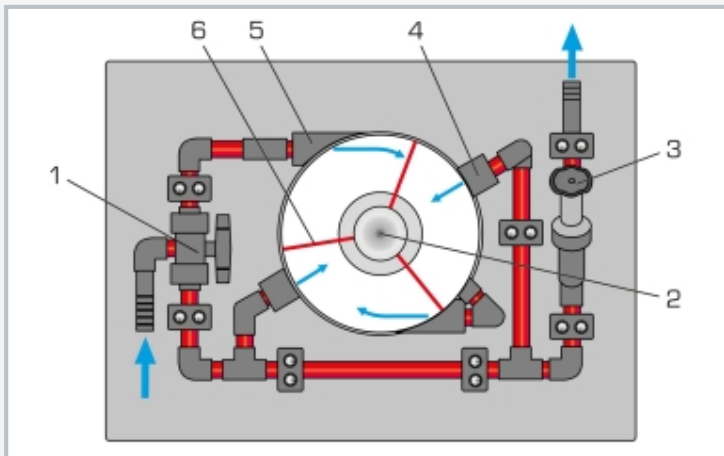
- E-Learning course with fundamental knowledge and calculations
- prepared CFD simulations for surface profile visualisation
- videos with detailed demonstration of the experiments: preparation, execution, evaluation
- assured learning success through digital worksheets
- retrieve information from digital networks

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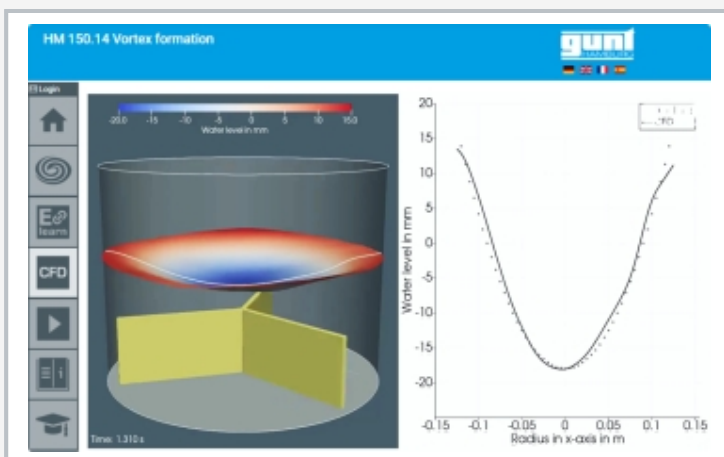
Vortex formation



1 scale for measuring height, 2 point gauge with scale for measuring vortex radii, 3 free vortex, 4 water drain, 5 valve for water drain, 6 point gauge for measuring height of the vortex surface



Plan view of the experimental unit: 1 valve for selecting tangential/radial water inlet, 2 water drain, 3 valve for water drain, 4 nozzle for radial water supply, 5 nozzle for tangential water supply, 6 impeller



Screenshot of the GUNT Science Media Center

Specification

- [1] generation and investigation of vortices
- [2] transparent tank allows visualisation of vortex formation
- [3] two nozzles for radial water supply (free vortex)
- [4] two nozzles for tangential water supply (forced vortex)
- [5] different inserts for the water drain to generate free vortex
- [6] impeller for generating a forced vortex
- [7] measuring ring for determining the rotational speed
- [8] point gauges detect the surface profile
- [9] flow rate determined by HM 150 base module
- [10] water supply using HM 150 base module or via laboratory supply
- [11] surface profile visualisation using prepared CFD simulations
- [12] digital multimedia teaching material online in the GUNT Science Media Center: E-Learning course, prepared CFD simulations, worksheets, videos

Technical data

Tank

- \varnothing inner: 240mm
- height: 190mm

4 inserts for the water drain

- diameter: 8, 12, 16 and 24mm

Impeller with 3 blades

Vertical point gauge: 6 movable rods

Horizontal point gauge: 2 movable rods

Measuring tube, movable

- horizontal 0...90mm, vertical 70...190mm
- diameter: 4mm

LxWxH: 640x400x675mm

Weight: approx. 18kg

Required for operation

HM 150 (closed water circuit) or water connection, drain;

PC or online access recommended

Scope of delivery

- 1 experimental unit
- 4 inserts for the water drain
- 1 impeller
- 1 measuring ring
- 1 set of instructional material
- 1 online access to GUNT Science Media Center

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Optional accessories

HM 150 Base module for experiments in fluid mechanics