HM 159.11
Natural vibration on a ship model

Description

- **dynamic behaviour of a ship structure**
- **simple ship form simplifies the mathematical approach**
- **different excitation signals possible**
- **optional excitation and measuring points**

Nowadays, experiment-based vibration analysis is an essential component in shipbuilding design and development.

The HM 159.11 unit helps students take their first steps in the field of experimental vibration analysis or modal analysis of structures. Using this trainer, the dynamic behaviour of a ship structure is studied, teaching students the fundamentals of experimental vibration analysis.

The HM 159.11 unit can be used to measure and record the natural frequencies and modes of a model ship. The simple, idealised ship shape makes it easier to approach the problem mathematically. The plastic model ship has nine ribs and an elliptical line plan.

The model ship is attached to a rigid cross-member by springs. The enclosed box cross-section with high rigidity means the natural frequency of the cross-member is negligibly high.

An electrodynamic vibration exciter causes the model ship to vibrate. A function generator produces the excitation signal, which can be adjusted in amplitude and frequency. An arbitrarily positionable acceleration sensor measures the model's response to the excitation signal. In this manner, the transfer functions for various points of the model ship can be generated step by step. These can be used to determine the vibration modes for various natural frequencies. Experiments can also be conducted in water.
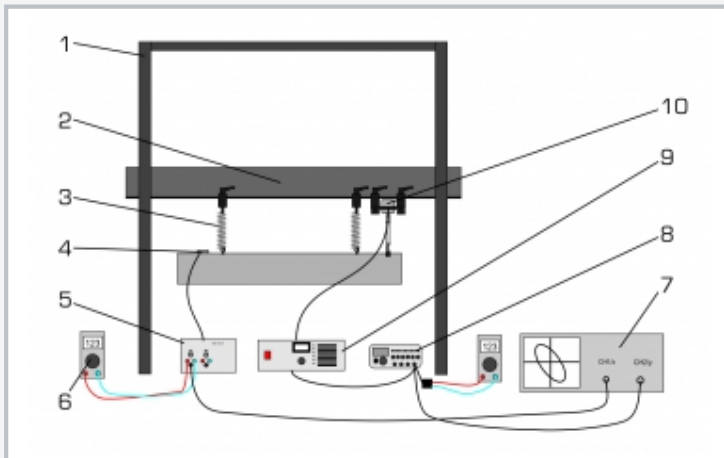
An additional tank is required to conduct these experiments (not included). Complementary experiments can be conducted with additional ballast and weights.

Learning objectives/experiments

- measure and record natural frequencies and modes of the model ship (in air)
- vibration behaviour of the model ship in air
- comparison between theory (approximation formula for determining the first bending frequency) and practice (measured natural frequency)
- influence of discrete additional masses or ballast on natural frequency and mode (ballast and extra weights not included)
- vibration behaviour of floating model ship (possible with additional tank)

G.U.N.T. Gerätebau GmbH, Hanskampring 15-17, D-22885 Barsbüttel, Telefon (040) 67 08 54-0, Fax (040) 67 08 54-42, Email sales@gunt.de, Web www.gunt.de
We reserve the right to modify our products without any notifications.
Page 1/2 - 07.2018

HM 159.11
Natural vibration on a ship model

1 frame, 2 adjustable height cross-member, 3 springs for suspending the model ship, 4 acceleration sensor, 5 measuring amplifier, 6 multimeter, 7 oscilloscope (not included), 8 function generator, 9 power amplifier for vibration exciter, 10 vibration exciter
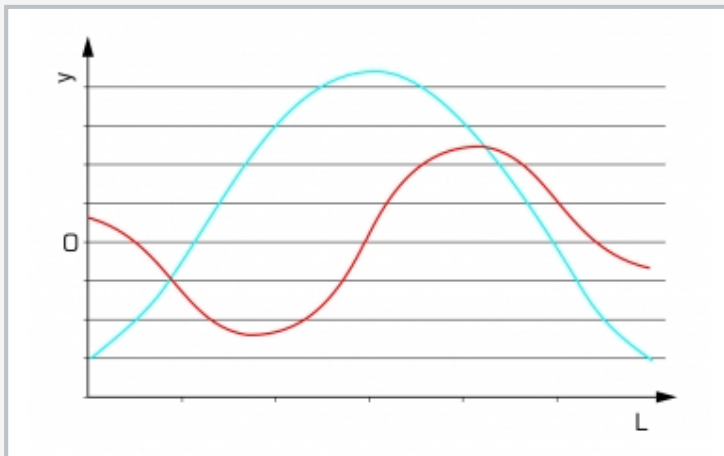
Elongation y of the vibration, shown over the length L of the model ship
blue: first order natural frequency, red: second order natural frequency
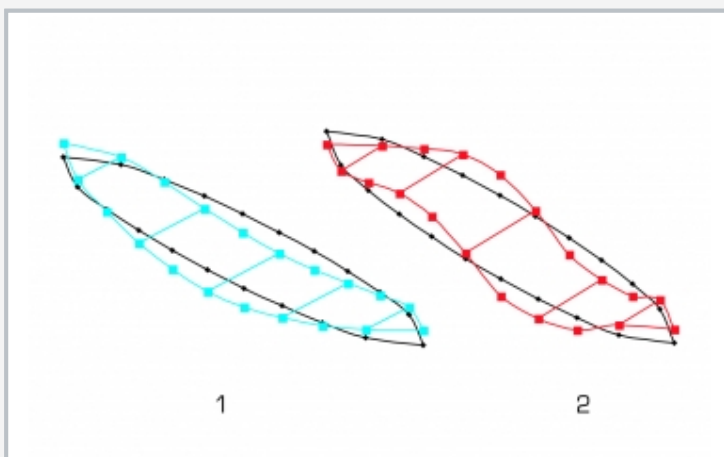
1 blue: first order natural frequency, 2 red: second order natural frequency

Specification

[1] vibration behaviour of a model ship in air and in water (with additional tank)
[2] model ship mounted on springs; vibration excitation and acceleration measurement at any point
[3] frame with height-adjustable cross-member for attaching the model
[4] high natural frequency of the cross-member owing to enclosed box cross-section with high rigidity and low weight
[5] plastic model ship with elliptical lines plan and 9 ribs
[6] capacitive acceleration sensor with measuring amplifier, freely positionable
[7] vibration exciter with power amplifier and function generator: sinusoidal, triangular or rectangular signal
[8] possible to display measured values on an oscilloscope (not included)

Technical data

Vibration exciter
- electrodynamic type with permanent magnet
- max. force: 8,9N
- frequency range: 5...12000Hz

Function generator
- adjustable frequency, amplitude and offset
- output: 0...10Vss, 50 Ohm

Acceleration sensor
- measuring range: ±5g
- frequency range: 0...400Hz

Model ship
- deck stringer with fastening holes for sensors and suspension

230V, 50Hz, 1 phase
230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase
UL/CSA optional
LxWxH: 1800x400x1700mm (frame)
LxWxH: 1200x200x150mm (model)
Weight: approx. 50kg

Scope of delivery

1   trainer
1   model ship
4   springs
1   measuring amplifier
1   power amplifier
1   vibration exciter
1   function generator
2x multimeter
1   acceleration sensor
1   set of cables
1   set of instructional material