Training

Onboard & Underwater Radiated Noise and Vibration

Cost (excl. VAT)

€ 3.000,- for NMT-IRO members
€ 3.750,- for non-members

Date and location

Three consecutive days, Delft (tbd)

This interactive course focuses on the practical side of shipboard noise and vibrations both on board and radiated underwater. The course consists of three topics, spread over 3 days: Vibrations, Onboard Noise, and Underwater Radiated Noise. Each topic will be presented in an accessible manner with connected practical examples, illustrative exercises and hands-on experiments. State-of-the-art tools and methods with their benefits and potential pitfalls are treated with examples based on experience.

Convinced? Then Sign up

Sign up

More information or interested in in-company possibilities?

Please contact our Training Advisor via T +31 (0)88 44 51 000 or
academy@maritimetechnology.nl

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Onboard & Underwater Radiated Noise and Vibrations:

The first day on vibrations will address questions such as: How do you design constructions such that no excessive vibrations occur? More importantly: how do you solve expected resonance problems in a design stage? What are possible solution strategies? During the experiments, the emphasis is on actual measurement techniques and their output. Answering questions such as how do you compare a measurement report with requirements from regulatory authorities? What does it mean if a pre-defined threshold is exceeded?

The second part of the course starts with an introduction to the field of acoustics by experiencing and measuring noise in a real-life experiment, using your smartphone with an app of your choice. Decisions on which measurements parameters to set and why and how will be further discussed in a session on the basics of acoustics. This will layout the foundation of the remainder of the day by introducing concepts such as decibels, spectra, and sound transfer paths and perception. After understanding the basics of acoustics, as a next step it is explained how sound can be reduced. Various sound transfer paths with corresponding noise control measures are discussed. The principles are illustrated by means of various real-time demonstrations. Attention is paid to calculation and prediction tools with their different approaches and limitations. The day ends with a case study in which the participants will look at results of various on-board experiments with microphones and accelerometers to select and evaluate noise control measures.

The third day of the course focuses on the increasingly relevant field of underwater radiated noise with experts involved in writing the upcoming ISO standards for underwater noise. The increasing focus on impact on the environment has resulted in underwater noise regulations in various regions. The third day starts with explaining the difference between onboard and underwater acoustics. This is followed by the largest source of underwater radiated noise: the propellor and the effects on ship design. Questions such as “How do you measure underwater noise and evaluate it against which norms?” are answered. Underwater radiated noise mitigation measures of propellor and machinery noise will be explained, and practical examples will be shared.

Global course layout - proposal:

Day 1 - Vibration (8 planned hours)
Day 2 - Acoustics (8 planned hours)
Day 3 - Underwater Radiated Noise (8 planned hours)

Day 1 - Vibrations (TNO-NOS)

Introduction to vibrations

Part 1 – Theory

- Mass spring damper system
- Eigen frequencies / Eigen modes
- Elementary plate fields, stiffened plates, deck panels
- Excitation sources (Campbell diagram)
- Exercise on hand calculation of stiffened deck panel

Part 2 – Modelling

- Beam model (effective plate width)
- Effect of boundary conditions
- Non-structural mass – distributed vs. point mass (equipment, interior, etc.)
- Solver options (numerical algorithms)
- 3D FEM
- Added mass (tank / shell)
- Exercises on numerical model of stiffened deck panel and prediction of vibration experiment

Part 3 – Experiment Vibrations

- Introduction vibration measurements
- Signal processing
- Explanation vibration definitions in reporting (mm/s, mm/s2, RMS, SDA, SSA)
- Actual experiment (experience vibrations)

Vibrations in Practice

Part 4. Rules & Regulations

- Current state and notations
- Additional explanation (RMS, SDA, SSA, dBA)
- Exercise: apply industry standard to experiment

Part 5. Vibration mitigation

- Design margins (uncertainty mass and boundary conditions)
- Structural changes
- Tuned mass dampers
- Exercise: solve a vibration problem for a structure

Part 6. Global Hull Vibration

- Added mass (global hull)
- Global hull (2 node bending)
- HAM318 case
- Shear mode superstructure

Day 2 - Acoustics (TNO-Acoustics)

Noise Experience

- Hands-on noise measurements
- Noise measurement with noise control measure
- Structure-borne sound measurement
- ISO standard

Basics

- Basics of acoustics,
- Decibels, spectra, sound transfer paths

Noise control

- Principles and mechanisms
- Real-time demos, examples

Calculation tools

- Approaches and limitations

Case study inland cargo vessel

- examples of on-board experiments with microphones and accelerometers

Day 3 - Underwater Radiated Noise (TNO-Acoustics + Marin)

Introduction to underwater noise

- Difference with airborne noise
- Environmental impact
- Rules and regulations

Propeller noise

- Justification of subject
- Physical mechanism
- Cavitation (physical models)
- Shaft forces and moments

Underwater noise measurements

- Equipment and calibration

Ship underwater radiated noise measurements

- ISO standards

Propeller noise mitigation

- Mitigation measurement techniques
- Prediction of noise and vibrations

Machinery noise mitigation

- Principles and prediction
- Examples