NOISE AND VIBRATION ANALYSIS, MITIGATION AND MEASUREMENT FOR MARINE VESSELS

Noise and Vibration analysis, mitigation and measurement help improve operational safety in terms of personnel task performance, habitability, proper functioning of equipment, and structural integrity at sea.

Appropriate noise and vibration levels can enhance operational safety by improving task performance, habitability, proper functioning of sensitive equipment, such as sensors and modern monitoring technologies as well as whole-body structural integrity at sea.

Because vibration can be global (vibration of the entire structure), local (vibration of selective structural components) or a mix of both, it has to be considered in a comprehensive way. Proper levels of vibration need to be maintained to limit an increased rate of fatigue failure in structural members and the malfunction of machinery and equipment.

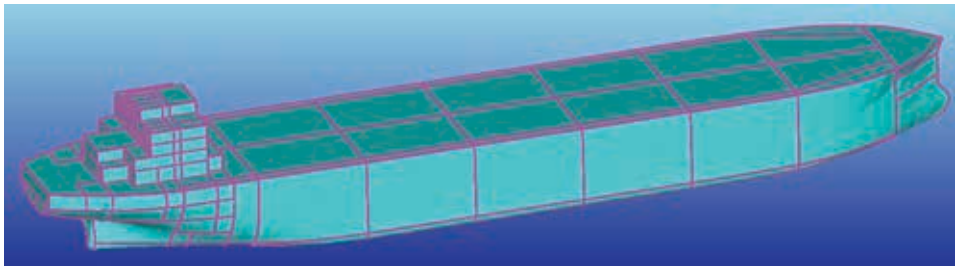
Personnel task performance is a key component of operational safety, and a critical component of task performance is habitability, which includes noise and whole-body vibration. Designing for performance and habitability goals allows for improvement of productivity, morale, safety, and comfort, and it reduces potential risk of fatigue and human error.

Noise and vibration performance goals are best achieved if noise and vibration analysis and mitigation are considered in early design stages. The cost of correcting a potential noise and/or vibration issue can be up to ten (10) times as expensive after construction than if incorporated into the design from preliminary design stage.

ABS CAPABILITY FOR NOISE AND VIBRATION ANALYSIS, MITIGATION AND MEASUREMENT

ABS has developed the capability for on-board noise and vibration analyses to address growing concerns and offers a number of services for noise and vibration analysis and measurement:

- **Onboard Noise Analysis**
  The analysis model considers major noise and vibration sources, such as main engines, auxiliary equipment, propellers, etc. The HVAC system, including duct dimensions, routes, insulation and etc., also can be modeled and analyzed. The ultimate



ABS noise and vibration analysis, mitigation, and measurement services are based on a three-stage approach to support the design improvement process:

STEP 01

- Collect required design information
- Identify the possible worst scenario for analysis
- Define baseline parameters
- Obtain client agreement on the scenario and design parameters

STEP 02

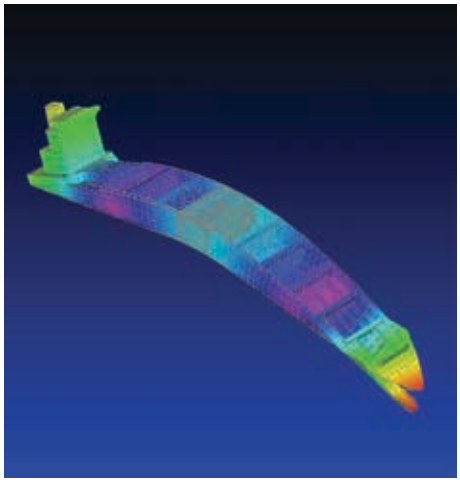
- Define suitable technical approach with the client
- Develop numerical model in accordance with the agreed approach
- Perform numerical analysis
- Review and evaluate the analysis results

STEP 03

- Provide options for mitigation plan(s) with clients if required
- Re-evaluate the mitigation plan and improve the design
- Perform full-scale measurement during sea trial to validate the numerical analysis and design improvement

compartment noise level is the combination of the machinery noise and the HVAC noise. Analysis results are evaluated against the relevant noise limit. If the predicted results exceed allowable noise limit, ABS can propose mitigation options for reducing noise levels.

- **Onboard Noise Measurement**
  ABS provides onboard noise measurement services to support verifying compliance with the IMO code on noise requires physical on-board measurements as well as voluntary class notations such as the ABS Habitability Notations.
- **Whole-body Free Vibration Analysis**
  The objective of whole-body free vibration analysis is to avoid resonance of the global offshore structure. Using a global Finite Element model, engineers model and resolve issues that impact the structure.
- **Whole-body Forced Vibration Analysis**
  Whole-body forced vibration analysis calculates the responses of the structure resulting from main engine, propeller, and/or thruster vibration. The forced vibration responses near accommodation areas, the vicinity of excitation areas, and the areas of specific concern can be investigated in detail. Analysis results can be evaluated against acceptance criteria in ABS HAB notations, and internationally recognized codes, such as ISO 6841 (1987), ISO 2631 (1997), ISO 6954 (1984), ISO 6954 (2000) and ISO 20283-5 (2016). If the predicted results exceed allowable vibration limit, ABS can propose mitigation options for reducing vibration levels.
- **Fast Local Vibration Analysis**
  This analysis checks the natural frequencies of three kinds of panels (plate panels, stiffener panels and girder panels) in the area of interest, such as accommodation areas and the vicinity of excitation sources. The calculated natural frequencies of these panels are evaluated to avoid coinciding with primary excitation frequencies.
- **Extended Local Vibration Analysis**
  The local vibration analysis at this level is more comprehensive than the simplified local vibration analysis method, analyzing substructures such as decks, machinery platforms, or the superstructure of sufficient mass and flexibility are analyzed. The natural frequencies of these substructures are evaluated to avoid coinciding with primary excitation frequencies.
- **Vibration Measurement for Habitability**
  The ABS vibration team offers two measurement services for habitability and machinery. Habitability measurements help verify if the vibration level is acceptable to crew habitability criteria according to different standards such as the ABS habitability notations **HAB, HAB(WB), MLC-ACCOM** or ISO 20283-5 (2016). Machinery vibration measurements gauge and evaluate the external mechanical vibration behavior of generating sets at the measuring points according to ABS Ship Vibration Guidance Notes or ISO 8528-9.



For additional information on ABS' Noise and Vibration Control services, please contact us at advisoryservices@eagle.org.

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