



Example configuration of USSB with USSB/TAN and ship model

INTRODUCTION

Naval architecture is divided into two branches: ship construction, which studies the structure of the vessel, the different characteristics of the hull according to the ship's function, and everything related to the structural part; and ship theory, which studies the behavior of the hull's exterior forms in the sea under various navigation conditions and stability.

The stability of a partially or fully submerged body is vertical and obeys the balance between the body's weight and the buoyant force. Hydrostatic equilibrium occurs in a fluid where the forces of the vertical pressure gradient and gravity are balanced. The metacenter is the point of intersection of the vertical lines drawn from the center of buoyancy, the center of gravity of the volume of water displaced by a floater, at small consecutive angles of heel.

Stability is one of the most important aspects to consider, as its study can lead to a better understanding of the ship's movements and reactions in various navigation situations, such as loading and unloading maneuvers in port, thereby helping to avoid possible accidents, generally related to adverse weather conditions and poor stowage.

Experimental vibration analysis is currently an essential part of construction and development in naval engineering. It allows for the initial steps in vibration analysis and modal analysis of structures. This approach analyzes the dynamic behavior of a naval structure, conveying the general fundamentals of vibration analysis.



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GENERAL DESCRIPTION

The study of ship stability and the analysis of vibrations that can occur in a vessel are crucial aspects for the construction and development of naval engineering.

The Ship Stability Study Unit, "USSB", designed by EDIBON, enables a comprehensive analysis of a ship's stability, vibrations, and hydrostatics. This equipment also allows for the determination of the buoyant force, the metacenter, and the center of mass.

In this way, it provides a detailed analysis of the ship's dynamic behavior and stability, which are critical for understanding how vibrations and design can influence the structural and operational stability of the vessel under various navigation conditions.

Four different models are available depending on the study to be conducted (not included):

- USSB/A. Rectangular Barge Model. A scale representation of a barge, a flat-bottomed vessel commonly used for transporting goods in rivers and canals.
- USSB/B. Trawler Model. A scale representation of a trawler, typically designed for fishing and usually equipped with nets that drag along the sea floor to catch fish and seafood.
- USSB/C. Crane Ship Model. A scale representation of a vessel equipped with a crane, primarily used for loading and unloading operations, lifting, and transporting heavy loads in ports, offshore platforms, and other maritime areas.
- USSB/V. Vibration Study Model. A scale representation designed to study the dynamic behavior and vibrations of naval structures, allowing for the analysis of how different frequencies and vibration modes influence the stability and performance of the vessel.

Additionally, the Water Tank and Angle Stability Accessories for USSB, "USSB/TAN," allow for the study of stability by immersing different ship models, which are secured with a mechanism equipped with a clinometer. This facilitates the execution of rolling and righting experiments. Additional ballast and weights enable complementary tests, providing a comprehensive understanding of the critical aspects of stability and the dynamic behavior of naval structures.

SPECIFICATIONS

The complete unit includes an anodized aluminum frame and painted steel panels.

The unit includes wheels to facilitate its mobility.

Main metallic elements made of stainless steel.

Set of Weights and Ballasts: The set comes with a complete collection of additional weights and ballast, which can be adjusted according to the needs of the experiment. These accessories allow for the adjustment of the center of gravity and heel of the model, providing a deeper and more practical understanding of the principles of stability and buoyancy in naval engineering.

Manuals: This unit is supplied with the following manuals: Required services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices manuals.

Required elements (at least one) (Not included):

- USSB/A. Rectangular Barge Model.
- USSB/B. Trawler Model.
- USSB/C. Crane Ship Model.
- USSB/V. Vibration Study Model.

Additional recommended elements (Not included):

- USSB/TAN. Water Tank and Angle Stability Accessories for USSB.

Required elements (at least one) (Not included)

USSB/A. Rectangular Barge Model

A precisely designed scale model of a rectangular barge, replicating the characteristics of a real vessel. This model includes strategically placed internal bulkheads to simulate the compartmentalization of a ship, allowing for detailed studies of stability and the vessel's responses to various loading and imbalance conditions.

Additionally, each compartment is equipped with flooding valves to facilitate experiments on the impact of water ingress in different sections of the barge. This enables analysis of how flooding affects the stability and dynamic behavior of the ship.

Model dimensions: 1200 x 200 x 150 mm approx.

Experiments can also be conducted in water, though this requires the use of the Water Tank and Angle Stability Accessories for USSB, "USSB/TAN". With the addition of extra ballast and complementary weights, it is possible to perform further tests in water.

USSB/B. Trawler Model

A carefully constructed scale model of a tugboat, designed to accurately represent the characteristics of a real tugboat. This model is equipped with a series of transverse watertight bulkheads, strategically positioned to reflect their arrangement in a true tugboat. These bulkheads allow for a detailed study of the ship's compartmentalization and stability.

Additionally, each compartment is fitted with flooding valves, facilitating the simulation and analysis of the impact of water ingress in various sections of the tugboat. This provides an opportunity to investigate how flooding affects the stability and operational behavior of the vessel in emergency situations.

This scale model is an invaluable tool for understanding and studying the principles of stability, buoyancy, and dynamic response in naval engineering. It features multiple frames and an optimal hull design for comprehensive studies of the vessel's aerodynamics and hydrodynamics.

Model dimensions: 1200 x 200 x 150 mm approx.

Experiments can also be conducted in water, although this requires the use of the Water Tank and Angle Stability Accessories for USSB, "USSB/TAN". With the addition of extra ballast and complementary weights, it is possible to perform further tests in water.

USSB/C. Crane Ship Model

A precisely designed scale model of a crane ship, typically used in various industries, replicating the characteristics of a real crane ship. This model includes a ballasted hull that simulates the operational conditions of a vessel with additional stability, essential for heavy lifting operations.

The crane ship is equipped with a movable crane that can be positioned at different angles and heights to perform various types of lifting and maneuvers. It comes with a collection of suspension weights, allowing for practical experiments on the ship's load capacities and lifting dynamics.

These features enable a detailed study of the principles of stability, balance, and operational efficiency of crane ships, providing a valuable educational tool for engineers and students in the field of naval engineering and maritime operations.

Model dimensions: 1200 x 200 x 150 mm approx.

Experiments can also be conducted in water, although this requires the use of the Water Tank and Angle Stability Accessories for USSB, "USSB/TAN". With the addition of extra ballast and complementary weights, further tests in water can be performed.

USSB/V. Vibration Study Model

The Vibration Study Model, "USSB/V", allows for the study of the dynamic behavior of a naval structure, providing the essential foundations of experimental vibration analysis. With this model, it is possible to measure and represent the natural frequencies and modes of a ship model. The simple and streamlined shape of the ship facilitates the mathematical treatment of the problem.

Using an oscillation generator, vibrations are induced in the ship model. A function generator produces the excitation signal, with the capability to adjust both amplitude and frequency. An accelerometer, which can be placed anywhere on the model, records the ship's response to the excitation signal. This facilitates the creation of transfer functions at various points on the model, allowing for the identification of natural vibration modes at different natural frequencies.

It is possible to measure and plot the natural frequencies and shapes of a model ship. The simple and stylized shape of the ship simplifies the mathematical treatment of the problem. The ship model has several frames and is designed with elliptical lines.

It will be fixed to the rigid crossbeam but through a system that allows for its vibration for calculation purposes.

Experiments can also be conducted in water, although this requires the use of the Water Tank and Angle Stability Accessories for USSB, "USSB/TAN". With the addition of extra ballast and complementary weights, further tests in water can be performed.

Additional recommended elements (Not included)

USSB/TAN. Water Tank and Angle Stability Accessories for USSB

This unit is designed for students to study the hydrostatics and stability of ships. It includes a water tank, a dynamometer, angle stability elements, and a clinometer. It also comes with additional weights and ballast.

The floatation tank of 1700 x 350 x 350 mm approx. Capacity: 180 l approx.

The dynamometer measures the righting moment of the model and can hold it at any heel angle within the range without exerting vertical force on it.

The high-resolution clinometer measures the inclination of the model within a range of 0 to 45°.

To study the functionality, you need to select any of the available ship models, allowing for a wide variety of studies on the stability and behavior of different types of vessels.

EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Study and conduct the heel test in air.
- 2.- Study and conduct the heel test in water (requires at least one of the models and USSB/TAN).
- 3.- Determine the effect of free surface on stability.
- 4.- Determine the influence of a suspended mass on stability.
- 5.- Study the effect of flooding one or more compartments.
- 6.- Study and conduct the rolling period test.
- 7.- Study and determine the buoyant force and center of buoyancy.
- 8.- Measure the natural frequencies of the ship model in air (USSB/V).
- 9.- Analyze the vibration behavior of the ship model in air (USSB/V).
- 10.- Compare theory (approximation formula to determine the first flexible natural frequency) with practice (measured natural frequency) in (USSB/V).
- 11.- Study the effect of different masses on the natural frequency and mode shape (USSB/V).
- 12.- Analyze the vibration behavior of the floating ship model (USSB/V + USSB/TAN).
- Several other exercises can be done and designed by the user.

REQUIRED SERVICES

- Electrical supply: single-phase 200 VAC – 240 VAC/50 Hz or 110 VAC – 127 VAC/60 Hz.
- Water supply and drain.

DIMENSIONS AND WEIGHTS

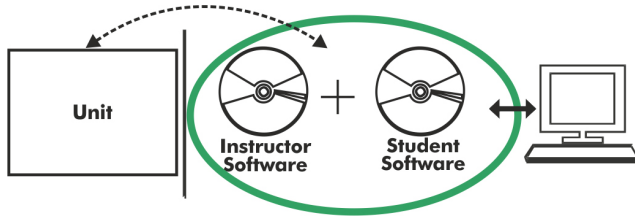
- USSB:
- Dimensions: 1900 x 1000 x 1000 mm approx.
(74,80 x 39,37 x 39,37 inches approx.)
 - Weight: 200 Kg approx.
(440 pounds approx.)

REQUIRED ELEMENTS (Not included)

- Required (at least one):
- USSB/A. Rectangular Barge Model.
 - USSB/B. Trawler Model.
 - USSB/C. Crane Ship Model.
 - USSB/V. Vibration Study Model.

ADDITIONAL RECOMMENDED ELEMENTS (Not included)

- USSB/TAN. Water Tank and Angle Stability Accessories for USSB.

USB/ICAI. Interactive Computer Aided Instruction Software:

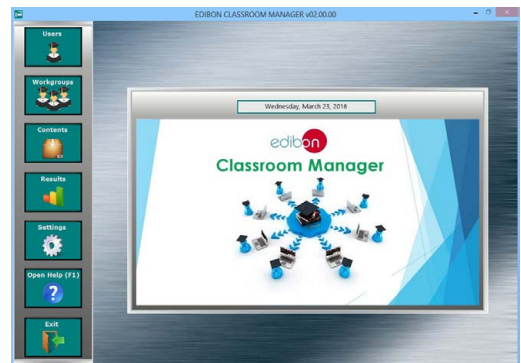
With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

Instructor Software**- ECM-SOF. EDIBON Classroom Manager (Instructor Software).**

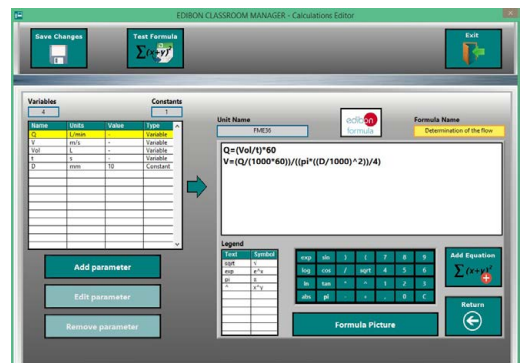
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

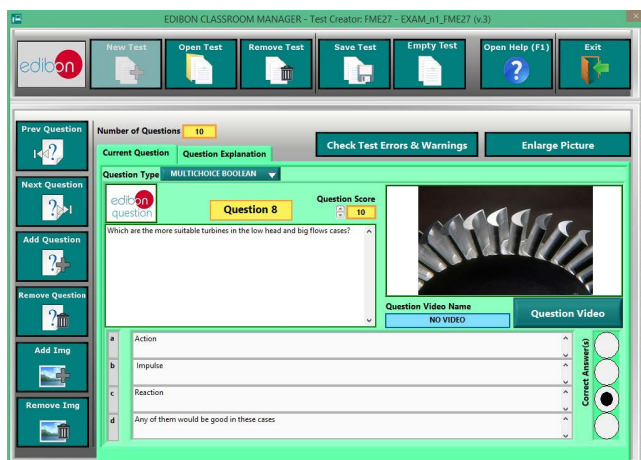
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

Optional
Student Software

- ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

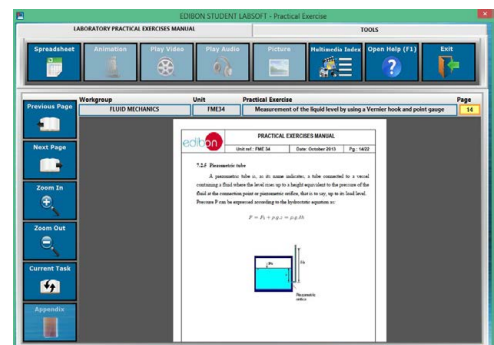
Innovative features:

- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

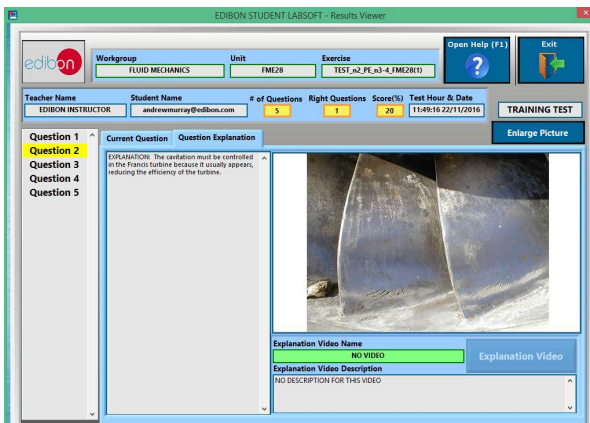
For more information see ICAI catalogue. Click on the following link:
www.edibon.com/en/interactive-computer-aided-instruction-software



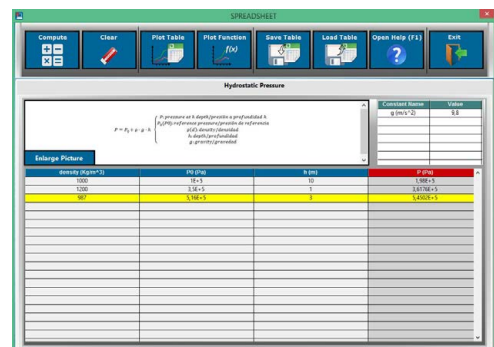
ESL-SOF. EDIBON Student LabSoft (Student Software)
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

* Specifications subject to change without previous notice, due to the convenience of improvement of the product.



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REPRESENTATIVE:

