MARINE TECHNOLOGY EDUCATION TODAY AND TOMORROW

Viinistu Art Harbour, 25.08.2023

Multiplier Event

Erasmus+ KA203 project SHIPMARTECH

„UPGRADING AND HARMONIZATION OF MARITIME ENGINEERING MASTER'S LEVEL COURSES„

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

Programme

- 09.00 Registration and coffee
- 09.30 Opening address and introductory remarks
- SUMMARY OF COMPANIES' FEEDBACK ON THE MASTER'S PROGRAMME IN MARINE TECHNOLOGY. Prof. **Kristjan Tabri**, TalTech
- 10.00 International cooperation in curriculum and course development in the Erasmus+ project SHIPMARTECH: results, experiences and lessons learnt. **Tõnis Tõns**, specialist-project manager; **Mihhail Afanasjev**, programme director, TalTech Kuressaare College, **Mikloš Lakatoš**, engineer, TalTech Kuressaare College
- 11.00 Panel discussion: DEVELOPMENTS IN MARITIME ENGINEERING HIGHER EDUCATION IN EUROPE. Moderator professor **Mihkel Kõrgesaar**, TalTech Kuressaare College.
- **Panellists**: prof. **Viktor Senčila**, Klaipeda University; prof. **Jani Romanoff**, Aalto University; prof. **Roger Skjetne**, Norwegian University of Science and Technology; prof. **Fjodor Sergejev**, Tallinn University of Technology
- 12:00 TEAMWORK: Brainstorming ideas for long-term marine technology student projects. Moderator professor **Kristjan Tabri**, TalTech
- 13:30 PRESENTATION OF GROUP WORK RESULTS
- 14:00 CLOSING WORDS. LUNCH
- 15:00 Transport to Tallinn

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

International cooperation in curriculum and course development in the Erasmus+ project SHIPMARTECH: results, experiences and lessons learnt

Mihhail Afanasjev
Mikloš Lakatoš
Tõnis Tõns

TAL TECH KURESSAARE COLLEGE

Viinistu Art Harbour, 25.08.2023

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

AGENDA

- SHIPMARTECH introduction and main outcomes – Tõnis Tõns
- Intensive program in Tallinn, November 2022 – Mihhail Afanasjev
- Course development example and lessons learnt – Miklož Lakatoš

Project details

- **Upgrading and Harmonization of Maritime Engineering Master's Level Courses**
- **Duration**

  01.11.2020 – 31.08.2023

  Erasmus+ Call 2020 Round 1 KA2 – Cooperation for innovation and the exchange of good practices

  KA203 – Strategic Partnerships for higher education

Co-funded by the Erasmus+ Programme of the European Union

SHIPMARTECH

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

Project participants

- Tallinn University of Technology /Estonia
- University of Zagreb / Croatia
- University of Naples Federico II / Italy
- University of the Aegean / Greece

SHIPMARTECH

Co-funded by the
Erasmus+ Programme
of the European Union

Project objectives and aims

- Upgraded, harmonised and more clearly aligned courses and Master's level programmes in Maritime Engineering/ Naval Architecture = intellectual output
- Improvement in quality of curricula and subject courses;
- Improvement and diversification of teaching methods and formats (inc. digital and blended learning)
- Supporting internationalisation and student/staff mobility during the project and further - the courses developed are made available in English (in addition to the language of their initial creation).

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

Thematic work groups

- Automation Technology & Integrated Ship Systems
- Hydrodynamics
- Ship Structural design

- 20 courses /approx. 122 ECTS

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

Courses	TALTECH	UAEGEAN	UNINA	UNIZAG	Grand Total
Hydrodynamics	6		15		21
Experimental Methods in Naval Architecture			6		6
Seakeeping			9		9
SKK1700 Testing methodology and Model testing	6				6
Materials and Structures	6			12	18
18725 Structural Analysis				4	4
18732 Fatigue Strength of Structures				4	4
18781 Mechanics of Composite Materials				4	4
SKK1690 Engineering Mechanics	6				6
Ship Design and Construction	6	6	9	4	25
184110 Multi-Criteria Design and Optimization				4	4
Marine Technology		6			6
SKR0064 Small craft technology and assembly	6				6
Ship construction			9		9
Integrated ship systems		18	9	4	31
171295 Navigation Systems				4	4
Data Transmission Networks		6			6
Marine Electrical Systems			9		9
Monitoring and Control Systems		6			6
Design of Ship Automation		6			6
Automation Technology	12	6	9		27
Marine Controllers and Sensors			9		9
Sensors and Mechatronic Technology		6			6
SKK1790 Microprocessor systems	6				6
SKR0063 Sensors and power supplies	6				6
Grand Total	30	30	42	20	122

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

Workgroups

Workgroup	Course title	ECTS	University	Responsible
Automation Technology and Integrated Ship Systems	Sensors and Mechatronic Technology	6	UAEGEAN	Nikitas Nikitakos
	Microprocessor System	6	TALTECH	Kaarel Koppel
	Sensors and Power Supplies	6	TALTECH	Kaarel Koppel
	Marine Controllers and Sensors	9	UNINA	Flavio Balsamo
	Navigation Systems	4	UNIZAG	Josip Stepanic
	Data Transmission Networks	6	UAEGEAN	Nikitas Nikitakos
	Marine Electrical Systems	9	UNINA	Maurizio Fantauzzi
	Monitoring and Control Systems	6	UAEGEAN	Dimitrios Papachristos
	Design of Ship Automation	6	UAEGEAN	Nikitas Nikitakos
Hydrodynamics	Experimental Methods in Naval Architecture	6	UNINA	Ermina Begovic
	Seakeeping	9	UNINA	Ermina Begovic
	Testing Methodology and Model Testing	6	TALTECH	Tarmo Sahk
	Computational Marine Hydrodynamics	6	TALTECH	Mikloš Lakatoš
Ship Structural Design	Structural Analysis	4	UNIZAG	Smiljko Rudan
	Fatigue Strength of Structures	4	UNIZAG	Žeiko Božic
	Mechanics of Composite Materials	4	UNIZAG	Ivica Smojver, Darko Ivančevic
	Multi-criteria Design and Optimization	4	UNIZAG	Pero Prebeg
	Marine Technology	6	UAEGEAN	Ioannis Dagkinis
	Ship Construction	9	UNINA	Maria Acanfora
	Small Craft Technology and Assembly	6	TALTECH	Mihkel Kõrgesaar, Tõnis Tõns

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

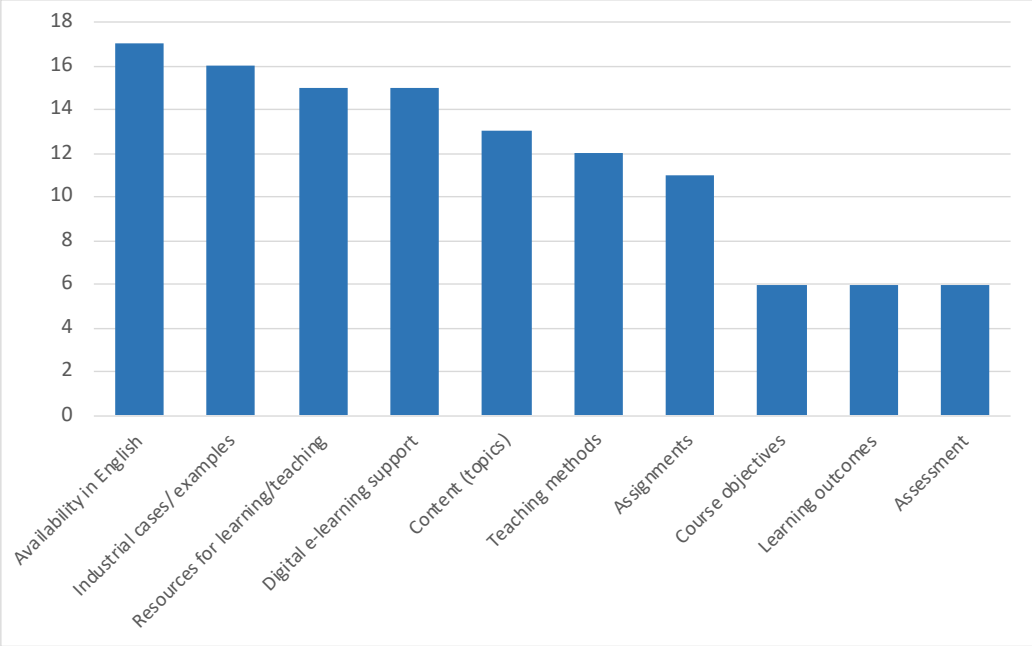
Course upgrading needs form

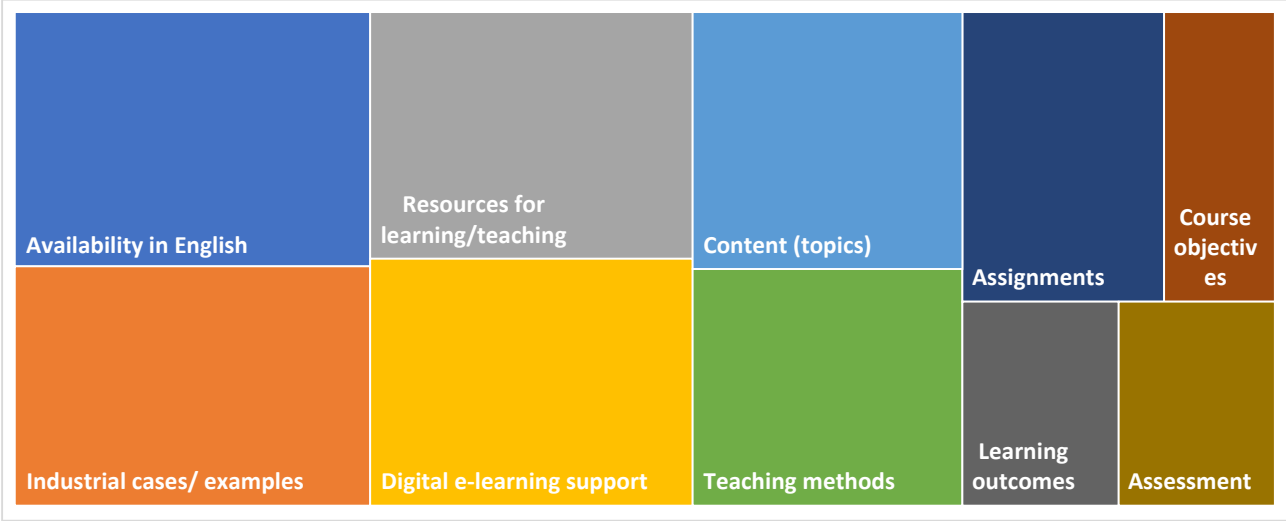
Assessment form	☐ written exam ☑ oral exam ☐ itten + oral exa ☐ s/fail assessm ☐ project/report ☐ group work ☐ course assign ☐ combined f combined, please comment evaluation criteria more detai
Teaching semester	☐ autumn ☑ spring
Study type	☑ daytime study ☐ session-based study ☐ both options, daytime and session-based st
Workload	lectures: 32 hours *if both study type options available, please give separately workload hours for each study type.* practices: 8 hours exercises: 8 hours
Brief description of the course	The course aims to provide the second level graduate in naval engineering with a general knowledge of marine automation systems and control systems. These skills will allow him, by eventually interfacing with automation specialists, to: - contribute to the definition of automation plant specification during design stage; - follow the automation plant commissioning and testing in the shipyard; - support on-board personnel in solving problems related with machinery automation. The course can serve as a basis for further study on data acquisition and processing systems and on the theory of automatic controls

Task: Defining of the components that need to be developed/upgraded/added during the following upgrading process (IO). This process results in course development needs analysis reports of each work group and a work plan for upgrading the courses. The components to be developed in case of each course are mapped, assessed and defined.

Components	Upgrading needed		Short description of upgrades needed	Any other comments?
	Yes	No		
Course objectives	☐	☑	The objectives of the course are well defined, no relevant updates are required	Always possible in relation to our project goals
Learning outcomes	☐	☑		Always possible in relation to our project goals
Content (topics)	☑	☐	The course will be held in the current semester for the first time at our university. A first syllabus has been issued but it can be upgraded in progress. A problem may be the limited number of assigned credits for a broad matter	
Resources for learning/teaching	☑	☐	Many resources can be considered for improve teaching effectiveness, as virtual laboratory and experiments, video and so on.	
Industrial cases/ examples	☑	☐	Industrial links are not easy to establishes, considering the basic level of the course and the limited workout. Integration with other experimental courses held in the same university may be desirable, ie Experimental Method in Naval Architecture	
Assignments	☑	☐	Exercises are currently only a limited part of the course. A data logging program to create simple automation routines might be helpful in providing students with some practical skills.	
Assessment	☐	☑		Always possible in relation to our project goals
Teaching methods	☑	☐	A discussion on teaching methods is auspicable even the uncertainty of the present pandemic situation does not help	
Digital e-learning support (Moodle /other)	☐	☑	In the current semester the course will be held via MS Teams platform, but at the moment no additional digital media has been considered	Always possible in relation to our project goals
Availability in English	☑	☐	The course is currently held in Italian, as material readings. New slides and material readings will be written in English. The course could be partially held in english	

Summary of course upgrading needs





Course title	ECTS	Course objectives	Learning outcomes	Content (topics)	Resources	Industrial cases	Assignments	Assessment	Teaching methods	Digital e-learning support	Availability in English
Sensors and Mechatronic Technology	6	X	X	0	X	X	0	0	X	NA	X
Microprocessor System	6	0	0	X	X	0	X	X	X	X	X
Sensors and Power Supplies	6	0	0	X	X	X	X	X	X	X	X
Marine Controllers and Sensors	6	0	0	X	X	X	X	0	X	0	X
Navigation Systems	4	0	X	0	X	X	0	X	0	X	X
Data Transmission Networks	6	X	0	0	0	X	X	0	0	X	X
Marine Electrical Systems	9	0	0	0	X	X	0	0	X	X	X
Monitoring and Control Systems	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Design of Ship Automation	6	X	0	X	X	X	X	0	0	X	X
Count		**3**	**2**	**4**	**7**	**7**	**5**	**3**	**5**	**6**	**8**
Experimental Methods in Naval Architecture	6	0	0	0	X	0	0	0	X	X	X
Seakeeping	9	0	0	X	X	X	X	0	X	X	X
Testing Methodology and Model Testing	6	X	X	X	X	X	X	0	X	0	0
Computational Marine Hydrodynamics	6	X	X	X	X	X	X	X	X	X	X
Count		**2**	**2**	**3**	**4**	**3**	**3**	**1**	**4**	**3**	**3**
Structural Analysis	4	0	0	X	X	X	X	X	0	X	X
Fatigue Strength of Structures	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mechanics of Composite Materials	4	0	0	X	0	X	0	0	X	X	X
Multi-criteria Design and Optimization	4	0	X	X	X	X	0	x	X	X	X
Marine Technology	6	X	X	X	0	X	0	0	0	X	X
Ship Construction	9	0	0	X	X	X	X	0	X	X	X
Small Craft Technology and Assembly	6	0	0	X	X	X	X	0	0	X	X
Count		**1**	**2**	**6**	**4**	**6**	**3**	**2**	**3**	**6**	**6**
Total count		**6**	**6**	**13**	**15**	**16**	**11**	**6**	**12**	**15**	**17**

IAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

INTELLECTUAL OUTPUT

- Each course is equipped with digital e-support
- Mandatory introductory poster in every e-support
- „Zero-lecture“ at the beginning of each course

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

Harmonizing e-support

SHIPMARTECH E-SUPPORT LEVEL 1. Chronological layout

Section 1 (Introduction: information and guiding documents of the course) (1) Erasmus+ logo, SHIPMARTECH logo (2) Course profile: Objectives, number of ECTS, lecturer's name and contacts (3) Introductory poster – infographics of the course (pdf-file uploaded) (4) Lecture zero/course guide (with Erasmus+ and SHIPMARTECH logos) incl. overview of teaching/learning formats and work arrangement, assessment, readings, lecture/class topics, main assignments/ project descriptions (pdf-file uploaded) (5) Extended course syllabus (incl. course content overview, learning objectives and outcomes, course activities plan with dates/deadlines, and assessment criteria) (pdf-file uploaded) (6) Forum for teacher's announcements (Moodle activity: Forum, Forum type: announcements) (7) Open Forum for students to post and discuss questions with each other. (Moodle activity: Forum; Forum type: Standard forum for general use) (8) Student feedback questionnaire (Moodle activity: Feedback)
Section 2 Course Topic 1/Module 1/ Week 1 (1) Name of the topic/module/week (label text) (2) Brief introduction to the topic/module (label text or pdf-file uploaded) -OPTIONAL (3) Lecture notes, readings, compendium etc. with guidelines or instructions (Label text and pdf-files uploaded/ or web-links to resources (OPTIONAL use of other Moodle resource or activity: folder, book, lesson, page, URL, or other) (template with project and Erasmus+ logo in lectures - OPTIONAL) (4) Assignment OR exercise OR test (5) Discussion forum, chat or other (OPTIONAL)
Section 3 Course Topic 2/Module 2/ Week 2 Same sub-sections as in Section 2 ETC.

SHIPMARTECH E-SUPPORT LEVEL 2. Chronological layout

Section 1 (Introduction: information and guiding documents of the course) (1) Erasmus+ logo, SHIPMARTECH logo (2) Course profile: Objectives, number of ECTS, lecturer's name and contacts (3) Introductory video (OPTIONAL, but recommended) (4) Introductory poster – infographics of the course (pdf-file uploaded) (4) Lecture zero/course guide (with Erasmus+ and SHIPMARTECH logos) incl. overview of teaching/learning formats and work arrangement, assessment, readings, lecture/class topics, main assignments/ project descriptions (pdf-file uploaded) (5) Extended course syllabus (incl. course content overview, learning objectives and outcomes, course activities plan with dates/deadlines, and assessment criteria) (pdf-file uploaded) (6) Forum for teacher's announcements (Moodle activity: Forum, Forum type: announcements) (7) Open Forum for students to post and discuss questions with each other. (Moodle activity: Forum; Forum type: Standard forum for general use) (8) Student feedback questionnaire (Moodle activity: Feedback)
Section 2 Course Topic 1/Module 1/ Week 1 (1) Name of the topic/module/week (label text) (2) Brief introduction to the topic/module (label text or pdf-file uploaded) -OPTIONAL (3) Lecture notes, readings, compendium etc. with guidelines or instructions (Label text and pdf files uploaded/ or web links to resources, but VARIED Moodle resources or activities used: folder, book, lesson, page, URL, videos, or other) (template with the project and Erasmus+ logo in lectures - OPTIONAL) (4) Assignments OR exercises OR test – INTERACTIVE tasks are included Moodle activity Assignment, Forum – uploading of files by students) OR exercise (quiz, student quiz, questionnaire, Hotpot, SCORM package, HTML5 Package, board, workshop, wiki, etc.), or test (e.g., Moodle quiz) – either self-assessed, peer-assessed/feedback given by peers or teacher-assessed/feedback given by the teacher (5) Discussion forum, chat or other
Section 3 Course Topic 2/Module 2/ Week 2 Same sub-sections as in Section 2

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

PROJECT ACTIVITIES

- **Course development needs analysis** (Feb – Aug 2021)
- **Upgrading and harmonisation of courses (developing Intellectual Output/IO)** (June 2021 – Nov 2022/Feb 2023)
- **Testing/piloting** of courses/their parts at an intensive programme (Nov 2022)
- **Course refining** (based on results of course testing and feedback) and **making courses available** via each partner university Moodle/e-learning platform (Jan – May/June 2023)
- **Staff training events and project meetings** (online Jan '21, face-to-face Nov. '21 (Naples), Nov '22 (Tallinn), May '23 (Piraeus), July '23 (Kuressaare)
- **Multiplier event(s)** – International seminar in Piraeus, Greece (May 2023) and in Viinistu, Estonia (Aug 2023)

TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union


JACK&
JONES


STATION 5
STATION 4


SHIPMARTECH
Co-funded by the
Erasmus+ Programme
of the European Union

ECK0380 Ship Buoyancy and Stability

- Masters' compulsory course, 6 ECTS (26h/ECTS, 156h workload), semester 1
  - Workload 156h = 48h frontal lessons (31%) + 108 self-study (69%)
  - Prerequisites: Engineering Mechanics, Fluid Mechanics
- **Learning Outcomes:** upon successful completion of this course, students will be able to evaluate:
  - Hydrostatic pressure force and the centre of pressure on submerged bodies
  - Ship's buoyancy and initial stability
  - Ship's dynamic stability
  - Ship's stability in special cases
    - free surface
    - hanging load
    - damage stability
    - grounding

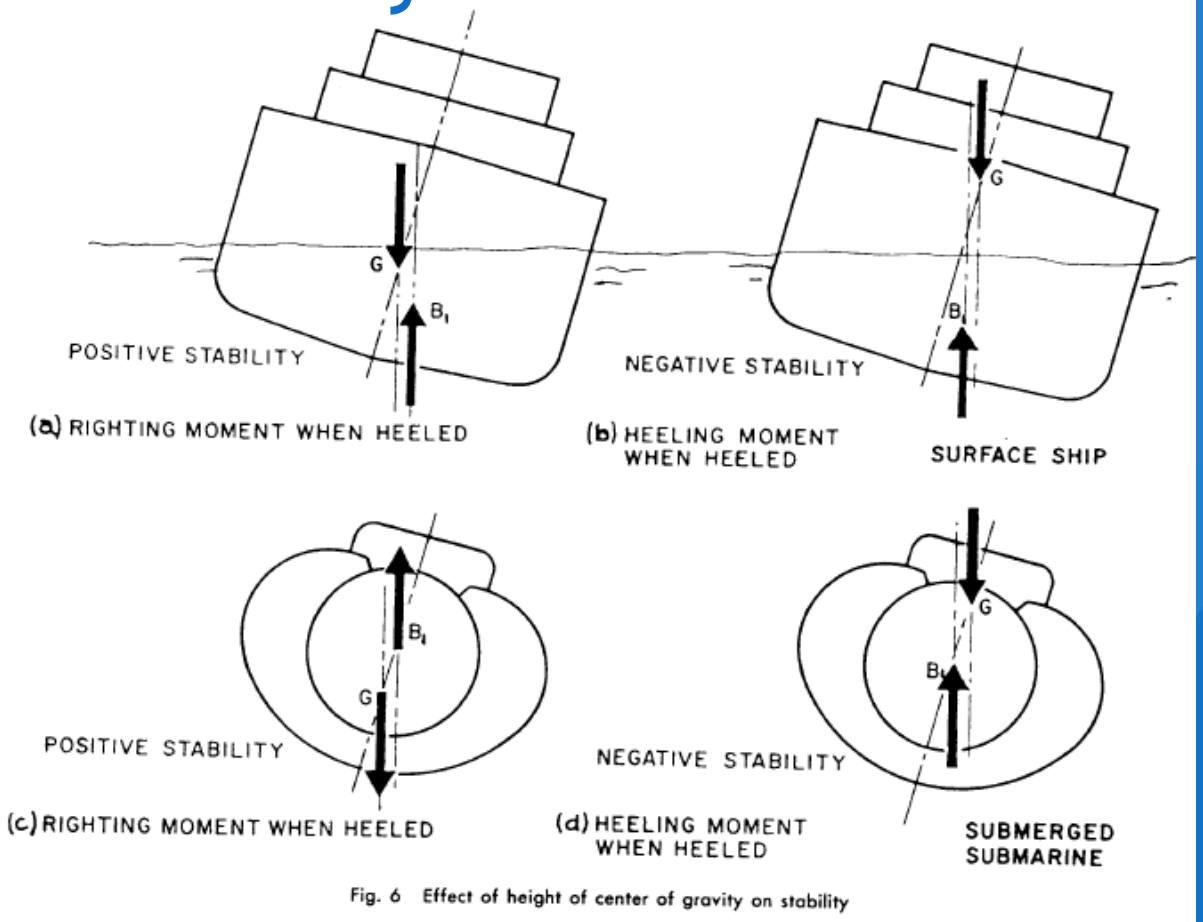
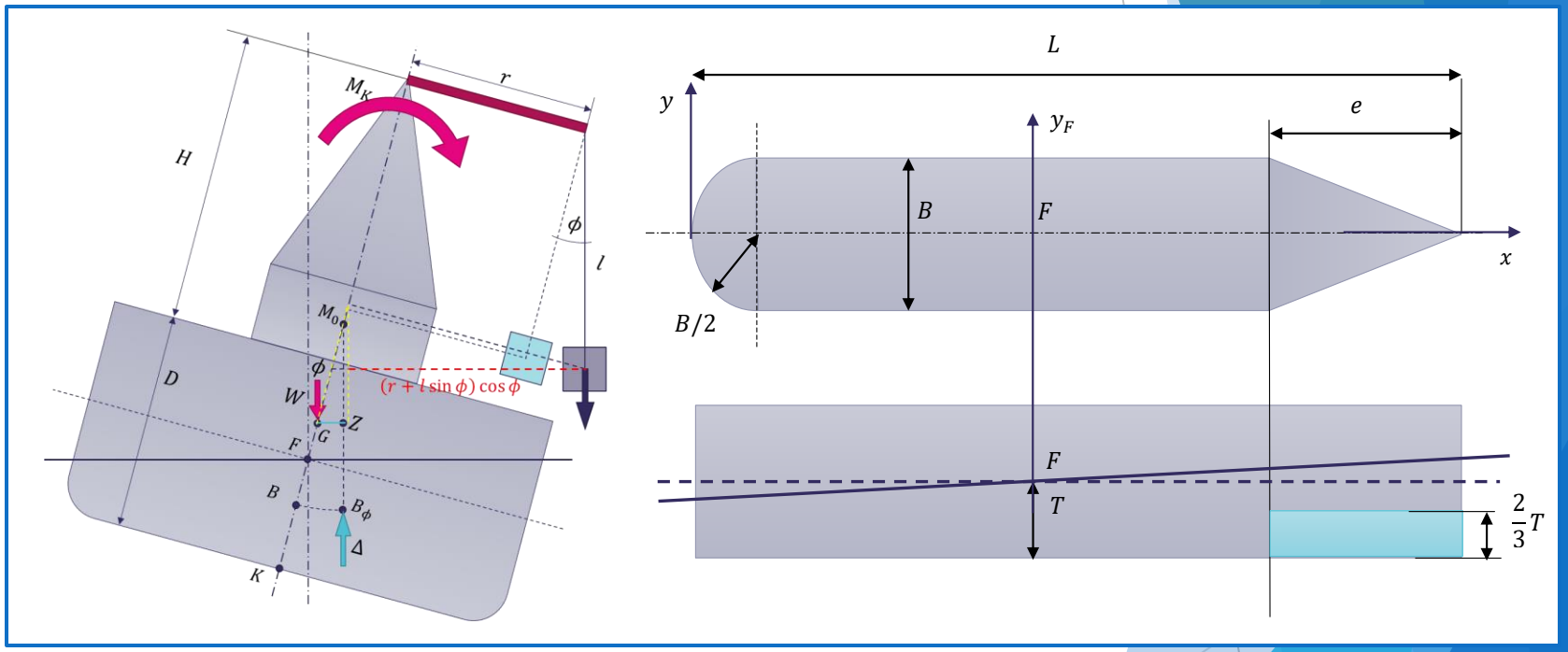


Fig. 6 Effect of height of center of gravity on stability

Co-funded by the Erasmus+ Programme of the European Union

ECK0380 Ship Buoyancy and Stability: Teaching & learning methods

- Seminars
  - (2x90min/week)
- 5 Moodle (online) tests
- Written exam
- Reading notes
- Course project



TAL TECH KURESSAARE COLLEGE

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

ECK0380 Ship Buoyancy and Stability: Teaching & learning methods

Küsimus 7

Pole veel vastatud

Võimalik punktisumma: 1,00

Märgi küsimus lipuga

Muuda küsimust

Laeva veeväljasurve DISM=13755 t ja ujuvuspind on A_{WP}=1921 m^2. Laeva võib pidada veeliini vahetus läheduses sirgekülgseks. Leida laeva süvise muut δT [m], kui laev siirdub mage veega sadamast (kus vee tihedus on 1 t/m^3) avamerele (kus vee tihedus on 1,026 t/m^3).

The ship's displacement mass is DISM=13755 t, and the waterplane area is A_{WP}=1921 m^2. The ship's sides can be considered vertical near the waterline. Calculate the change of draught δT [m] when the ship is sailing from the port (water density 1 t/m^3) to sea (water density on 1,026 t/m^3).

Vastus:

Co-funded by the Erasmus+ Programme of the European Union

ECK0380 Ship Buoyancy and Stability: Learning resources & Assessment

Learning resources

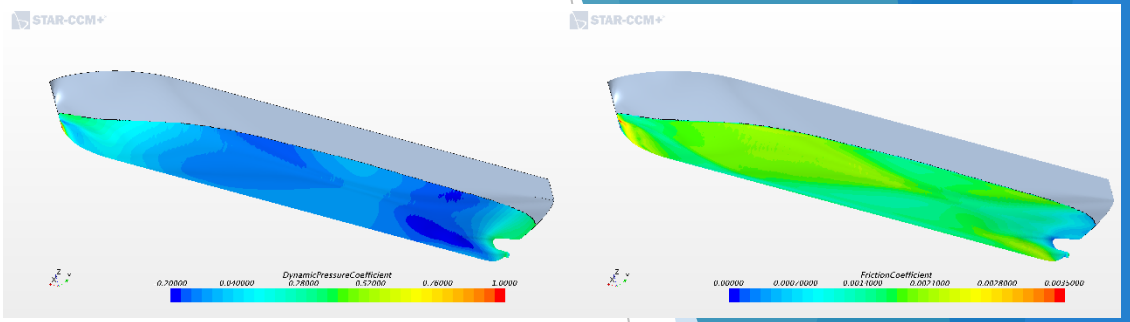
- Lecture notes
- Adrian B. Biran Ship Hydrostatics and Stability 2014
- Rawson, K.J., Tupper, E.C. Basic Ship Theory. Vol. 1,2, 5th Edition, Oxford: Butterworth-Heinemann, 2001.
- Larsson, L., Eliasson, R., Orych, M. Principles of Yacht Design. A&C Black, 2014

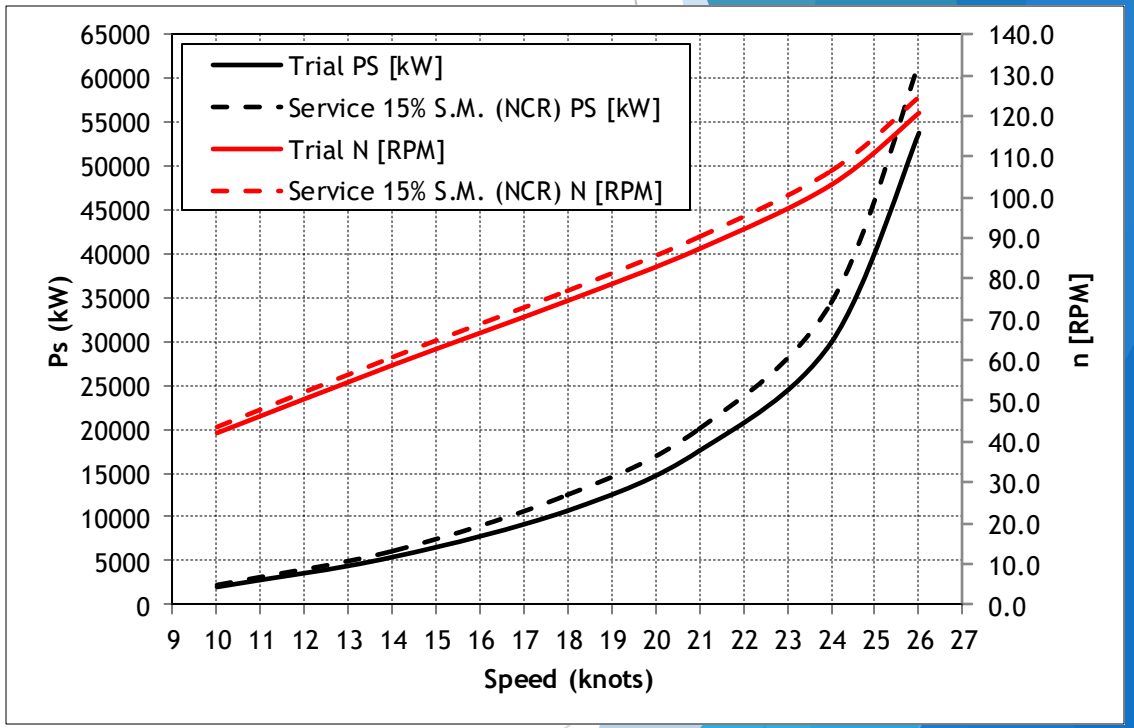
Assessment tool	Weight
Moodle tests	10 %
Reading notes	20 %
Course project	20 %
Written Exam	50 %
Total	**100%**

"5" excellent 91-100
"4" very good 81-90
"3" good 71-80
"2" satisfactory 61-70
"1" poor 51-60
"0" fail less than 51

ECK0390 Ship Hydrodynamics

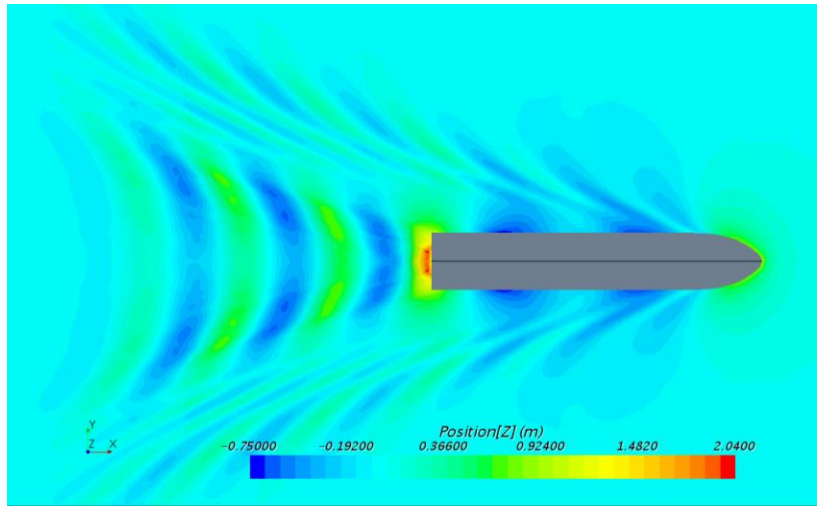
- Masters' elective course, 6 ECTS (26h/ECTS, 156h workload), semester 2
  - Workload 156h = 48h frontal lessons (31%) + 108 self-study (69%)
  - Prerequisites: Engineering Mechanics, Ship Buoyancy & Stability, Fluid Mechanics
- **Learning Outcomes:** upon successful completion of this course, students will be able to:
  - Classify different components of a ship's resistance.
  - Estimate a ship's resistance using experimental and empirical methods.
  - Estimate a ship's propulsive power and efficiency.

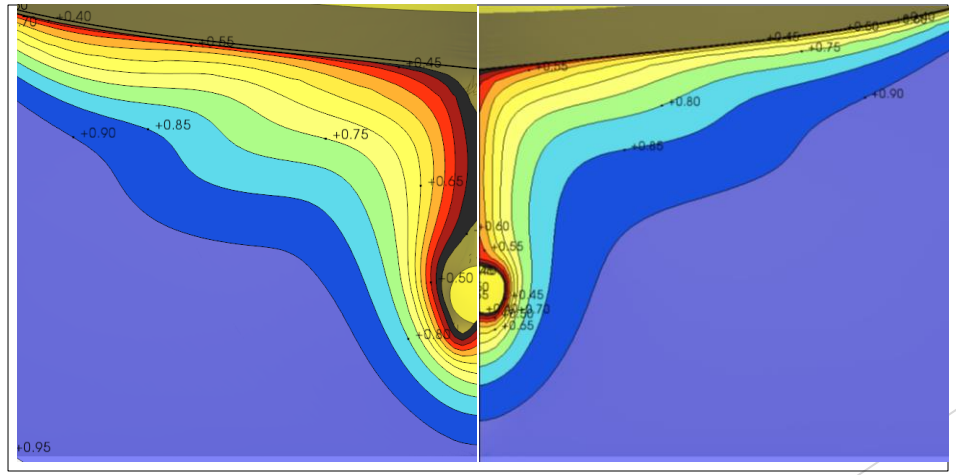




ECK0390 Ship Hydrodynamics:Teaching & learning method

- Seminars
  - (2x90min/week)
- 5 Moodle (online) tests
- Written exam
- Reading notes
- Course project





Wake at propeller plane CFD in model scale (left) and in full scale (right) with default k-ε turbulence model

ECK0390 Ship Hydrodynamics: Learning resources & Assessment

Learning resources

- Lecture notes
- Lars Larsson & Hoyte C. Raven, Principles of Naval Architecture Series - Ship Resistance and Flow,(2010)
- Justin E. Kerwin and Jacques B. Hadler, PRINCIPLES OF NAVAL ARCHITECTURE SERIES: PROPULSION, (2010)
- J.S. Carlton, Marine Propellers and Propulsion , (2007)
- Molland, A., Turnock, S., & Hudson, D. (2017). Ship Resistance and Propulsion

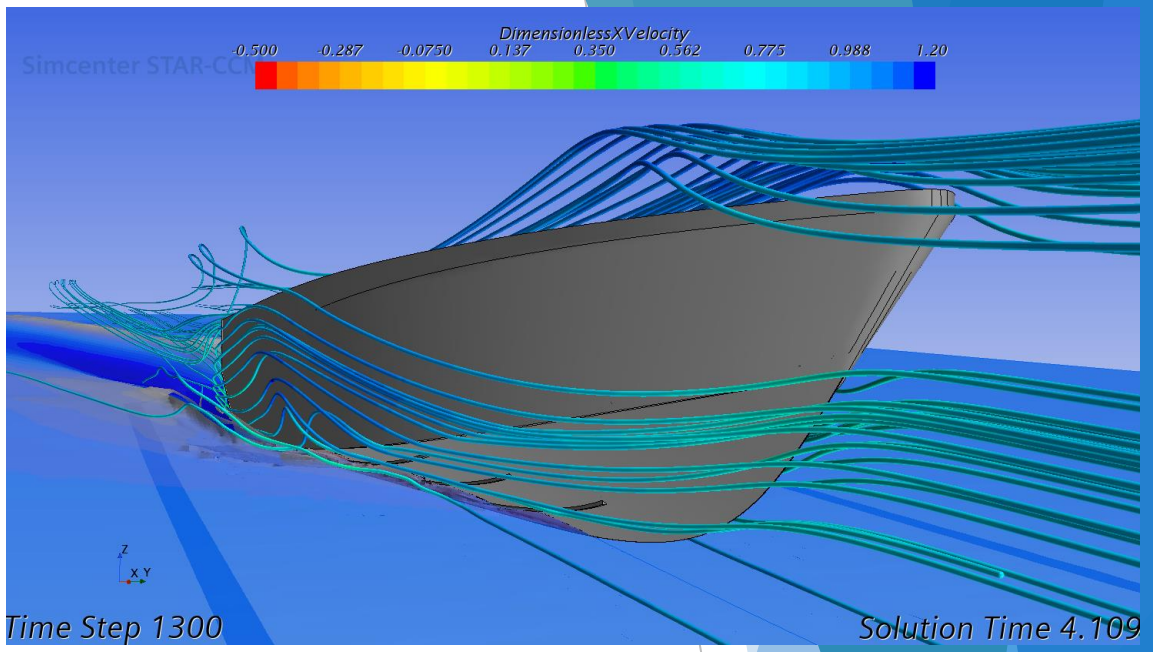
Assessment

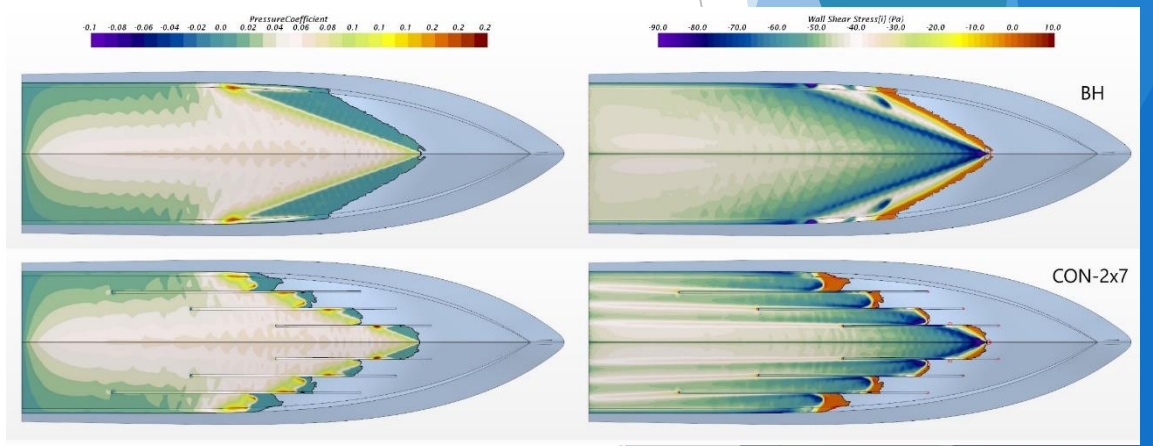
Assessment tool	Weight
Moodle tests	30 %
Reading notes	20 %
Written Exam	50 %
Total	100%

"5" excellent 91-100
"4" very good 81-90
"3" good 71-80
"2" satisfactory 61-70
"1" poor 51-60
"0" fail less than 51

ECK0400 Computational Marine Hydrodynamics

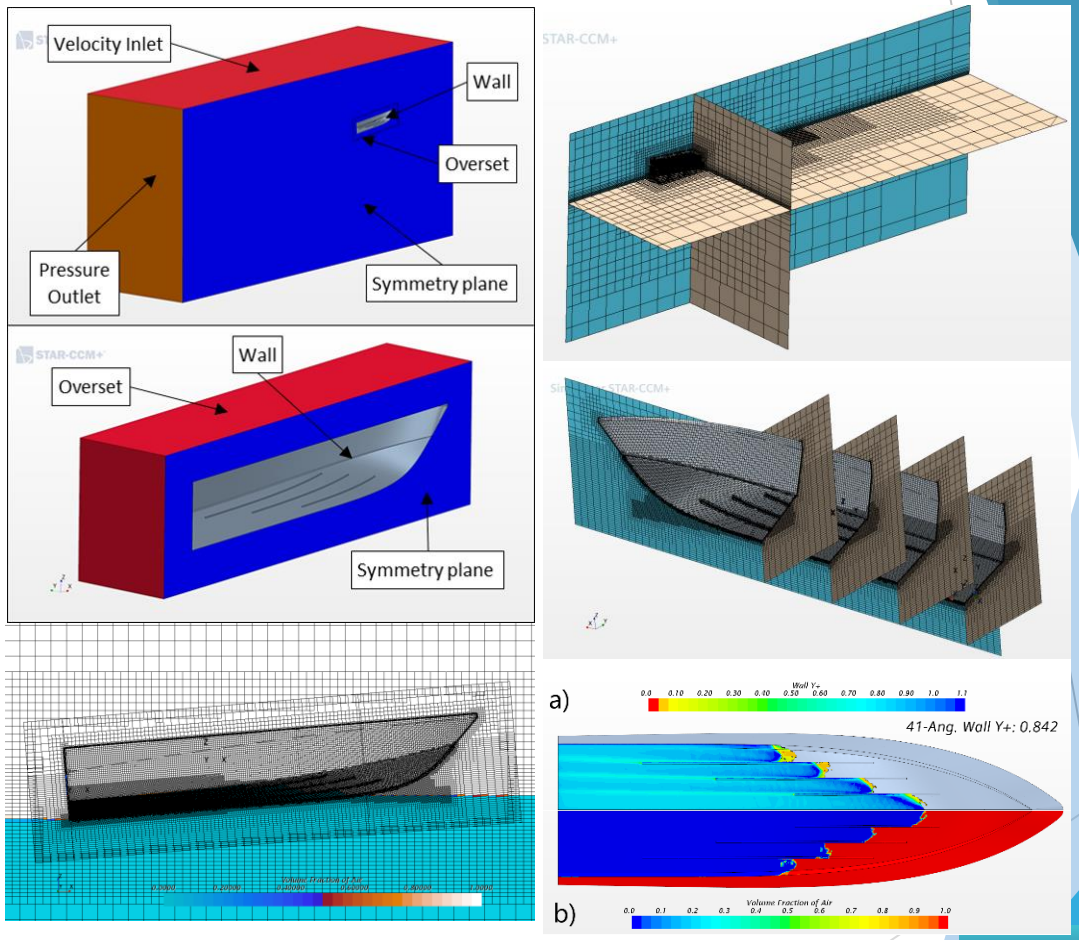
- Masters' elective course, 6 ECTS (26h/ECTS, 156h workload), semester 3
  - Workload 156h = 48h frontal lessons (31%) + 108 self-study (69%)
  - Prerequisites: Ship Stability, Ship Hydrodynamics, Fluid dynamics
- Learning Outcome Upon successful completion of this course, students will be able to:
  - Compare different numerical approaches
  - Select an appropriate numerical set-up for a given problem
  - Calculate a ship's resistance by numerical simulation
  - Verify & validate the numerical model





Teaching & learning formats and methods

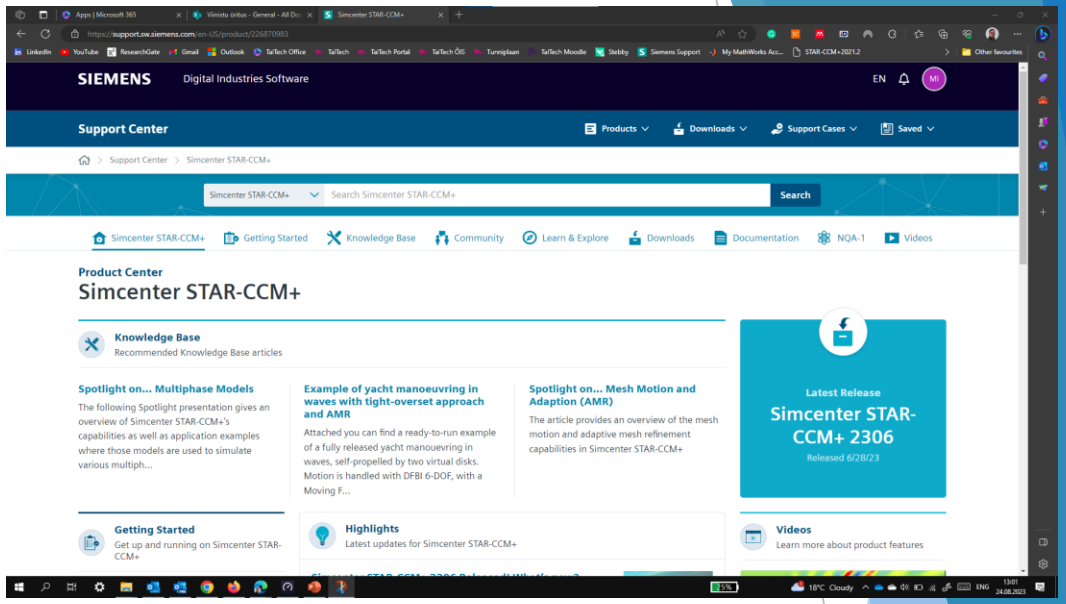
- Seminars
  - Biweekly seminar on reading circles
  - Weekly tutorial/help-desk sessions
- Reading Notes/ circle (RC)
  - 6 Biweekly reading reports (individual and group memos)
- Course Project (technical report)
  - Boundary conditions
  - Discretisation schemes
  - Local features of the mesh
  - Turbulence models
  - Verification & Validation against model test data
- Peer review
- Work Diary
- Final presentation



Co-funded by the Erasmus+ Programme of the European Union

Learning resources & Assessment

- Student will be provided with:
  - Licence keys for STAR-CCM+
  - Siemens support account (for knowledge base)
  - TalTech HPC cluster account (for simulations)
- Reading material
  - Oleg Zikanov, Essential Computational Fluid Dynamics, 2010
  - Lars Larsson & Hoyte C. Raven, Principles of Naval Architecture Series - Ship Resistance and Flow,(2010)
  - Scientific papers available Moodle
  - Articles in Siemens knowledge base



Assessment tool	Mark
Course project report	60 %
Peer review	10 %
Reading notes	10 %
Work diary	10 %
Final presentation	10 %
Total	**100%**

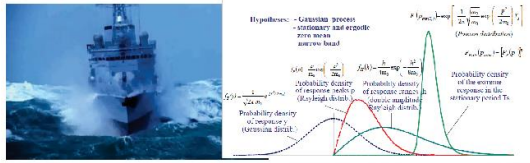
"5" excellent 91-100
"4" very good 81-90
"3" good 71-80
"2" satisfactory 61-70
"1" poor 51-60
"0" fail less than 51

SHIPMARTECH

Co-funded by the Erasmus+ Programme of the European Union

Lessons learned

- North VS South
  - Northern European teaching is significantly more application oriented compared to the theoretical teaching at Southern European Universities.
  - Southern European universities prefer oral examination.
- Moodle test & course project instead of uniform home assignments.
  - Moodle test are a great for self-assessment
  - Problem solving is evaluated in the written exam
- Reading circles and notes enhance learning
- Cheat sheets



Ship Seakeeping

Ermina Begovic

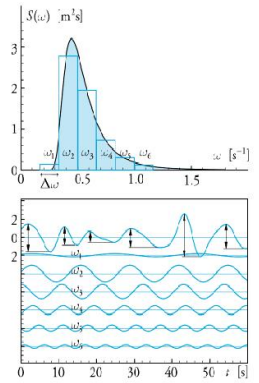
Abstract: Ship Mission, Environment, Ship Responses and Seakeeping Performance criteria are four principal terms to describe seakeeping behavior of the ship and offshore structures in design and operational studies. The course will give you knowledge of the mathematical models, overview of numerical and experimental methods and will equip you with tools to perform the seakeeping analysis and evaluate ship operability at the design stage.

Contents of the Course

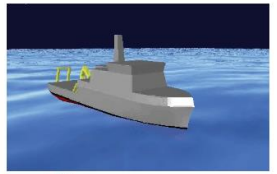
L1 – L4 Regular Waves. In these lectures we will repeat Airy and Stokes wave theories, introduce velocity potential and define wave parameters

L5 – L6 Irregular wave as stochastic process. In these lectures we will introduce statistical analysis of wave record, introduce PDF of wave amplitudes and apply probability of exceedance.

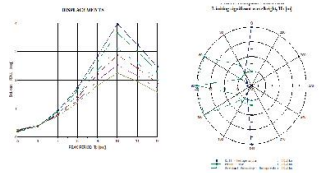
L7 - L9 Spectral analysis. In these lessons we will learn and apply Fourier analysis, define Power Density Spectrum and Ideal sea spectra. We will calculate spectral moments and connect them with the statistical analysis.



L10 – L15 Ship Responses in Regular Waves. In these lectures we will learn and calculate radiation and diffraction forces acting in linearized seakeeping. We will calculate ships' elementary, absolute and relative motions.



L16 – L20 Ship Responses in Irregular Seas. We will learn frequency mapping, apply variance preserving method and calculate ship responses in irregular waves. We will define and calculate performance criteria and ship operability.



L21 - 24 Experimental assessment of Seakeeping and Nonlinear Phenomena. In these lessons we will measure ship responses in towing tank and learn data analysis. We will discuss slamming, water on deck, propeller emergence and added resistance.

TAL TECH KURESSAARE COLLEGE

University of the Aegean

FSB University of Zagreb Faculty of Mechanical Engineering and Naval Architecture

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

Co-funded by the Erasmus+ Programme of the European Union