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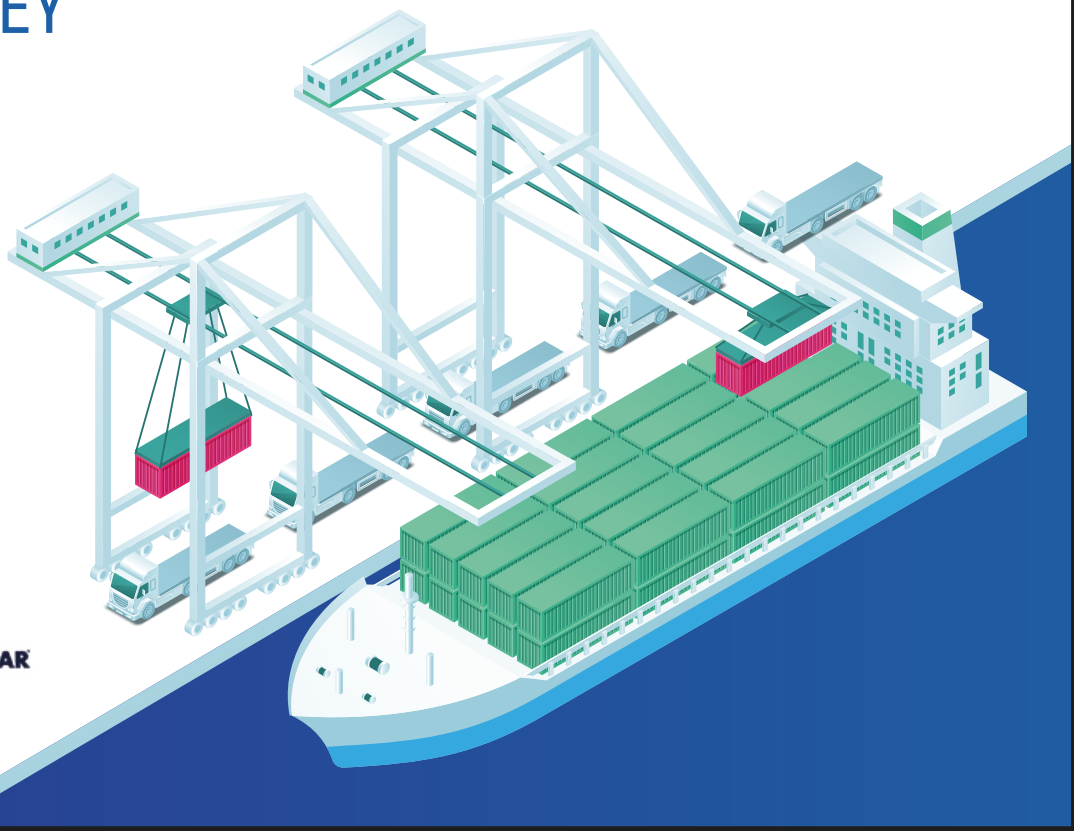
ABSTRACT BOOK

ORAL PRESENTATIONS

4th GLOBAL CONFERENCE ON INNOVATION IN MARINE TECHNOLOGY AND THE FUTURE OF MARITIME TRANSPORTATION

GMC'21

NOVEMBER, 18th-19th, 2021
ISTANBUL, TURKEY



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FOREWORD

On behalf of the organizing committee, we are delighted to welcome you for Global Conference on Innovation in Marine Technology and the Future of Maritime Transportation, which will be organized for the 4th time with the partnership of TMMOB The Chamber of Marine Engineers, Strathclyde University, Constanta Maritime University and Iskenderun Technical University.
In today's world global warming is talked about intensely. Also, The International Maritime Organization has set an ambition to reduce the carbon intensity of emissions from shipping. From this point, we were determined the first main theme of the international conference as "Decarbonization in the Maritime Sector".

The pandemic has brought to the fore the importance of maritime transport as an essential sector for the continued delivery of critical supplies. The global shipping industry has played a vital role in the global response to the COVID-19 pandemic. Moreover, seafarers are heroes of the pandemic as shipping plays vital role in this crisis. In this respect, the second main theme of the international conference is "Effects of the Pandemic on Maritime Transport and Maritime Education which includes distance learning.

In addition to this main topics, scientific research on subjects such as alternative Fuels & Renewable Energy, Autonomous Ships & Systems, shipbuilding, Energy Efficiency&Energy Management, Material Technology, Naval Architecture&Offshore Technologies, port operations, digital approaches in maritime transport management, Maritime Policy, Law & Governance, Seafarers Health & Environment, human factor, innovative design and inventions, cyber security, Port Operations & Technologies, Polar Research will be presented on twenty-eight sessions in these conference. From this standpoint, I would like to thank researchers and authors from twenty-nine different countries who show politeness by sharing their studies with us here. Furthermore, many thanks to all chairmen and invited keynote speakers who will give their precious time to the conference.

During organization process, which was started at October 2020, The Global Maritime Conference organisation committee have done fantastic and great work. I would like to thank them for their energy and competence during the organization process.
I would like to present a special thanks to Opteamist Team that find immediate solutions to our problems.

Another special thanks to Board Members of TMMOB The Chamber of Marine Engineers, for their fundamental work in motivating of organisation committee.

Finally, on behalf of the Conference Organizing Committee, I would express special thanks to all the financial supporters, delegates of maritime sector and participants and deeply indebted to all the committee members whose voluntary efforts brought such a great success to conference.

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ORAL PRESENTATIONS

[Keynote Speaker]
Antarctica in the View of an Analytical Chemist

Sezgin Bakırdere

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ABSTRACT
The better understanding of anthropogenic pollution requires a deep knowledge on the contamination levels of terrestrial and marine ecosystems of Polar Regions. Despite the geographically isolated environment of Antarctica, persistent contaminants have been detected in environmental samples taken from various areas of Antarctica (Ashraf, 2017). These pollutants are transported by long-distance atmospheric and oceanographic circulation, and cause the destruction and deterioration of the ecosystem of the region. These compounds can accumulate in tissue organisms and alter the reproductivity and homeostasis, disrupt the normal functioning of immune and endocrine systems (Bargagli, 2006, Jones and Voogt, 1999).
As the world has become more concerned about the vulnerability of abiotic and biotic environments of Antarctica to persistent contaminants, the monitoring of pollutants in these regions is of great importance for protecting the biodiversity and functioning of ecosystems. Addressing the rapid change in the global pattern of contaminants due to the exponential population growth and industrialization (Sosa-Ferrera et al., 2013), accurate data on the level of contaminants in terrestrial and marine ecosystems requires continuous monitoring of contaminants using sensitive and accurate analytical methods (Szopińska et al., 2017). Currently, modern analytical instruments have still problems for the determination of most organic/inorganic contaminants due to the complex nature of environmental samples. Therefore, several extraction/preconcentration methods have been combined with analytical instruments such as liquid-liquid extraction, solid phase extraction and other microextraction strategies to get high accuracy and precision at trace levels.
This study was designed to obtain low detection limits and accurate results for the determination of organic/inorganic contaminants in environmental samples taken from Horsehoe island of Antarctica by combining dispersive liquid-liquid microextraction, switchable solvent liquid-liquid microextraction and dispersive solid phase extraction strategies with analytical instruments such as AAS, ICP-OES and ICP-MS for inorganic contaminants and GC-MS and HPLC-UV for organic contaminants.

Keywords: Antarctica, Anthropogenic Pollution, Contaminants, Analytical Strategies

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[Keynote Speaker]
The Journey from Deterministic Rules to Risk Based Ship Design & LCRM

Dracos Vassalos

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ABSTRACT
The Design for Safety philosophy and the ensuing formalised methodology, Risk-Based Design, was introduced in the maritime industry in the mid-nineties as a design paradigm to help bestow safety as a design objective and a life-cycle imperative. This was meant to ensure that rendering safety a design driver, would incentivise the maritime industry to seek for cost-effective safety solutions, in response to rising societal expectations for human life safety. It turned out that the removal of rules-imposed (largely-conservative) constraints and the adoption of a goal-based, hence performance-based, approach to address safety has had much more profound effects than originally anticipated, the full impact of which is yet to be delivered. This paper is tracing the learning curve of Design for Safety (Risk-Based Design) and presents implementation examples at local and ship levels of what is now regarded as an established methodology, highlighting the challenges ahead and the opportunities awaiting those willing to rise to these challenges.

[Alternative Fuels & Renewable Energy]
Comparison of Alternative Fuels in Marine: A Review

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[2]*Department of Maritime Business Administration, Bandırma Onyedi Eylül University, Balıkesir, Turkey*

PURPOSE: The aim of this article is to compare academic studies on the advantages, disadvantages and use of alternative fuels used in ships.

METHOD: In this study, the method of data analysis by literature review is used. During the study, various academic publications and books were examined and the data were examined.

FINDINGS: In this study, no data was found, as no experimental study was conducted. In this study, data on the advantages, disadvantages and use of alternative fuels have been found.

CONCLUSION: As a result of this study, the comparison of the types of alternative fuels used in ships was made and the advantages and disadvantages of alternative fuels were mentioned. Information on why alternative fuels are used and what effects they have are explained.

Keywords: Alternative Fuel, Renewable Energy, Emission

[Alternative Fuels & Renewable Energy]
Safety Precautions for the Use of LNG as Marine Fuel

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PURPOSE: Global warming and air pollution causes irreversible consequences on climate change and human health.Main reason of this is fossil fuel used in transportation.IMO(International Maritime Organisation), has changed the emission rates in the MARPOL Annex 6 rules as of 2020 and reduced the sulfur rate from 3.5 percent to 0.5 percent and led the maritime sector to alternative fuels. Compared to other alternative fuels, liquefied natural gas (LNG) is an attractive option with almost zero emission rate, ease of access, availability of ports that currently supply LNG and low price in the fuel market. In addition, according to the life cycle assessment, which is a methodology created by ISO 14040: 2006 to examine the impact of a product on the environment, in order for a fuel to be environmentally sustainable, it has to be associated not only with low emissions during fuel combustion, but also with the entire fuel life cycle, starting with raw material extraction, fuel production, distribution and finally combustion.

METHOD: A vast literature review method has been applied on the topic so as to determine if it is feasible to use LNG as an alternative fuel and its probable risks in bunkering operations.

FINDINGS: The life cycle environmental performance of LNG as a marine fuel has been observed to have its impact on climate change in the range of 20% to 5%, significantly reducing SO2 and NOX emissions compared to HFO.LNG Refueling is specified in the IGC code. In addition, there are standards brought by class organizations.

CONCLUSION: This study shows us how to avert from the risk of LNG leakage accident.For this reason, risk analysis should be done correctly, ISM checklists should be created and applied on ships accordingly.

Keywords: Alternative Fuel,LNG,Bunkering Operation

[Alternative Fuels & Renewable Energy]
Decarbonisation; Analysing Green Fuel Practices for the Shipping Industry

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PURPOSE: Nowadays, the ocean globally faces tremendous changes and challenges due to pollution. Moreover, an increasing number of environmental externalities and consequences affect society. Sustainability has a multidimensional meaning, especially for shipping where great effort is put for its seamless implementation. For a fuel to be considered sustainable, it must be relatively cheap, environmentally friendly, and massively adopted. This paper aims to uncover any correlation between shipping and sustainability.

METHOD: Extensive Fuel Analysis answers whether green shipping is forging ahead. An interesting challenge the industry has to do with balancing green practices with profitability. Pollution, responsible for climate change, can be suppressed if well established, ingenious and adequate measures are taken. Being sustainable is extremely useful, promoting economic prosperity, environmental quality, and equity. A main goal is to find effective ways so that transportation can be more sustainable, thus viable and eco-friendly. Studies have shown that customers and shippers seem to trust and rely on businesses with a well-thought sustainable management.

FINDINGS: In the structures literature review, relevant research has been analysed in order to understand how each sustainable solution works and how it can be integrated into a company's culture. Promising solutions for Green shipping include use of; biofuels, hydrogen, electric power, hybrid engines, LNG-based propulsion, biodiesel, biomass, wind-powered propulsion, solar panels, green chain management -including Market Based Indicators-, hydrogen and slow-steaming. Containerized industries seem prone to slow-steaming as it is easier to implement and is profitable in the long-term. Hybrid use of biodiesel, LNG and PV seems to be popular amongst green propulsion techniques.

CONCLUSION: This paper pertains to extensive analysis of alternative ways to achieve sustainability, their impact, cost, advantages, and drawbacks. Hence it is able to answer the research question: Are the current maritime sustainable practices able to deliver on the promise of "going green"?

Keywords: Alternative Fuels, Sustainable Transportation, Maritime Transportation, Sustainable Fuels, Green Shipping

[Alternative Fuels & Renewable Energy]

Parametric Analysis of a Methane Fueled CI Engine Using RSM.

Halil Saraçoğlu

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OBJECTIVE: This review is an application of response surface methodology for investigation the effects of design and operating parameters on performance and emissions of a methane fuelled CI engine. Kriging and multivariate linear regression methods which have different structural approaches are used for estimation the effects of input parameters.

CASE REPORT: The study has three steps. In the first step, selected CFD code is validated by test engine measurements. The defined Design of Experiment (DoE) plan was simulated for CFD real data generation. In the second step, Linear regression and Kriging models are constructed on observed CFD dataset. The approximation accuracy of the two response surface models are examined and compared according to their the estimation ability. Last step, results of the best estimator method are examined for the parametric analysis of a methane fuelled CI engine.

CONCLUSION: The significant outcomes of this study; It is found that Kriging method has a much stronger estimation ability than the linear regression method. Also a new algoritm is developed to obtain estimation data by reading Kriging contour maps properly.
In this study, Kriging estimation results can be summarized as: Da and SOI are the most effective parameters to improve performance and emissions simultaneously. The narrowing on the piston bowl parameters “Da, Tm and R” has 100%, 60% and 50% improvement effects on the performance and emission formation. Also, delaying at SOI and decrease at SpAng (injection of pilot fuel into the center of the piston bowl) has an 71% and 33% improvement. In addition, Kriging estimation results of this study were found to be consistent with the results of other parametric studies of methane fuelled CI engine.

Keywords: Response Surface Modelling, Compression Ignition, Linear Regression; Kriging, Latin Hypercube Sampling

[Alternative Fuels & Renewable Energy]

Evaluation of LNG, Ammonia and Methanol as a Marine Fuel

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PURPOSE: Alternative fuels are considered a priority to reduce greenhouse gas (GHG) emissions within the decarbonisation target by 2050 determined through the International Maritime Organization (IMO). Among alternative fuels, some of them such as liquefied natural gas (LNG), methanol, and ammonia attract attention due to their low carbon or carbonless structures. On the other hand, the rate of alternative fuel usage on marine vessels is affected by some factors such as sustainability and availability of infrastructures in technical and operational ways, and insufficient network at the point of bunkering of fuels, the safety factor of fuel systems, fuel costs, capital and operational expenses of systems, etc...

METHOD: Within the scope of this study, the use of LNG, ammonia, and methanol as a marine fuel is examined with SWOT (strengths, weaknesses, opportunities, and threats) analysis, individually.

FINDINGS: Then a detailed comparison process has been carried out between the fuels based on their properties.

CONCLUSION: Finally, significant results that could be taken in the decision-making period during the meeting of the decarbonisation target have been presented to policy-makers, stakeholders, and maritime companies.

Keywords: LNG, Ammonia, Methanol, Ship, SWOT Analysis

[Maritime Policy, Law & Governance]
"A Rush to Icebergs?": International Law on Iceberg Harvesting

Onur Sabri Durak

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PURPOSE: As anyone familiar with the Titanic case can assume, icebergs frequently expose unforeseen and uncontrollable problems for humanity. Moreover, the frozen lands and seas of polar regions may soon become the scene of dispute for international law. Besides the exploration and exploitation of aquatic and mineral resources in polar regions, harvesting icebergs for fresh water will soon portray a new era, rushing to icebergs. Even though, it seems likely that icebergs soon will be harvested and utilized for their fresh water resources, a number of legal issues remain unclear. This paper aims to address thematic problems arising from iceberg harvesting and discuss whether an international regime is needed for regulating the activities of iceberg harvesting.

METHOD: For the research method, the paper initially defines the iceberg harvesting and discusses whether it falls within the scope of mineral mining or not. In the second place, the paper analyzes the concept of iceberg harvesting within the ambit of international law instruments. Thirdly, the paper aims to discover side legal issues related to iceberg harvesting, namely as, water law and food safety law.

FINDINGS: Harvesting icebergs for fresh water resources is not a new concept, however, establishing or acquisition of ownership on icebergs or harvesting them is challenging, since the status quo of icebergs have not been clearly defined under the international law. Therefore, it requires a further and deeper legal analysis for the joint interest of humankind.

CONCLUSION: The iceberg harvesting will soon become a new way of fresh water resources. However, international legal regime is not sufficient enough to respond all issues arising therefrom. In this context, this paper aims to conclude with a proposal of international legal instrument.

Keywords: Iceberg, Iceberg Harvesting, International Law

[Maritime Policy, Law & Governance]
Considerations on Legal Context Regarding Cyber-crime in Maritime Transport

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PURPOSE: Nowadays, the Internet is an extremely favourable space for criminals. The shifting of crime to the virtual space did not happen accidental, had very pragmatic reasons, abolition of distances, minimum costs and anonymity. The maritime transport is not excluded from this interest. The cyber criminals found ways to penetrate the maritime technologies and to affect in different forms the safety and security of their functionality. Organising of the virtual space, the infrastructure and the multitude of networks make it really difficult to carry out investigations in this area.

METHOD: The maritime transport is realised in open seas condition, outside of national borders and the control and investigation of an incident is really difficult to be covered efficiently to establish the involved parties. A strong cooperation between investigative bodies from different countries is essential, despite of legislative and procedural differences, by establishing common contact points at their level, covering the sea areas also. The collaborative policies for the investigative bodies involved in maritime transport cybercrime must be realised highlighting the particularities of these activities, together with their integration in a wider geographical context.

FINDINGS: Currently, criminal groups are mostly organised and structured as cross-border formations. A certain group can include several nationalities. In this way, in the last period, there has been a greater diversification of the nationalities of the members apart to such a group, depending on their specialisation, individual skills and complexity degree of the cyber operations that those involved are able to offer to the group.

CONCLUSION: Considering the variety of attack types and increasing of their sophistication, to be in line with new developments is a real challenge both in terms of legislation and actions to combat them.

Keywords: Maritime Transport, Cyber-crime, Legislation

[Maritime Policy, Law & Governance]
Legal Challenges of Using Drones in Maritime Transportation

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PURPOSE: To tackle those legal challenges, the paper firstly examines SOLAS Convention to indicate whether the current instruments are sufficient for the performance of safe and secure drone operations. Secondly it focuses on STCW Convention to indicate the sufficient requirements needed for seafarers to be a drone operator. Thirdly, regarding privacy issue current data protection regulations and their applicability to drone operations are examined. Finally, in cases where any personal injury or damage occurs the person(s) who could be held liable will be examined, and some suggestions for future regulatory framework will be made.

METHOD: Shipping industry is one of the sectors that is keen to adopt new technologies like drone technology. For almost a decade, drones have been used in maritime transport for various purposes. For instance, shipyards usually use drones to inspect the areas of ships where inaccessible to humans or are dangerous to reach whereas ports use drones for surveillance such as assessing oil spills, and security purposes. Drones are also used for navigation, anchoring, docking, vessel trafficking, surveying or monitoring ships and goods on board and so forth. Particularly during COVID-19 drones have been widely used to deliver supplies, such as foods, medicines, etc., from shores to ships.

FINDINGS: The intense use of drone technology in maritime transportation has revealed some legal challenges particularly on the issues of safety and security, privacy, and liability. For example, a drone could be hacked because of failing to take necessary cyber risk management measures, and used for espionage, terrorist attacks or other criminal activities such as breach of data privacy.

CONCLUSION: In such cases, on what basis and who would be held liable? In cases where drones are used on boards by the seafarers, the questions of whether seafarers need a drone training and licence would arise.

Keywords: Drones, Cyber Security, Legal Issues, Liability

[Energy Efficiency & Energy Management I]
Energy Balance for a Hybrid Naval Propulsion System

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PURPOSE: Presentation of an analysis of the energy balance of the hybrid energy system and the mooring scheme for a container vessel

METHOD: The paper present an analysis on the energy balance of the hybrid energy system and the mooring scheme for a container ship, as well as the energy balance of the electricity generating systems, from unconventional sources; Technical characteristics of the container ship, elements of the hybrid energy system, which uses unconventional energy, energy balance of electricity generating systems from unconventional sources, connecting conventional and unconventional power sources to the ship's main power bar.

FINDINGS: Calculation of the volume, mass and ascending force of the Flettner balloon with helium, assimilated with an airship. Positioning scheme of large vertical wind turbines installed in the bow of the container ship and in the stern of the container ship. The energy balance of electricity generating systems from unconventional sources.

CONCLUSION: Following the calculation of the energy balance of the two types of wind energy capture systems, we concluded that, depending on the speed of the ship, in ideal wind conditions and depending on the number of vertical wind turbines running, which use wind energy, the system balloon-turbine can generate between 500 kWh and 9000 kWh. Of course, it will never be necessary to turn on all wind power equipment at full capacity. The Flettner balloon can generate up to 1000 kWh. Because of this we have to calculate the number and diameter of cables needed to transmit electricity.

Keywords: Energy, Balance, Hybrid, System, Unconventional, Propulsion

[Energy Efficiency & Energy Management I]

An Investigation on Energy Efficiency of Turkish-owned Bulk Carrier Fleet

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OBJECTIVE: At the MEPC 75 session 16-20 November 2020, two novel amendments are introduced and approved to reduce greenhouse gas emissions sourced by the maritime transportation by IMO. One of the novel amendments is "Energy Efficiency Index of Existing Ships (EEXI), which is a design index suggested as an alternative to the EEDI valid for new building ships after 2013. Another amendment is the Carbon Intensity Indicator (CII), which is an operational index that will evaluate existing ships by classifying them in the A-E range according to their carbon emissions. These regulations that were proposed within the extent of the IMO's short-term measure, will enter into force in 2023. The purpose of this paper is to analyze the impact of carbon intensity of Turkish-owned bulk carrier ships by using the classification algorithm.

CASE REPORT: In this study, the classification and evaluation of Turkish-owned bulk carrier cargo ships has been done subject to A – E range according to their greenhouse gas emission amounts.

METHOD: The method previously recommended by a private company, RightShip, has been used for this classification. Moreover, the current energy efficiency index of the Turkish-owned bulk carrier ship fleet has been calculated and the measures to be taken to bring the ships to the appropriate class has been presented as a recommendation.

FINDINGS: According to the findings, 70.48% of Turkish-owned bulk carrier ships are in class C, which has the highest rate. This is followed by class D, 14.2%. In addition, class A ships are only 4.06% of all bulk carrier ships.

CONCLUSION: As a result, the number of A and B class ships from Turkish-owned bulk carriers is quite low in terms of energy efficiency evaluation. Therefore, ship owners should take the necessary measures to reduce CO_2 emissions before IMO 2023 requirements come into effect.

Keywords: Carbon Intensity Indicator, Energy Efficiency, Emissions, CO_2, Decarbonization

[Energy Efficiency & Energy Management I]

Effect of Mucilage Pollution on Ship Energy Efficiency

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OBJECTIVE: In recent years, ecological degradation has increased and drawn many environmental problems with it. One of the outcomes is the mucilage problem, which directly affects tourism, fishing, and especially the maritime sector. The recent mucilage outbreak in the Sea of Marmara has brought attention to these environmental disaster-related studies. However, there are only a few studies about mucilage's effect on maritime transportation. In this context, the impact of mucilage on a marine vessel is examined within the scope of the study. One of the major negative effects of mucilage on a vessel is, its cooling system. Due to the mucosal formation of mucilage, it clogs the filters and reduces the cooling effect of seawater.

CASE REPORT: In our paper, a case study was made, and data was obtained from a simulator. The seawater filter in front of the seawater pump was clogged by 0%, 30%, 45%, and 60% during the simulated case study. 0% is the base condition that is not clogged by the mucilage while the other three cases are partially clogged.

CONCLUSION: A comparison study was made according to the data gathered from the simulator. While the filter is clogged by 60% main engine slowed itself down, but during 30% and 45% of cases, pumps tried to compensate cooling effect by increasing the seawater flow. However, this was not provided with enough cooling effects on the main engine jacket water, air cooler, lubrication oil cooler, steam condenser, and air compressor. Moreover, the reduced cooling effect increases fuel oil consumption which leads to higher CO_2 emissions. These results show that mucilage not only affects fishing, and tourism but also affects the environment via fuel oil consumption of a vessel.

Keywords: Mucilage, Marine Pollution, Turkish Straits, Energy Efficiency

[Energy Efficiency & Energy Management I]
Energy Efficiency Management Plan on Board

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PURPOSE: A Ship Energy Efficiency Management Plan provides an approach for monitoring ship and fleet efficiency performance in time. The received data would assess in optimizing the fuel consumption and energy performance of the ship at the end.Operational measures are one of the ways to increase operational efficiency. For example slow-speed operation planning, and good communication between shipping entities for efficient route planning,shorter port stay time is another way of increasing ship efficiency.

METHOD: Energy management helps to identify potential measures and energy savings to make the correct decisions for new investments and to operate in an energy-efficient manner. The purpose of Ship Energy efficiency management plan is to improve the efficiency of the ship and can be implemented in various ways,such as by optimizing the speed of the vessel, by propeller condition, hull cleaning in dry dock, using the current when vessel is underway between ports, this will improve energy efficiency and reduce costs,and engine performance.

FINDINGS: The IMO has set the goal to reduce carbon intensity by 35% within the next ten years and up to 2030 to reduce carbon intensity by 50% in total. Short-term and long-term measures are distinguished to achieve the goal. IMO has decided to introduce a combination of technical and operational measures. The SEEMP is a reasonable success for IMO and are aimed to control and subsequently reduce the CO_2 emissions of the Maritime industry.

CONCLUSION: The maritime industry continues to research for more plausible solutions to enhance efficiency of ships, however there is big scope for implementing standards which would further reduce the maritime share of global CO_2 emissions.Looking ahead more organizations big and small are eager to contribute them share for the global environment. More importantly the collective measures taken by the global fleet would be significant in reducing the consumption of fossil fuels.

Keywords: Fuel Consumption, Energy Performance, Energy Management, Ship Efficiency

[Energy Efficiency & Energy Management I]

Integrating Stowage with Trim Optimization: Linking Safety with Fuel Efficiency

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OBJECTIVE: One of fuel efficiency measures is trimming. Trimming could be conducted by stowage planning, namely arranging cargoes and ballast water properly. The paper describes the integration of trimming and stowage planning, in order to enhance fuel efficiency whilst maintaing level of safety.

CASE REPORT: Stowage planning is a linkage between shore and sea sub-systems within a bigger sea transport system. Accurate stowage planning is instrumental for ship's safety. All stowage plans must meet all IMO stability criteria, its shear forces and bending moments must reside between the allowable limits. Apart from its functionality to ensure safety, stowage planning could play a role in enhancing fuel consumption efficiency. In operations, a ship sails in fully or partly loaded or in ballast conditions. From the hydrodynamic perspectives, ships often may have less resistance in a certain trim condition, meaning the ship consumes less fuel in that condition. A trim optimizer Eco Assistant (EA) seeks an optimum trim condition at which the ship consumes least fuel. Stowage planning is instrumental to meet optimum condition, by rearranging the stowage plan. A loading software iStow executes the EA's trim recommendation. iStow helps the planner to rearrange the stowage of cargoes and ballast water in such a way, in order to meet the recommended optimum trim as much as possible. The achieved trim is sent back to EA, to compute the final prediction of fuel consumption.

CONCLUSION: The loading software iStow developed by Pranala, an Indonesian startup, and the trim optimization software Eco Assistant (EA) developed by DNV have been successfully integrated and installed on board a tanker.

Keywords: Stowage Planning, Trim Optimization, Safety, Fuel Efficiency, iStow, Eco Assistant

[Port Operations & Technologies]
The Future of Smart Container Ports

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PURPOSE: Container maritime transportation, on the other hand, emerged with the idea of transporting truck trailers by ships, and today it has a very important position in maritime transportation with containers of certain sizes produced according to ISO standards. The integrated evolution of ports with technology continues in container transportation, which serves fast and safe port operations and efficient freight transfer. This evolution is renewed by the integrated use of smart equipment and systems, with the aim of becoming a more efficient terminal due to the competition between container terminals. All kinds of disruptions, deficiencies, delays and accidents in the container terminals, both in port operations and in the movements of cargo within the terminal, are indications that the terminal needs different equipment and systems. The effect of the trend of being smart, which came into our lives with Industry 4.0, on the container terminals has been the faster and safer port operations, as well as providing convenience to the port and the customer for tracking the cargoes, and providing new conveniences in terms of smooth communication and uninterrupted information flow. The need to develop and be smart has become even more important with the changing demands of global trade today. These automation systems are seen in different types in the world's most advanced container ports. But the common goals are to reduce the number of workers when reducing the time in port operations.

CONCLUSION: In this paper authors analyzing future of smart container terminal in the maritime sector. While maritime container transportation increases its importance and value day by day, thanks to these designs, future container terminals will have the ability to rapidly transfer large numbers of containers and the increasing world trade needs will be met due to population growth.

Keywords: Smart Port, Maritime, Container

[Port Operations & Technologies]

Waiting Reasons Affecting the Handling Process at Terminals

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PURPOSE: The loading and unloading times of liquid bulk cargoes, which are the most frequently handled cargo types in Turkish ports in 2019 and the latter in 2020, are important in terms of handling efficiency. While higher amount of cargo handled per unit time increases the profitability for terminal operations, short handling time of tankers at the terminal provides an advantage for the next voyage. In this study, the process in the terminals in Turkey where 19,05% of the total liquid bulk cargo handled is reviewed as well as the reasons of waits in this process. Thus, it is aimed to find subjects that need to be focused to reduce the waiting times.

METHOD: An expert team consisting of terminals employees was asked to indicate the reasons for the waits with using the fishbone method. In addition, a questionnaire was applied to a sample group of 100 people consisting of operators, seafarers, inspectors and terminals employees who are the stakeholders of the handling process. Thus, the relative importance of the reasons for waiting determined by the fishbone method was obtained by the questionnaire method.

FINDINGS: Delays due to the shift change, lack of communication, sample analysis process taking longer than expected, disruptions of the flow of information, waits in case of any wastage occurrence, unavailableness of piers in the terminals are identified as the factors that causing the unnecessary waits by the expert team. The stated reasons received the highest score in the questionnaire.

CONCLUSION: It was found out that the reasons of waits obtained through the questionnaire matched those determined by the fishbone method. In order to reach a solution, prioritization was provided by scoring the reasons that lead to waits.

Keywords: Liquid Bulk Cargo, Handling, Terminal, Port, Efficiency

[Port Operations & Technologies]

Port Location Selection Factors and Examinatıon of Selection Methods

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PURPOSE: In this study, it will be tried to reach a versatile and comprehensive roadmap for port location selection by considering environmental awareness.

METHOD: The advantages and disadvantages of the previous studies on port location selection have been examined in a multifaceted manner around the principles of engineering studies and economic efficiency, taking into account environmental sensitivity.

FINDINGS: Ports are closely related to the economy of both the country and the neighboring countries, especially the region they are located in. Countries whose economic power is based on maritime trade should attach great importance to the selection, construction and development of new ports in order to meet the increasing import and export volume and market demands in the developing and changing world trade with technology. Otherwise, it will be difficult for countries to compete economically in the market, especially in their foreign trade. Climate, raw materials, energy, transport, land, market, strategic situation etc. It has been observed that the selection of a port location to be made by considering the criteria makes great contributions to the development of the regional economy, as well as making the most environmentally friendly choices in construction techniques with a proactive environmentalist approach in its construction and the use of materials, also plays an encouraging role in the protection of the ecosystem in which the port is located throughout its lifetime.

CONCLUSION: In addition to accelerating the economic, infrastructure and superstructure development of the region, country and neighboring countries, a port to be built with a general site selection roadmap reached in the study, as a result of medium and long-term strategies for climate and environment-friendly development, sustainability in terms of ecosystem and green port criteria and legal It also makes an important contribution to the development of processes.

Keywords: Site Selection, Environment, Efficiency

[Port Operations & Technologies]

The Content Analysis of Academic Studies About Green Port

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PURPOSE: Ports are centers where handling operations, ship movements, logistics activities and human mobility are intense. The damage caused to the environment by the emissions (liquid waste, dust, gas emissions from ships, noise, etc.) caused by the operational activities in the ports draws attention to the formation and importance of green ports. The aim of this study is to perform a literature review for the publications prepared within the scope of the concept of green port, and to obtain the opportunity to evaluate the studies by making conceptual content analyzes of the identified studies.

METHOD: In this context, the publications in the open-access databases regarding the studies on the Green Port were reviewed. Firstly, a literature review of academic studies about "Green Port" was performed on Google Scholar. 108 of the publications obtained as a result of the literature review were determined for the analysis. These 108 publications about the green port were analyzed with the conceptual content analysis method.

FINDINGS: When the publications about green ports are reviewed, it is seen that these publications are prepared by one or two academicians, and the number of publications prepared with the contributions of private sector or public personnel is low. It was observed that the publications prepared by the authors working in the institutions in China constitute almost 1/3 of the publications in this field.

CONCLUSION: Considering that the concept of green port is a concept that concerns many issues in different fields related to each other, it is considered that the effectiveness of academic publications prepared with the contributions of field experts will be more. The preparation of publications on green ports with the contributions of academicians, the private sector, and public personnel, will be more beneficial in terms of increasing publication efficiency. The concept of the Green Port is important not only for the Southeast Asian Region, but also for the ports located in the maritime transport regions such as the Eastern Mediterranean, the Black Sea, and the Adriatic Sea. It is thought that the publications to be prepared by academicians working in riparian countries, which have intense economic interactions with each other in regional sea areas, will be important in terms of environmental protection and sustainability.

Keywords: Green Port, Marine Environment, Port Management, Sustainability

[Port Operations & Technologies]
Service-dominant Logic Perspective in Port Service Design

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PURPOSE: Service-dominant logic perspective in port service design: a fuzzy QFD model. Service, as practised today, is an important element in value creation. In this economy, customers are purported as a collaborative partner in creating value through operant resources which is a major source of competitive advantage. In the port service industry, physical elements have mostly promoted gaining a competitive advantage in service provision. However, the non-physical elements in service design have gained little attention. This study aims to design container port services based on the perspective of service-dominant logic (SDL) to enhance competition.

METHOD: To do this, fuzzy quality function deployment (QFD), which is a powerful method in transforming the customer voices into the service characteristics was adopted to design port services regarding both customer requirements and design requirements. As a first step, competitive factors were explored by a thorough analysis of the port selection literature, and operant resources affecting the port competition were selected. These factors were used as a basis for the customer requirements (WHATs) in the fuzzy QFD model against the technical characteristics of the services (HOWs) offered by the container terminals.

FINDINGS: The empirical results showed that there was a difference between the crisp values of container terminal services but this difference was relatively balanced. The most prominent service types in these categories were API (=78.53), container sales (=73.53), pre-trip inspection for reefer cargoes (= 71,25), hazardous cargo storage (69,81), rail transportation (69,56), respectively. This ranking does not show the importance of services, but it shows that the service with the highest value has a significant impact on the set of selection criteria. When designing the container terminal services, operators may give special attention to develop functional activities of API services, container sales, pre-trip inspection of reefer cargoes, hazardous cargo storage, rail transportation. In main service categories, some selection criteria (customer requirements) were more prominent.

CONCLUSION: The result of this study will be useful for both port competition literature and practitioners in terms of finding out new avenues for improving competition tools by providing customer commitment in value creation in port services within the ever-changing business environment. Several external and internal groups and interest collaborate for creating and distributing the value while pursuing their own interest and goals. Within this perspective, these groups involve in service production process and value creation. Thus, taking into consideration of requirements of these interests groups may enable creating and delivering the value effectively. Regarding the results of current study, these services can be usefully exploited to enhance related selection criteria, and terminal operators can focus on these special requirements in service categories to create value in specific services.

Keywords: Service-dominant Logic, Port Services, Value Co-creation, Competition

[Energy Efficiency & Energy Management II]
Systematic and Transdisciplinary Approach to Reduce GHG Emissions from Ports

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PURPOSE: The paper aims to help in decarbonizing and improve energy efficiency in ports.

METHOD: The authors through a systematic approach and literature review classified the measures and tools within five main disciplines, and the features, mitigation potential, and key issues of measures were discussed.

FINDINGS: The results show that due to complexity, various reduction potential, costs, as well as relation and interaction of measures and tools there is not any single solution for decarbonizing the ports' activities.

CONCLUSION: The study highlighted the importance of a systematic and transdisciplinary approach in decarbonizing ports' activities. The results of the study can be considered as a tool and guideline for policy makers, corresponding governance, as well as ports' decision-makers for decarbonizing the shipping industry.

Keywords: Ports, Decarbonisation, Energy Efficiency, Systematic Thinking, Transdisciplinary Approach

[Energy Efficiency & Energy Management II]
Life Cycle Assessment Approach for Antifouling Coating Performance Comparison

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PURPOSE: The purpose of the study is to present a life cycle assessment (LCA) approach to compare the performance of fouling control coatings during a ship life cycle.The LCA considers environmental and monetary effects due to paint production, application and hull maintenance processes, and fuel consumption penalties due to biofouling on the ship hull.

METHOD: The life cycle assessment method is used in this study.The data provided by shipyards and coating manufacturers are used to calculate the cost and emissions incurred due to coating production and application. The increases in required ship powering and fuel consumption penalties due to biofouling are predicted based on the time-dependent biofouling growth model, an in-house tool developed by the authors.The analyses are conducted through two case studies in which the same ship is coated with two different antifouling coatings and operating at the same ship route and operating profile.

FINDINGS: The coating performances are compared in terms of increases in fuel consumption costs, total costs, and CO_2 emissions at the end of the selected life cycle period.

CONCLUSION: The developed LCA model enables us to select the most efficient antifouling coating among the available coatings by considering all factors via a cradle-to-grave approach. Maintenance and dry-dock schedules can also be optimised according to the developed LCA model to operate ships in the most cost-effective and environmentally friendly way.

Keywords: Life Cycle Assessment, Antifouling Coatings, Time-dependent Biofouling, GHG Emissions

[Energy Efficiency & Energy Management II]
Optimization of the Regenerative Organic Rankine Cycle for Greener Shipping

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PURPOSE: Shipping has a very important share in world trade. However, it has an inevitable effect on global green house gas emissions. Therefore, there is a great motivation for the reduction of fuel consumption and exhaust emissions. Waste heat recovery systems based on ORC technology have a significant potential to reduce fuel consumption and exhaust emissions. In this study, the optimization of the regenerative Organic Rankine Cycle (ORC) waste heat recovery system was carried out for a bulk carrier.

METHOD: Multi-objective optimization was performed using a grey wolf optimization algorithm that is powerful and novel algorithm. Thermo-economic evaluations was carried out by considering the design and off-design working conditions. In addition, the impact of the optimized ORC system on decarbonization was investigated. The fuel saving and CO_2 reduction amount was determined.

FINDINGS: The annual average fuel saving and CO_2 reduction were calculated as 522.8292 tfuel/year and 1628.09 tCO_2/year, respectively.

CONCLUSION: This study showed that using RORC system on ships is a promising solution for increasing emission restrictions and environmental concerns.

Keywords: Organic Rankine Cycle, Waste Heat Recovery, Multi-objective Optimization, Fuel Saving, CO_2 Emission

[Energy Efficiency & Energy Management II]

Increasing Efficiency of Marine Engine with Supercritical CO_2 Rankine WHRS

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PURPOSE: Fossil fuels, which are utilized in internal combustion engines, cause several issues such as climate change and air pollution amongst all. Hence, the efficiency of a power system becomes more and more important considering the economic as well as environmental effects resulting from the combustion. Increasing the efficiency could be handled with two basic approaches as either obtaining more power from the same amount of fuel or using less fuel to obtain the same power.

METHOD: This study is focused on the former by using waste heat recovery system (WHRS). Additional power is provided by supercritical CO_2 Rankine cycle (sCO_2RC) via the utilization of the waste heat sources such as exhaust gases and cooling water of a marine engine. sCO_2RC has been optimized to evaluate maximum power recovery potential. Analyses, based on the first and the second laws of thermodynamics, are carried out.

FINDINGS: It has been obtained that the annexation of the sCO_2RC system provides a better thermal efficiency with a better fuel economy. Moreover, exergy analysis of each component, which are included in the sCO_2RC, as well as the entire sCO_2RC system are also performed to calculate not only the exergy efficiency but also the exergy destruction.

CONCLUSION: Results of exergy analysis yield which component should be optimized primarily to possible increase in overall efficiency and reduce fuel consumption as well as in which order improvement efforts should focus on to decrease the environmental effects of the destructed exergy.

Keywords: Waste Heat Recovery, Supercritical CO_2 Rankine Cycle, Exergy Analysis, Efficiency, Environment, Fuel Economy

[Energy Efficiency & Energy Management II]
Introducing Waste Heat Recovery Systems for Marine Applications

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PURPOSE: With the growth of the world population and economy, maritime trade importance has grown over the years. Nowadays, about 90% of world trade is carried out by sea, making navigation the main mean of transport. It is cost-effective and the most environmentally friendly and efficient mode of transport. However, shipping is still accounting for more than 2.5% of the total bases of carbon dioxide and other polluting gases. Most ships are fitted with Diesel engines of about 50% efficiency, meaning that there is still a significant potential to reduce fuel consumption and pollutants emissions by recovering waste heat. Thus, the following paper presents a review of alternative waste heat recovery systems in marine applications.

METHOD: In this work, a basic review of the literature on this subject is carried out. Therefore, different systems of waste heat recovery from shipping are analyzed, such as the organic Rankine cycle, Kalina cycle, binary cycle, combined cycles, cogeneration, and combinations of these, comparing the advantages and disadvantages of each application.

FINDINGS: It was verified as an advantage the use of working fluid with thermodynamic properties suitable for low temperatures, such as the organic fluids used in the binary cycle and organic Rankine cycle. However, some disadvantages of heat recovery systems were analyzed, such as corrosion caused by ammonia, and the cost of plant components caused by the Kalina cycle and the binary cycle, respectively.

CONCLUSION: After analyzing the systems used for marine engine residual recovery, such as exhausted gases, jacket water, lubricating oil, and scavenge air, it was found that each of the systems has advantages and disadvantages, that is, the system that generates higher efficiency may result in higher costs and corrosion for equipment or more environmentally efficient systems may not be what translates into greater energy efficiency in the cycle.

Keywords: SRC, ORC, Kalina, Marine Engine, Exhaust Gas, WHR

[Maritime Education I (Covid-19, Distance Learning)]
Evaluations of Maritime Students on Distance Education During Covid-19 Pandemic

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PURPOSE: The COVID-19 epidemic, which first appeared in late 2019, led to a pandemic process that affected the whole world by spreading rapidly. The negative effects of the COVID-19 pandemic continue in every part of life, especially in the health and the economy. One of the most affected sectors in this process has been the education sector. As in many countries, a transition from face-to-face education to distance education was made also in Turkey within the scope of the measures taken against the epidemic. In this study, it was aimed to evaluate the views of the maritime faculty students in Turkey both about technical and learning process regarding the distance education they received during the pandemic.

METHOD: In this context, the "Distance Education Evaluation Scale" was applied to the students through online platform. The data obtained were analyzed by statistical methods in terms of variables such as university, department, class, gender, grade point average etc.

FINDINGS: Male students evaluate distance education more positively. Students who attend lessons with their mobile phones evaluate distance education more negatively than students who attend lessons with their laptops. Students who own their tools make more positive evaluations. As the grade point average increases, students make more positive evaluations.

CONCLUSION: Significant relationships were found between distance education evaluations and gender, ownership, tool, and grade average. However, no differences were found according to university, department and geographical region.

Keywords: Distance Education, COVID-19, Maritime Education

[Maritime Education I (Covid-19, Distance Learning)]
Distance Education and Maritime Students' Competencies

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PURPOSE: The Covid-19 virus, which emerged in the Far East, has had effects that shook countries worldwide and caused the change in many areas. One of these areas is the field of education. With the break given to face-to-face training due to Covid 19, mandatory changes have taken place in conducting lessons in maritime education. This change in education methods causes hesitations about the effects of students on their professional competence.

METHOD: In this study, the opinions of the students who graduated with the distance education model at the undergraduate level in Turkey and that they had difficulties in the critical competencies within the scope of Standards of Training Certification and Watchkeeping (STCW) part A were taken. An estimation database based on the decision tree was created with their opinions.

FINDINGS: The obtained database was used to estimate the professional competencies of 20 students from 5 different universities who are currently studying.

CONCLUSION: According to the findings, the shortcomings of maritime distance education were determined, and suggestions were made.

Keywords: Distance Education, Maritime Education, Maritime Students' Competencies,

[Maritime Education I (Covid-19, Distance Learning)]

Effects of the Pandemic on Students' Performance in Maritime Education

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OBJECTIVE: This study presents analyses of students' performance on learning mathematics and statistics during the COVID-19 pandemic at maritime higher education institutions in Croatia, Estonia, Latvia, and Poland. The study discusses (a) overall students' performance on mathematics and statistics-related courses, (b) evaluation of causes affecting students' ability to pass exams on related courses, and (c) teaching methods/tools applied to facilitate students' performance in the studying process during the pandemic.

CASE REPORT: Following indicators were analyzed to reveal problems in the teaching process during compelled distance learning caused by pandemic restrictions: passed exams' rate, learning outcomes gained, and teaching methods/tools used by lecturers.

Analyses is based on (a) data on students' exam pass rate in 2019/2020 and 2020/2021 academic years, and (b) two surveys conducted for students in years 2020 and 2021. The surveys were conducted in four higher maritime education institutions: the University of Split, Faculty of Maritime Studies; Latvian Maritime Academy; Tallinn University of Technology, Estonian Maritime Academy; The Polish Naval Academy, Department of Mathematics and Physics, and the aim of the surveys was to evaluate the effectiveness of teaching and learning mathematics and statistics during distance learning (a) just in the beginning of distance learning and (b) one year later when distance learning became the predominant form of studying.

CONCLUSION: The paper highlights the teaching tools and methods mostly positively affecting learning ability during distance learning.

Keywords: Higher Maritime Education, Mathematics, Statistics, COVID-19, Distance Learning

[Maritime Education I (Covid-19, Distance Learning)]

Maine Maritime Academy's Maritime Education and Training Response to Covid-19

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OBJECTIVE: Application of the emergency management process at Maine Maritime Academy to respond to and recover from the Covid-19 Pandemic with respect to Maritime Education and Training.

CASE REPORT: Emergency Management is presented by the US Federal Emergency Managaement Agency as the analysis, planning, decision-making and assignment of available resources to mitigate, prepare for, respond to and recover from the effects of all hazards (FEMA, 2006). The Covid 19 Pandemic is one of the most serious hazards in recent history. Its global impact, fast acceleration and unpredictability allowed little time for preparation. Higher education institutions, including those with Maritime missions were heavily impacted and had to adapt swiftly in order to achieve their educational and training goals.
This paper presents an in-depth, multi-faceted sequence of events using a chronological approach to share the experiences and learnings of the Maine Maritime Academy (MMA) as it responded to COVID 19. It outlines what MMA did in terms of the mitigation, preparedness, response, and recovery phases in this emergency situation as applied to Maritime Education and Training.

CONCLUSION: MMA applied all phases of emergency management effectively in order to continue to meet our education and training responsibilities without compromising safety and health requirements during the Covid event. Involvement of all stakeholders, in decision making processes helped to make this process manageable and effective.

The experiences gained, lessons learned, and best practices applied during the Covid 19 crisis will help MMA to respond to similar emergencies more efficiently and effectively in the future. Some of the initiatives that came from our response to the pandemic have been recognized as improvements over our prior practices and are being permanently integrated into MMA's maritime education and training programs.

Keywords: MET, Covid19, Emergency Management, Response, Recovery

[Maritime Safety & Security I]
Data Repository and Accident Analysis; What Experts Need to Know

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PURPOSE: The main aim of the SAFEMODE project is to develop a novel Human Risk Informed Design framework. SAFEMODE adopts a cross-industry approach to capture and analyse safety events for maritime and aviation. Among other activities, SAFEMODE develops a digital data repository system based on analysis of incident and accident reports. These data, however, have to be categorised under a uniform scheme of categorisation, 'Taxonomy'. The final digitalised system and categorisation are aimed to facilitate the experts and researchers in the maritime and aviation sector. The present task is oriented to understand the needs of maritime experts and to capture their expertise and knowledge for a more suitable digital data repository system.

METHOD: Selected experts in the field of maritime domain worldwide have been invited for an interview in order to give their opinion on the repository and the taxonomy. The experts who participated in the interviews were recruited from different professional maritime backgrounds, such as safety engineering, Human Factors, seafaring and research in maritime safety, with a range of years of experience. The interviews were conducted online, based on a mixture of open and closed questions.

FINDINGS: Suggestions on how to use the data, what the experts need to search in a digital repository of past accidents, as well as suggestions on the output of statistics will be presented. Insights for preventive actions based on statistics and the necessity of near miss data will also be explained.

CONCLUSION: Despite modern approaches to safety in maritime practice, accidents still occur. Many argue that learning from past accidents is among the best practices for ensuring safety; however, understanding these data may vary based on conflicts between common understanding and different taxonomy systems. Maritime experts all agree that capturing accident data properly, especially near miss data, is the key for ensuring safety proactively.

Keywords: Accident Repository, Taxonomy, Human Factors

[Maritime Safety & Security I]

Deficiency Analysis Identified in PSC Inspections Using Event Tree Analysis

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PURPOSE: In the study, PSC inspections data performed in Paris MoU between the years 2016 and 2020 were analysed with the purpose of providing reasonable decision supports for key stakeholders such as ship operators, national and international authorities, cargo owners and classification societies in terms of enhancing safety on board ship and minimizing sub-standard ships in maritime transport.

METHOD: The probabilistic analysis is conducted with the help of Event Tree Analysis (ETA) method on deficiency risk areas respect to the number of deficiencies in each area. In the analysis, the deficiency risk areas are prioritized respect to the different combination of ship type and ship age.

FINDINGS: In the analysis made on the inspections data, it was found that the number of deficiencies detected under each relevant main item (deficiency risk areas) show significant variation for type of ship and age of ship.

CONCLUSION: With the conducted analysis, in the study, it is aimed to contribute to the more effective inspection by focusing on certain deficiency risk areas in line with the ship type and ship age in the ship inspections.

Keywords: Event Tree Analysis (ETA), Port State Control (PSC), Ship Inspection, Deficiency Risk Area

[Maritime Safety & Security I]

Integration of Fuzzy Cream and Therp to Assess Human Reliability

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PURPOSE: The maritime industry is a safety crucial domain, and various factors are related to the occurrence of the accident. Notably, human errors in ship operations contribute significantly to maritime accidents. Therefore, the application of the human reliability assessment in maritime is inevitable. The human reliability assessments focus on human error quantification because HRA is dealt with within probabilistic risk assessment. The main challenge of human error quantification is dealing with uncertainties from expert judgment, assignment of nominal failure probability for specific tasks, and selection of performance shaping factors that affect human performance. In this context, this research aims to provide a risk assessment framework integrated with human reliability assessment. The case study for the test procedures for a ballast tank airtightness is selected for illustration purposes.

METHOD: This research proposes integrating the Fuzzy-Cognitive reliability and error analysis method (CREAM) and the Technique of Human Error Rate Prediction (THERP). The human errors are computed by fuzzy CREAM, and uncertainty is treated by the Fuzzy multi-attribute decision-making method. THERP is utilised to represent human error incorporated with other component failures and deal dependency between different tasks by the same person, task by different persons including recovery actions by a human reliability analysis event tree (HRAET).

FINDINGS: The proposed approach presents individual human failure probabilities for all sub-tasks during the test procedures for ballast tank airtightness by the fuzzy CREAM method. Furthermore, the event tree shows the pathway of success and failure for whole procedures with the adjusted failure probability by recovery actions and dependency.

CONCLUSION: This paper is expected to contribute to the improvement of safety by identifying vulnerable tasks in association with other factors that influence human performance during the selected operation and help find effective risk reduction measures for human error and other components.

Keywords: Human Reliability, Maritime. Safety, CREAM, THERP, Human Error

[Maritime Safety & Security I]

Application of Human Factors-based Risk Models to Support Accident Investigation

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PURPOSE: Accident investigation aims at identifying underlying conditions and root causes for accidents in order to understand how things went wrong and identify weaknesses in risk control systems. Commonly, accident investigations identify human error as a root cause of an accident which limits the safety learning as no further information of underlying conditions that contributed to the human failure event is provided. Therefore, the identification of contributing factors such as inadequate training and supervision, poor equipment design, leadership commitment, poor safety attitudes is essential to enhance safety of operations and prevent recurrence.

METHOD: The SAFEMODE project brings together key experts from both the aviation and maritime sectors to develop a novel Human Risk-Informed Design (HURID) Framework in order to identify, collect and assess human factors data. As part of the approach followed, human factors-based risk models have been developed. These models are barrier-based and allow the identification of human events and influencing factors that contributed to the failure of safety barriers. This work explores the application of risk models in accident investigation to support the identification of key contributors to the failure of barriers and risk, and the collection of additional information on factors that contributed to the human failure event.

FINDINGS: Recommendations on how human factors-based risk models can be utilised to support accident investigation as well as the benefits of applying such approach will be presented.

CONCLUSION: The collection and analysis of contributing factors data such as safety barriers that were missing or did not work as intended, poor practices, inadequate operating procedures will support the implementation of more robust risk control measures that will result in improved safety assurance, more effective and resilient operations and enhanced human performance.

Keywords: Risk Models, Human Factors, Accident Investigation

[Maritime Transportation & Maritime Economics]

The Impact of the Pandemic to E-commerce and Logistics Sector in Turkey

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OBJECTIVE: E-commerce; Nowadays, as the purchasing preferences of consumers have completely changed, it covers the processes that start with the consumer's sense of trust in the seller and continue to comply with the needs of buyers. With the change in the purchasing methods of customers, there has been a transition from face-to-face purchasing to online purchasing. E-businesses aiming to provide the best service to their customers have become very advantageous in the e-commerce market with the software they developed and put in place in a very short time.

CASE REPORT: E-businesses continue to offer better service to the consumer by competing with each other E-businesses continue their existence in the e-commerce market with a win-win approach with all stakeholders in the sector by evaluating themselves and improving their service quality with the feedback they receive from their customers and the ease of use of applications on devices. s. Enterprises can quickly adapt the unexpected gains of e-commerce to their businesses, allowing them to reach more buyers.

CONCLUSION: Accordingly, the most important reasons leading to successful e-businesses can be listed as the rapid adaptation of innovations to their systems and the continuous developments and updates of the applications and softwares which enables and encourages buyers more easier use of their online selling sites

Keywords: E-commerce,E-business,Pandemic,Logistics

[Maritime Transportation & Maritime Economics]

Statistical Analysis of Maritime Piracy Cases in World Territorial Waters

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PURPOSE: In today's world trade, most of the import and export cargoes are transported by sea. In parallel with the increasing trade volume, shipping trade and thus maritime traffic are also increasing. The smooth functioning of global trade depends on the safety of shipping trade routes. However, since ships may encounter some dangers during maritime transport, it is important to ensure safety. One of the dangers facing sailors today is piracy, which has existed since the earliest times of history.

METHOD: Piracy in the world's seas is a global problem. Piracy incidents occur where shipping trade is intense, and authority and control are weak. In this context, piracy is one of the most important problems that threaten the maritime sector, especially due to reasons such as financial crises, unemployment, high food prices, bribery, corruption, political instability and inadequate surveillance and inspection.

FINDINGS: Today, many regions such as Somalia, the Gulf of Aden, the Strait of Malacca, the South China Sea, the Gulf of Nigeria, where piracy events are intense, are risky for safe navigation. Therefore, ships going to areas at risk of piracy take extra security measures or change their routes. Due to piracy; ransom expenses, insurance expenses route change cost, security expenses and military measures etc. along with the costs, not only billions of dollars of damage occur each year, but also death and serious injuries.

CONCLUSION: Piracy takes place in territorial waters, international seas and port areas, and in this study, it is aimed to analyze the piracy events in the territorial waters that have been in the IMO database since 2010. In this context, piracy events that have occurred in recent years will be analyzed statistically; first of all, frequency distribution will be made and hypotheses will be analyzed with Chi-Square analysis.

Keywords: Maritime Piracy, Chi-Square Analysis, Territorial Waters, Shipping Trade

[Maritime Transportation & Maritime Economics]

Freight Market Evaluation of Shipowners Amid the Pandemic: Case Study

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PURPOSE: During the pandemic, all sectors were affected negatively. Turkish and foreign multinational shipowners of the maritime sector in return have turned this situation into an opportunity as well as in our country. Freight increases have been in place all over the world since 2020 have enabled Shipowners to operate their ships at full capacity at extra profit margins. In this period when container demand is increased and freight rates are very high, it has adopted oligopolistic marketing approach and brought new perspectives to the maritime transport sector.

METHOD: Collection and evaluation of the current ocean rates date from 8 different carrier providing service between Ambarlı and New York ports.

FINDINGS: In this study, shipowners in our country will be examined from the third quarter of 2019 and four quarters within 2020 and their policies will be discussed. It will observe the policies developed by customers who take precautions against the monopolistic approaches of shipowners during the pandemic period.

CONCLUSION: The reasons for the unpredictable price increase in the freight market between certain routes will be discussed and the continuation of this process will be evaluated in order to maintain the country's economy and avoid further monopoly within the maritime sector.

Keywords: Freight Market, Shipowner, Pandemic

[Maritime Transportation & Maritime Economics]
Discrete-event Simulation Application for Integrated Energy Efficient Shipping

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PURPOSE: Energy is a strength and one of the most indispensable resources for maritime transport activities. Efficient utilising of energy is crucial to protect the limited sources and marine environment. The energy usage in shipping is generally port and fleet operations-oriented. Therefore, minimisation of this consumption added significant value to the maritime supply chain system. Energy efficiency and port operation are widely mentioned in the current literature. However, there is still a research gap on the ship-port interface regarding energy efficiency. These complex logistic chains ought to comprise port performance to reduce certain delays to make a better energy-efficient system. This examination aims to improve our understanding of port and ship operations based on energy efficiency.

METHOD: A modelling framework is developed to investigate how ports and ships could work together to reduce energy consumption and maximise the efficient operation time. According to the integrated concept of shipping, the system is analysed to create a case study application of a container port discrete-event simulation application (DES) with ARENA software, which aims to support the fleet and port optimisation as well.

FINDINGS: In this research, one of the primary container ports in Europe was taken as a case study to analyse the operation of the port. This research may assist in understanding the whole model of the maritime transportation of container shipping. ARENA application on a case study showed that considering the integrated system's energy efficiency instead of only port energy efficiency, the whole system's energy consumption and $CO2$ pollution have around 6% improvement in the port area. The case study also clearly demonstrates that ship operation is the main contributor and has a more significant effect on the integrated system.

CONCLUSION: This research creates a solution to analyse the energy efficiency of the ship and port integration which is a gap in the literature.

Keywords: Integrated Maritime, Energy Efficiency, Discrete-event Simulation, ARENA Modelling, Container Port, Decarbonisation

[Maritime Transportation & Maritime Economics]

Analysis of the Relationship Between Factors Affecting Ship Operating Costs

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PURPOSE: To determine the factors which are affecting ship operating costs and the relationships between these factors.

METHOD: The ship operation costs and the factors affecting these costs were determined by the literature review and the survey study conducted with the maritime sector employees. Then, the interaction of these factors with each other was calculated using the Cognitive map method.

FINDINGS: With the help of the cognitive map method, a total of 19 connections and 19 variables, 8 of which are the main factors affecting the ship operation cost, were determined. According to the results, regulation comes to the forefront as the most influential factor on costs. In addition, it has been observed that non-random situations such as natural disasters and strikes have a high impact on costs.

CONCLUSION: The investment and operating costs of companies engaged in maritime transport are high. For this reason, necessary evaluations should be made in order to reduce costs and adopt a sustainable company management structure. Among these costs, there are costs that are not under the control of the companies. It is important for the future of maritime companies to make the necessary financial risk assessments to determine these costs.

Keywords: Maritime Economy, Cognitive Mapping Method, Ship Operation Costs

[Maritime Safety & Security II]
Risky Maritime Encounter Patterns via Clustering

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PURPOSE: The volume of maritime traffic is increasing with the growing global trade demand. The effect of volume growth is especially observed in narrow and congested waterways as an increase in the ship-ship encounters. These ship encounters can have severe consequences such as collision, which is the primary reason for maritime accidents, with 16%. A proxy measure to analyze maritime accidents is risky encounters. The aim of this study is to analyze the patterns of the risky encounters and inform captains and maritime authorities to obtain preventive measures.

METHOD: A database of ship-ship interactions is developed from the AIS messages. These interactions are analyzed via unsupervised learning algorithms to determine risky encounters using ship domain violation. A k-means clustering based novel methodology is developed to explore patterns among encounters. The methodology is applied on a long-term dataset from the Strait of Istanbul.

FINDINGS: Ship length and ship speed are identified to be indicators of risky encounters.

CONCLUSION: The developed approach can be integrated to narrow and congested waterways as an additional safety measure for maritime authorities to use as a decision support tool.

Keywords: Maritime Safety, Automatic Identification System (AIS) Data, Non-Accidental Critical Event, Clustering, Anomaly Detection, Pattern Discovery

[Maritime Safety & Security II]

Analysis of Port State Control Through the Association Rule Mining

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PURPOSE: Ship inspections are the best way of improving safety at sea. Therefore, it is vital to determine the parameters that cause deficiencies in the prevention of ship accidents. Thus, the main purpose of this study is to analyze the inspection results of Turkish flagged ships using the data mining model.

METHOD: Considering a total of 209 inspection reports resulting in the detention of Turkish flagged ships between 2014 and 2019, the Apriori Algorithm was applied using SPSS Modeler 18.0 software to determine the association rules of deficiencies detected.

FINDINGS: The study found that the safety of navigation, living/working conditions, and emergency systems are the main factors creating association rules in deficiencies. On the other hand, when the deficiencies causing detention were analyzed, the most frequently associated variables were safety of navigation, certificate/documentation, and emergency systems. We also concluded that general cargo ships, Black Sea and Paris MoU regions were found to be important variables in association rules.

CONCLUSION: The results of the study are supposed to be useful for the flag state control mechanism in order to improve the port state control performance of Turkish flagged ships. We recommend that further research collect more data on the inspection of ships flying other flags of all sizes to update the proposed models and improve their analysis performance.

Keywords: Port State Control, Ship Inspections, Turkish Flagged Ships, Data Mining, Association Rule Mining

[Maritime Safety & Security II]

A Conceptual Proposal for Human Error Contribution to Maritime Operations

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PURPOSE: Risk analysis is of crucial role in ensuring operational reliability by identifying the underlying factors of the system vulnerability. Since each activity performed onboard ships represents a high risk due to the nature of work, the human element should be the focal point of the quantitative risk analysis (QRA) in maritime operations. Indeed, the statistics confirm that more than 80 per cent of marine casualties are related to human error. This paper aims to propose a conceptual approach for evaluating potential human error contributions to the operational risks in maritime transportation.

METHOD: Based on this, a hybrid approach incorporating Fault Tree Analysis (FTA) and Interval type-2 fuzzy (IT2F) based Success Likelihood Index Method (SLIM) is proposed to evaluate the human error probabilities (HEPs) and calculate the risk level. Whilst the FTA is evaluating the operational risks, the IT2F logic copes with subjectivity in the process of using experts' judgements, and the SLIM estimates the HEPs for designated tasks.

FINDINGS: In view of the findings, that the quantitative hybrid approach can effectively be applied for determining the vulnerabilities of maritime operations and human errors contributions to the operational process is obvious.

CONCLUSION: Besides highlighting the influence of human errors on the operational process, the paper is also intended to contribute to the improvement of maritime safety and reduce losses in the future in maritime transportation.

Keywords: FTA, IT2FL, SLIM, Risk Assessment, Maritime Operations

[Maritime Safety & Security II]

Dynamics of Maritime Security in the Context of Black Sea

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PURPOSE: Maritime security is used in the sense of being away from threats and threat perception as a result of maritime activities in ports and open seas. Maritime security is a concept that has not reached a consensus due to its complex structure. Studies in the literature have defined the dynamics of this concept and determined the framework of this concept with its dynamics. Therefore, these dynamics necessitated the evaluation of maritime security according to the situation and regions of the countries.

METHOD: From this point of view, in this study, maritime security dynamics for the Black Sea Region have been revealed by applying the analytical hierarchy process, and maritime security has been evaluated for Turkey.

FINDINGS: As a result of the literature study, maritime security dynamics were defined as geopolitical and socioeconomic.

CONCLUSION: Black sea region has been analysed throughgh these parameters

Keywords: Black Sea, Maritime Security, AHP

[Material Technology]

Steels and Other Promising Materials in Shipbuilding: A Comparative Review

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PURPOSE: Many shipbuilding materials have been tested for centuries in order to provide the required performance, reliability, and sustainability. In the past 150 years, steels began to be used, became popular and even dominated the market. However, today it is aimed to produce larger ships and it is desired to be more resistant to the marine environment. Promising advanced materials are also thought to be used for this purpose in future applications. Therefore, it is necessary to compare and research the compatibility of the most frequently used marine-grade steels with these materials.

METHOD: Evaluation of the current status, development and future of steel and other advanced materials. Furthermore, analyzing the findings obtained in previous studies and making predictions for the future.

FINDINGS: Current estimates indicate that steel will still be used mostly in manufacturing until the middle of the 21st century. However, this is related to the fact that the production of other advanced materials is still difficult and therefore limited. However, most advanced materials are more resistant to the marine environment and much stronger compared to steel.

CONCLUSION: Steel seems to prevail in production for many more years, with the advantage of its availability and thousands of studies on it. However, this does not mean that other advanced materials will not be used in the future, on the contrary, it creates excitement and has a positive impact on research and development studies carried out on it. This will pave the way for the invention of new methods in the production of advanced materials and will help ensure their applicability in many industries as well as in the maritime industry.

Keywords: Shipbuilding, Steel, Advanced Materials, Material Selection, Properties

[Material Technology]
Producibility of Functionally Graded AlB2/Al Composite Material

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PURPOSE: This study is intended to investigate producibility of functionally graded AlB_2/Al composites which are used in the manufacture of ship machinery parts.

METHOD: AlB_2 particles have been spontaneously formed in liquid matrix as reinforcement. A semi-solid composite ($Al_{(l)}$ - $AlB_{2(s)}$) prepared at 850°C was solidified under a centrifugal force to grade functionally. The properties of composite materials such as hardness and microstructure have been examined.

FINDINGS: This research provided the following findings, AlB_2 particles can be successfully synthesized with in situ reaction technique in molten aluminum. It was determined that the hardness value of the composites increases with increasing AlB_2 reinforcement content within matrix.

CONCLUSION: Functionally graded AlB_2/Al composite materials can be successfully produced with centrifugal casting technique. It is also determined that AlB_2 reinforcement ratio of the composite materials ranged from 0 to 7 vol. %. In addition, it was observed that the hardness values of the composites increased with the addition of reinforcement ratio.

Keywords: AlB2, Functionally Graded Composite, Ship Machinery

Acknowledgments

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[Material Technology]
Swot Analysis of Scrubber Installation on Ships

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PURPOSE: With the expansion of the world's trade, marine transportation has also expanded. Thus, ship traffic has increased and continues to do so. Ships, by using fuels creating greenhouse gas emissions in order to operate, cause air pollution. To minimize the greenhouse gas emissions caused by ships, the International Maritime Organization (IMO) has established various rules, regulations and applications. One of the most important alternatives among these applications is the installation of scrubbers on ships. Even though using alternative fuels instead of installing scrubbers is an option, many ship owners and ship management companies have chosen to install scrubbers on their ships due to their advantages and to get ahead in maritime transportation by complying with IMO regulations. The aim of this study is to define the advantages and the disadvantages of scrubber installation on ships.

METHOD: In this study, scrubber installation has been analyzed by the Strength Weakness Opportunities Threats (SWOT) method. The advantages and the disadvantages of scrubber installation on ships were addressed by brainstorming, utilizing expert views, literature reviews and statistics.

FINDINGS: It was found that the strengths and the opportunities of scrubber installation on ships outweigh the weaknesses and the threats.

CONCLUSION: The results of this study are presented as a decision making support tool in terms of scrubber installation. In further studies, the criteria determined via the SWOT method can be analyzed using a multi-criteria decision making method.

Keywords: Greenhouse Gas Emission, Scrubber, Maritime Transportation, SWOT

[Material Technology]
Investigation of Wear Behavior of Al_3Ti-reinforced Aluminum Matrix Composites

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PURPOSE: This study aims to investigate the production of composite materials containing Al_3Ti particles by centrifugal casting method for ship machinery parts.

METHOD: Three different matrix composites reinforced with Al_3Ti were produced as Al_3Ti /Al, Al_3Ti /Al-Cu and Al_3Ti/Al-Si. Al_3Ti particles were formed spontaneously by the in-situ technique. The prepared semi-solid mixtures were solidified under a centrifugal force for functional grading. Optical microscope, XRD (x-ray diffraction model), scanning electron microscope (SEM) and Brinell Hardness (BHN) were used to determine the properties of the composites produced.

FINDINGS: Functionally graded Al_3Ti reinforced pure Al, Al-Cu and Al-Si matrix composites were produced successfully by centrifugal casting method.

CONCLUSION: It was observed that Al_3Ti particles were graded with the effect of centrifugal force from the center outward, and it was determined that the hardness and wear resistance increased with increasing Al_3Ti particles inside matrix.

Keywords: Functionally Graded, Al_3Ti, Ship Machinery

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[Material Technology]

Production of TiB_2/Al Composite Material for Ship Machinery Parts

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PURPOSE: This study aims to investigate production of TiB_2/Al composite material for ship machinery parts by centrifugal casting method.

METHOD: TiB_2 particles have been spontaneously formed in liquid matrix as a reinforcement. A semi-solid ($Al_{(l)}$ - $TiB2_{(s)}$) prepared at 1200°C was solidified under a centrifugal force to grade functionally. Optical microscope, XRD (x-ray diffraction model), scanning electron microscope (SEM) and Brinell Hardness (BHN) were used to determine the properties of composites.

FINDINGS: Functionally graded TiB_2 reinforced aluminum matrix composites were successfully produced by centrifugal casting method.

CONCLUSION: It was seen that hardness value of the composites increases with the addition of TiB_2 reinforcement.

Keywords: TiB_2, Composite, Ship Machinery

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[Maritime Safety & Security III (Casualties & Accidents)]
Examination of Human Factors on Potential Ship Accidents under Pilotage

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PURPOSE: Pilot assistance in sailing is vital to facilitate the safe navigation of merchant vessels passing through the narrow canals, straits, rivers and entering port areas. Governments or local authorities set pilotage compulsory at such dangerous fairways but poor cooperation between pilot and bridge team lead to increase human contribution to the risks of accidents which cause to environmental pollution, economical casualties and injury/loss of life. Therefore, to examine the role of human factors in maritime accidents occurring during presence of pilot is of paramount importance.

METHOD: In this study, DEMATEL (Decision Making Trial and Evaluation Laboratory) method was developed and analysed to examine the effect of human factors on accidents during navigation under pilotage. The DEMATEL method enables to explore interaction among human factors and to visualize them with help of causal-effect relation diagram.

FINDINGS: The findings based on expert recommendation indicates that crew training, master experience and pilot experience are significant factors compared to other human risk parameters, and there is a need for collaborative relationship between masters and pilots.

CONCLUSION: It is concluded that understanding casual relations among human factors is important to prevent marine accidents. Moreover, these relations were explored and visualized for contributing to safety management system. Findings of this study are providing knowledge for policy makers, shipping companies and port authorities and also have potential to help them develop preventive measures.

Keywords: Pilotage, Maritime Safety, Human Factors, Accident Prevention, DEMATEL

[Maritime Safety & Security III (Casualties & Accidents)]
Determinants of Marine Accidents Leading Oil Spills in Port Areas

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PURPOSE: Due to its various features (loading/unloading and storage of dangerous goods; proximity to urban areas, etc.), accidents that occur in port areas may cause serious environmental impact in addition to social and economic consequences. If these accidents involve oil spills, one of the most hazardous sources for the marine ecosystem and coastal environment, the extent of the impact would be undoubtedly magnified even further. Therefore, it is noteworthy to investigate the contributing factors of marine accidents that may occur in port areas and cut the risk of the marine accidental oil spills. From this perspective, this study investigates contributing factors on tankship accidents leading to oil spills (for both oil-cargo spills and bunker oil spills) in US port areas during 2000-2015.

METHOD: The chi-square test was performed on a total of 155 cases obtained from the United States Coast Guard (USCG)'s Marine Information for Safety and Law Enforcement (MISLE) database to test for an association between the factors. While much study has been conducted to investigate the determinants of oil spills caused by marine accidents, few papers have focused on the contributing factors of tankship accidents leading to oil spills in port areas.

FINDINGS: The results demonstrated that there is a statistically significant association between the occurrence of oil spills and ship age, ship class, accident severity, ship flag, propeller type, hull material and ship type. More specifically, accidents on older ships and petroleum oil tank ships are, for example, more likely to cause oil spills.

CONCLUSION: This study will guide authorities and policymakers in estimating tankship accidents in port areas that may result in oil spills. Furthermore, it will contribute to the development of strategies and countermeasures for tankship accidents leading to oil spills in port areas.

Keywords: Oil Spill, Port, Marine Accident

[Maritime Safety & Security III (Casualties & Accidents)]

Mucilage-related Risk Assessment in the Marmara Sea Using AHP-TOPSIS Methods

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PURPOSE: The Marmara Sea has recently been confronted with the mucilage event, which is a serious environmental problem, especially in narrow areas. Agricultural activities are carried out intensively in the Marmara Region as well as many seaports and industrial facilities. Marine and air pollution increased over the years as a result of the discharge of wastes generated from these facilities or commercial ships using the Marmara Sea and the Turkish Straits. Mucilage formation has accelerated due to this type of pollution and the increase in seawater temperature caused by climate change. It can easily spread and accumulate in coastal areas and adversely affects the maritime and fishing activities and coastal tourism. Therefore, this study aims to investigate the potential problems on vessels caused by mucilage or other marine pollution sources.

METHOD: It was used Analytic Hierarchy Process - Technique for Order Preference by Similarity to Ideal Solution (AHP-TOPSIS) methods utilized from expert judgements.

FINDINGS: For marine vessels, sea saliva can be quite challenging when manoeuvring or navigating in narrow waterways. Insufficient supply of cooling water for engines due to clogged filters by mucilage or other pollution sources may cause losses in the power of ship propulsion. Additionally, the change in water density due to the existence of mucilage may impede the propulsion of waterjet-typed systems used by high-speed boats and tugboats. The findings reveal that AHP-TOPSIS method could be useful for determining these risk factors in narrow waterways.

CONCLUSION: It is believed that this study can contribute to the preparedness of vessels against mucilage or pollution related dangerous situations. The decision-makers or authorities could use the proposed model to implement risk management strategies for different type of vessels. Furthermore, the masters of tugboats/high-speed boats and merchant ships could take advantage of easy application of AHP-TOPSIS method in any circumstances.

Keywords: Navigation, Risk Assessment, Narrow Channels, Analytic Hierarchy Process, TOPSIS, Multi-Criteria Decision Making.

[Maritime Safety & Security III (Casualties & Accidents)]
Use of Simulation Training for Real Conditions Risk Assessment

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OBJECTIVE: Safety and security are the matters which count mostly on board of all ships today. There are many rules and regulations regarding these problems, which contain requirements about what have to be done in different situations, how to approach a safety or security problem, and most important how to prevent these events. But, all of these are stated to be understood and applied when is necessary, as a cold thing, without connection with the human behavior in such situations. So, starting from these considerations, we can say that rules and regulations are very important, but is more important to know how people understand to apply them and in what way. In the first phase, all situations related to ship safety and security are treated as possible risks, after being considered a real threat. For this reason is important to be able to identify and assess the risks in order to prevent a future dangerous situation. But, coming back to first consideration, how understand and assess one person a considered risk?

CASE REPORT: In this way, we tried to found how is understand and assess a risky situation for ship safety mainly, using for this simulation applications based on different possible to meet situations at sea, like, stranding or collision situations, piracy attacks and terrorist threats. In our study we included seafarers with different levels of training, from students, considered without or just few experience, until ship masters with a considerable number of years on sea.

CONCLUSION: Through this paper we intend to present the methods used in this study and the results obtained about the human approaching of any risky situation, how is made the assessment of this situations, what role plays the experience and which solutions can be considered optimum and in conformity with the actual rules and regulations about.

Keywords: Simulation, Risk Assessment, Training, Awareness

[Maritime Education II]
An Evaluation to Improve Quality of Maritime Education in Turkey

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PURPOSE: Maritime transportation has huge volume, represents approximately 90% of international cargo flow. With its feature, it can be clearly said that maritime transportation has fundamental role for global trade. Therefore, seamen's importance and their responsibilities are vital to provide continuousness of maritime transportation. On the other hand, to educate qualified seamen to the industry is as important as to employ them. At this point, quality of maritime education undertakes crucial role. In this study, criteria were determined on how to improve the quality of maritime education in Turkey. AHP method that based on fuzzy sets was employed to prioritize these criteria. A group of experts evaluated the nine criteria for employing the proposed methodology. Analysis results revealed important inferences to shape future maritime education.

METHOD: In this study, criteria were determined on how to improve the quality of maritime education in Turkey. AHP method that based on fuzzy sets was employed to prioritize these criteria.

FINDINGS: A group of experts evaluated the nine criteria for employing the proposed methodology.

CONCLUSION: Analysis results revealed important inferences to shape future maritime education.

Keywords: Maritime Education, Seamen Qualification, Fuzzy Logic, AHP Method

[Maritime Education II]

Computer-based Aptitude Testing; An Alternative for the Assessment Of VTSO

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The increase in the number and size of ships, demands, needs and expectations have an effect upon Vessel Traffic Service Operator (VTSO) daily workload and require a high concentration, attention to perform one or more tasks at the same time. In addition that the recent developments in shipping industry reveal that VTSO will also be interacted simultaneously with ships partly automated, remotely controlled with/without seafarers on board or fully autonomous ships other than non-SOLAS vessels in the near future. As a consequence of these emerging developments that aptitude of a VTSO is become distinguished attribution more than having skill, attitude and knowledge even if VTSOs have previous maritime experience. This study is proposed a solution to carry out aptitude assessment on e.g. spatial awareness, visual memory, reasoning, multi-task, complex attention, auditory memory, psychomotor as computer-based along with VTS simulator. The computerized aptitude test may also be used stand-alone instrument for the assessment of VTSOs during recruitment process.

Keywords: Vessel Traffic Service Operator, Aptitude Test

[Maritime Education II]
Innovative Port and Logistics Curriculum to Meet Stakeholders' Future Expectations

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PURPOSE: This paper discusses reflections of the recent developments in the maritime sector and expectations of the stakeholders on maritime education and training in terms of logistics curriculum. Rapid changes in technologies and regulations, as well as unexpected crises, have profound effects on maritime operations. Therefore, it is a must to prepare future employees in line with the expectations of the sector's dynamics and keep them up-to-date to meet the requirements of the future maritime trends. Maritime Education and Training (MET) institutions should do their part and educate their students to meet the challenges by innovative solutions and to reskill/upskill them as future managers. The first step to realize these is to develop the curriculum for different fields one of which is maritime logistics that requires a combination of transport and logistics-related services.

METHOD: In this study, new issues to be covered in the curriculum of the MET institutions in the future are determined by a survey given within the scope of the MINE-EMI* Project, which aims to create an international graduate program for maritime universities with a focus on meeting the future trends and needs of the sector. It will consist of three modules, one of which is the "Port Management and Logistics". The project survey was replied to by 225 stakeholders from 5 countries.

FINDINGS: Its results showed that the courses in the new module should mainly focus on more efficient and fast cargo handling systems, effective use of technology in port management, multimodal transport regulations, and updating port facilities.

CONCLUSION: Modification of the curriculum by taking the needs and expectations of the sector into consideration will not only enable the MET institutions to give more effective education to help the graduates meet the challenges of the future but also equip them with a curriculum for sustainable development in the maritime sector.

Keywords: Maritime Education And Training (MET), Logistics, Port Management, Curriculum, Future Maritime Trends

[Maritime Education II]

Digitalization of Container Ports and Tracking of Products in Containers by Internet of Things

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PURPOSE: Seaports are regarded as significant actors in global logistics and supply chains since a large part of the cargoes carried over the globe are being processed there. When the cold chain breaks down during transport and storage in the ports, the humidity, nutrition, temperature and time conditions to be required for the growth of the bacteria occur, and rapid reproduction occurs and the properties of the products are rapidly deteriorating. It is imperative that especially medicines, some chemical substances and foodstuffs need to be transported without breaking the cold chain in the logistics. The monitoring and control of the temperature and humidity level is important in the time period between the loading of these containers in special areas in ports, the loading of freight in open areas, or the loading of freight on roads and railway carriages. For this reason, precise monitoring and control of the system is vital in the port logistics management.

METHOD: In this study, a pre-receiving IoT-based system is designed for Container Ports by developing software, interface and equipment that will enable remote monitoring of temperature, humidity and other necessary key status parameters.

FINDINGS: The developed IoT-based system provides audible and visual warning, e-mail and SMS communication, similar to a monitoring screen such as a heart graph monitor, when the instant values of the refrigerated container are transmitted to the database, when the defined upper and lower values are approached.

CONCLUSION: All these data and major change information are archived in the database and retrospective situation analysis and data analysis can be performed.

Keywords: Container Ports, Port Logistics Management, Port Operations, Internet Of Things, IOT Based Cooling System, Remote Monitoring and Controlling of Containers

[Maritime Education II]

Examination of Maritime Education within Frame of Gamification

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PURPOSE: Gamification is a new design for many fields in regard with changes in the expectations and satisfaction levels of each individual with digital literacy skills, as well as in their behavior and habits. It is expressed as the use of digital game elements and game thinking in non-game environments to enable the user to connect to the environment, increase motivation and increase user experience. For this reason, gamification is a critical issue for the maritime education in regards to use the benefits of its frame.

METHOD: In this context, in this study, it is aimed to measure the predisposition and interest of the maritime university students in the game contents by conducting a survey. In addition, it is aimed to obtain statistical results regarding the attitudes of the participants towards learning with computer games, their attitudes and expectations towards gamification, and how useful gamification could be for non-game systems. Lastly, it is revealed which courses in maritime can be gamified.

FINDINGS: According to results, it is seen that the majority of the students are intertwined with games every day. This shows that the game is a part of the students' life. In addition, it is concluded that the reason why the majority of the people prefer to play 'multiplayer' games is the desire to be successful brought by the competitive environment or the communication-based system being more interesting and increasing motivation even more. Besides, a significant portion of the students think that gamification will make the lessons more interesting, specifically electronic navigation and maritime security courses.

CONCLUSION: With the COVID-19 pandemic around the world, disruptions have occurred in many areas, specifically education. It can be foreseen that some of the online solutions created with the compulsory innovations and changes, such as gamification in education will become continuously sustainable.

Keywords: Gamification, Maritime, Maritime Education

[Autonomous Ships & Systems]
Interoperability of Emerging Technologies with Ports in Autonomous Shipping Era

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PURPOSE: The study mainly aims to analyze the possible effects of Maritime Autonomous Surface Ships (MASS) on port operations and the problems that may be encountered during port operations. It is also aimed to contribute to the development of suitable ship-port interoperability so that ports can be ready for MASS operations.

METHOD: This study applies a statistical analysis method in order to measure the dimensions of (1) the impact of autonomous ships on port operations and (2) the possible problems that may arise during port operations of MASS. The required data for the analysis has been collected by a questionnaire that reflects the views of port authorities, ship owners, shipbuilding industry, academics, and people who work related to port operations in institutions.

FINDINGS: In accordance with the purpose of this study, analyzes will be carried out by using statistical tools with the obtained survey data to measure the effect of MASS on port operations and the determination of the problems that may be encountered during the port operations of MASS. As a result of the analysis, the effect of autonomous ships on port operations and determining the problems that may occur during the operations will be the main success criteria.

CONCLUSION: This study reviews the interoperability of MASS and ports, and evaluates the interoperability of MASS and ports from the perspective of shipowners, port operators, and shipbuilders, and presents results on the compatibility of port infrastructures with autonomous ship systems. Consequently, the outputs of this research are expected to assist efforts to successfully implement autonomous systems in the shipping chain.

Keywords: Autonomous Ships, Maritime Shipping, MASS-port Interoperability

[Autonomous Ships & Systems]
A Discrete Choice Analysis of Port Stakeholders on Autonomous Shipping

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PURPOSE: This study primarily focuses on determining and evaluating emerging issues needing to be addressed by port stakeholders regarding the commercial use of Maritime Autonomous Surface Ships (MASS) in the maritime transport chain. These issues not only include operational challenges but also transformative influences from the perspective of port stakeholders. Comprehension of existing technological adaptation choice drivers of stakeholders is important to allocate limited technology and innovation resources of the ports appropriately to gain competitive advantages in return.

METHOD: In this study, a discrete choice analysis model is utilised as an examination tool to evaluate likert scale based choices of the port stakeholders for technological adaptation regarding the challenges generated by MASS use in the port area. The data of the model is collected by a survey questionnaire with valuable participation of responders from port stakeholders including port authorities, shipowners, academics and industrial researchers, as well as other major stakeholders.

FINDINGS: In line with the purpose of this study, detailed analyses are conducted by using the aforementioned methodological tool based on the data obtained from the elaboration of the survey questionnaires distributed to the target groups. By utilising the outputs of the model, results are generated to investigate the challenges in adaptive development of ports.

CONCLUSION: The results of this study particularly provide an overview of the emerging ship-port communication interoperability challenges with the use of MASS in the shipping industry. As a consequence, the practical outcomes of this study are anticipated to develop successful technology and innovation resource management implementation of ports for effective use of MASS in the port area.

Keywords: Discrete Choice Analysis, Autonomous Ships, Ship-Port Interface

[Autonomous Ships & Systems]
Ship-to-Ship Dialogues Using a Finite State Machine Approach

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PURPOSE: Algorithms for Collision Avoidance Systems (CAS), especially for autonomous vessels, require that there are no situations where the application of the Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) results indeterminate or ambiguous.

METHOD: It is essential to add some ship-to-ship communications to share data in order to eliminate differences in decision-making and to achieve safer encounters. An example of a risky encounter illustrates this assertion, which is not contemplated in the related studies consulted. Finite State Machine (FSM) is a mathematical model for describing the sequential behaviour of a control program. Sequential function chart (SFC), subset of FSM, is a graphical programming language for Programmable Logic Controllers (PLCs), defined by the international standard IEC 61131-3.

FINDINGS: SFC is used in this work to model and program the set of states and transitions involved in the ship-to ship dialogues initiated when one of them detects a risky situation. This language facilitates the development, verification and maintenance of the program. An analysis is made of the defined states.

CONCLUSION: The implemented dialogues will allow to share information on the characteristics of the encounter and to reach agreements on the manoeuvres to be carried out, or to keep record about disagreements.

Keywords: Collision Risk Reduction, Inter-ship Communications, Decision Support Systems

[Maritime Transportation & Management]

Green Liner Ship Routing with Time Windows under Weather Conditions

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PURPOSE: The effects of globalization resulted in maritime transportation being as one of the main pillars of the international trade. Maritime transportation has a substantial share in global trade in volume, which causes shipping companies to have larger fleets in size and numbers as well as to provide faster logistics services to survive in the competitive environment. On the other hand, total fuel consumption and greenhouse gas (GHG) emissions increase each year, posing a threat to the environment. Hence, new concepts such as green vehicle routing have emerged considering the ever-growing effects of environmental pollution. The aim of this study is to propose a solution scheme for the liner shipping companies by revising the shipping routes in order to reduce the effects of their fleet's fuel consumption and carbon dioxide (CO_2) emissions.

METHOD: In this study, a green vehicle routing problem approach on liner shipping has been proposed. The proposed methodology considers not only the effects of several weather conditions but also time windows restrictions and cargo demand in various ports. To evaluate the viability of the proposed methodology, a case study has been conducted. Total carbon dioxide emissions and fuel consumption output by the novel shipping routes have been compared to the ones obtained with the current routes.

FINDINGS: The proposed methodology shows that the new ship routes with reduced carbon dioxide emissions allows for better planning compared to current liner routes under several weather conditions.

CONCLUSION: Significant efforts have been made for greening the maritime transportation and hence reducing the effects of both ship-based carbon dioxide emissions and fuel consumption. Accurate modelling of ship routes keeping in mind green approaches and related constraints will yield both financial and environmental benefits in the near future.

Keywords: Green Vehicle Routing, Liner Shipping, CO_2 Emission, Fuel Consumption

[Maritime Transportation & Management]
Port Activity Application for Port of Rauma and Gävle

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OBJECTIVE: To improve efficiency in the Baltic Sea transport corridor Gävle - Rauma and facilitated increase information exchange between ship and ports, between the ports and between ports and hinterland operators to ensure high and efficient transport flows. CB EfficientFlow project work package Gävle – Rauma led by Satakunta University of Applied Sciences, partners ports of Rauma and Gävle and Swedish Maritime Administration.

CASE REPORT: The results of the project were carefully analyzed and evaluated, widely disseminated, and served as best practices examples for other corridors and ports in the Central Baltic area and beyond. By improved information exchange between the actors of the two ports in the Central Baltic area contributed to higher efficiency and timesaving, reduced transport time, higher transport predictability and improved sustainability and transport quality. Terminals and operators (maritime and hinterland) together with other actors in the maritime transport eco-system benefit from the project results and participated in and contributed to the project work. Real successful digitalization case. See video from port of Rauma at https://www.youtube.com/watch?v=odpqz676smE.

CONCLUSION: The project's primary outcome was a Port Activity Application for Port of Rauma (PoR app) and Port of Gävle (PoG app). Port apps have different levels of users; administration, the port, first-level user who can send notifications, and user-level who can monitor the action. Today there are more than 100 registered stakeholders in the PoR app. Fintraffic VTS decided to take this new application as a part of their digitalization strategy, providing more diverse information exchange and transmission capability between different actors. New SaaS (Software as a Service) – model brought all major Finnish ports into the system, as Fintraffic VTS is offering this service free of charge, and ports can develop the software further at their own cost. Developed Port Application is a real example of a Just-In-Time solution.

Keywords: Just-in-Time, Efficiency, Application

[Maritime Transportation & Management]
Just in Time, Vessel Arrival System for Dry Bulk Carriers

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PURPOSE: The cargo conveyance onboard dry bulk carriers is contemporarily often affiliated to preoperational waiting times, which may affect the income situation of stakeholders and the sustainability of the sector. Repetitively occurring waiting problems, potentially paired with the phenomena of port congestion, thereby indicating that JIT arrival potential for a distinct or a combination of reasons has not been realised, can be frequently identified. The undesired increment of waiting times and development of port congestion is frequently responded to by an array of measures. JIT arrival concepts, VAS and VA agreements thereby do not strive to eliminate waiting times but facilitate their sensible transformation into additional navigation time. In practice, VAS applications may, however, only enfold their inherent sustainability potential within closely defined delimitations, while JIT mechanisms and VA agreements may lack acceptance due to impracticability or missing alignment to underlying trade requirements. Therefore, fair but environmentally inefficient arrival mechanisms like the FCFS concept remain widely applied.

METHOD: To remedy the depicted situation, a novel VAS has been conceptualised by diverting from a static to a dynamic time-, distance- and speed concept. These parameters are defined by the predicted berth and cargo operation availability.
A circular based reporting Line vested with the genuine functions attributable to the customary place where line up positions are allocated is fluctuating in correspondence to the time to go until the nearest available berthing opportunity is becoming available.

FINDINGS: The proposed method does not only provide for a dynamically shifting line and corridor to obtain an often highly valued line up position but for the distance at which and conditions whereunder a vessel is going to arrive JIT to exert its full fuel-saving potential.

CONCLUSION: The FCFS concept interwoven with unbiased allocating of line-up positions is being retained as an integral part while VA applications are supported.

Keywords: Just In Time, Vessel Arrival System, Dry Bulk, Green Shipping, Decarbonisation

[Navigation & Marine Traffic]

Research for Improving Navigation Safety: Gulf of Izmit Case Study

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PURPOSE: In this study, it was aimed to determine the risk factors that threaten the navigation safety of ships in the Gulf of Izmit. In addition, it was intended to carry out a risk analysis to increase the navigation safety in the region by classifying the identified hazards.

METHOD: In this context, literature review was conducted to identify potential hazards threatening navigational safety in the Gulf of Izmit. Afterwards, a survey was conducted with an expert group consisting of maritime pilots and Vessel Traffic Services (VTS) operators who knew the navigation conditions of the region very well. Obtained feedbacks were analyzed with the Analytic Hierarchy Process (AHP) method.

FINDINGS: As a result of the analysis, it has been concluded that many factors such as heavy commercial ship traffic, local traffic elements, meteorological conditions pose a risk in terms of navigational safety in the region.

CONCLUSION: The importance of complying with the Convention on the International Regulations for Preventing Collisions at Sea (COLREG-1972) rules was emphasized in order to prevent possible marine accidents by increasing the navigation safety in the Gulf of Izmit. In addition, many suggestions have been made such as the providing effective communication between ships and the VTS.

Keywords: Gulf Of Izmit, Safe Navigation, Accident Risk, Risk Analysis, Congested Waterway

[Navigation & Marine Traffic]

A Simulation Model for Marina Traffic and Berthing Services

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OBJECTIVE: Due to the increasing yacht traffic on the Mediterranean coasts, marinas are facing steep competition. To be able to maximize their profitability, marinas need to increase the efficiency of their services by shortening the waiting times for entering and exiting a marina, as well as the total time elapsed for docking and undocking a boat. To that end, the existing systems should be analyzed, and the characteristics of these systems should be well-defined. Furthermore, problems in a conventional marina operation system, and the bottlenecks in these problematic areas must be specified in order to improve.

CASE REPORT: The simulation model can be utilized by marina managers as a decision support system to compare various alternatives for the current system. In this study, the service performances of various marinas' operations are analyzed through simulation modeling.

CONCLUSION: Utilization of the berths in a marina, number of yachts in queue (in and out), number of rejected yachts, and average waiting time for yachts in queue (in and out) are chosen as the performance criteria for the purpose of this study. Additionally, an improved system of marina operations is proposed.

Keywords: Marina Management, Yachting, Berthing, Docking, Simulation Modeling

[Navigation & Marine Traffic]
SWOT Analysis for Safer Ship Navigation at 1915 Çanakkale Bridge

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PURPOSE: 1915 Çanakkale Bridge will be the suspension bridge with the longest middle span in the world with 2023 meters. Since the piers of this huge bridge are located in the waterway, it is obvious that it will bring great risks in terms of navigational safety in the Çanakkale Strait, which is an important trade route and thousands of ships pass through every year. Considering many ship-bridge accidents throughout history, the environmental and financial effects of the accidents are remarkable. Therefore, it is very important to identify and evaluate risks and take measures in order to prevent a possible disaster or reduce its effects. The aim of this study is to determine the factors affecting the safety of navigation on the 1915 Çanakkale Bridge and to reveal the necessary measures to provide a safer navigation environment.

METHOD: Factors were determined by SWOT (strengths, weaknesses, opportunities and threats) analysis method.

FINDINGS: It has been observed that the measures taken for ship-bridge collisions are insufficient.

CONCLUSION: With this approach, strategic action plans have been developed to minimize the risk of ship-bridge collisions and to reduce the effects in case of collision.

Keywords: 1915 Çanakkale Bridge, Ship-bridge Collision Risk, SWOT Analysis, Navigational Safety

[Navigation & Marine Traffic]

Marine Traffic Analysis by Calculating the Ship Encounters

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PURPOSE: Marine Traffic Analysis are mainly evaluating with the consideration of Ship Domain that can be calculated by empirical, knowledge-based and analysis-based methods. In this study, Ship Domain is revealed by calculating the ship encounters with empirical methods by AIS data. The purpose of this study is to show the one of the empirical calculation methods for revealing the Ship Domain for a navigation area.

METHOD: The method of the study for these calculations are using the data mining methods and mathematical calculations. During the calculations, AIS data is used and the analysis are made for a coastal navigation area. Firstly, all data set is arranged for the process and after that data cleansing process is done for the accurate analysis. After that each vessels encounters with each other are calculated with mathematical calculations. Then the vessel passages with each other during navigation are visualized with different styles as heat map and grid plot.

FINDINGS: The findings of the study show the Ship Domain calculations and visualization for different types, sizes of vessels and their differences according to the Ship Encounters.

CONCLUSION: As a conclusion of the study, empirical methods and differences with other methods are compared and evaluated.

Keywords: Marine Traffic, Marine Traffic Analysis, Ship Encounter, AIS

[Naval Architecture & Offshore Technologies (Hydrodynamic-Aerodynamic)]
Design of a 24 M Full Electric Tugboat

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PURPOSE: Green technology is the 21st century's popular subject for all the industries. The improving battery power and lifespan are enabling sustainability of the operations thus, creating an area for intermittent working tugboat industry. The nonfossil fuel energy source has effects on design parameters such as power calculations and efficiency of the tug, the exhaust line and machinery space arrangement. The emergency situations are of another important issue. In this study, a concept of 24m full electric tugboat will be introduced via design and efficiency estimation and a feasibility research will be given.

METHOD: An existing 24 meter diesel engine tugboat is turned into full battery power tugboat, the power is calculated according to operational profile of a 24m harbour tug, the battery set is chosen. Then the added/subtracted equipment is concerned in way of weight.

FINDINGS: In order to complete a 95 minute of one operation 3600 kWh energy is needed. The detail of the calculation starts with battery usage.The batteries can be used up to 20% left and considering a 10% system loss, 3600 is divided by 0.3. Then, the towing operation requirement of 200 kWh and 100 kWh of ship general duty power is all added yielding a sum of 3330 kWh, rounding up to 3600 kWh. The battery set capable of providing 3600 kWh is 39 tons, which is found to be feasible.

In the second part of the study, the CO_2 emission values are compared. 20 years of operation of a conventional harbour tug is found to yield 20200 tons of CO_2 whereas full battery yields zero emission. However the battery production yields CO_2, the battery life is 10 years and need to be changed once in 20 years of lifetime of a tug. So the emission of batteries is 720 tons of CO_2.

CONCLUSION: First of all the energy density, technological maturity, capital cost and global production are challenges to be improved for battery power.

Then comes the environmental impact of battery production which uses more water and emits more particulate matter and more sulfur oxides.

The technical feasibility study shows that it is possible to build a full electric tug but, in case of an emergency the batteries can't be charged while navigating. So there should be a generator and a small fuel tank for the emergency operation.

Keywords: Electric, Tugboat, Efficiency

[Naval Architecture & Offshore Technologies (Hydrodynamic-Aerodynamic)]
Novel Air Lubrication Method Applied to a 36-m-long Model Ship

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PURPOSE: Air lubrication technology is utilized to reduce the frictional resistance of ship hull and applied to more than 20 vessels. The authors' group has been developing the novel method of air lubrication, termed repetitive bubble injection (RBI), to improve the efficiency of drag reduction. Air flow rate for the bubble injection is periodically fluctuated in RBI in contrast to the conventional method blowing air continuously. We investigated promotion of drag reduction by RBI in a quasi-full-scale environment using a 36-m-long flat bottom model ship.

METHOD: The model ship was towed in a 400-m-long water tank at 8.0 m/s. The total resistance of the model ship and the local wall shear stress on the bottom plate were simultaneously measured. The RBI frequencies f = 0.5 Hz, 1.0 Hz and 2.0 Hz were examined, and duty cycle ε, namely the fraction of period blowing air, was controlled to be 0.25 and 0.50.

FINDINGS: The reduction of the total resistance was enhanced by RBI at f = 0.5 Hz and 1.0 Hz, and the promotion was larger at ε = 0.25 than ε = 0.50. Frictional resistance reduction on the bottom plate was improved by 5% at the best case (f, ε) = (0.5 Hz, 0.25) relative to the continuous injection. In this case, the reduction of the local wall shear stress was promoted by RBI along the entire ship and seems to persist much longer distance.

CONCLUSION: The experiments demonstrated the superiority of RBI to the conventional method in the large-scale environment nearly equivalent to the ships. Because the local drag reduction persisted to the stern of the model ship, the amount of drag reduction is expected to increase on the longer hulls.

Keywords: Air Lubrication, Model Ship, Repetitive Bubble Injection, Turbulent Flow Control

[Naval Architecture & Offshore Technologies (Hydrodynamic-Aerodynamic)]
Aerodynamic Optimization of Pyramid Stacking for Container Ships through CFD

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PURPOSE: Over the recent decade, container ships have gone through a dramatic boom in size, while attention spans have been paid toward hydrodynamic characteristics rather than aerodynamic features. This lack popped up when a 20000-TEU container ship of Ever Green line went aground under a gale in the Suez channel for six days and somewhat the sea transportation, and subsequently, the global economy was captivated. Despite few studies on mega-sized container ship stacking configurations, the aerodynamic features of pyramid stacking types have not ever been studied in particular.

METHOD: To this end, the present paper aims to unravel the case by testing various cross-sectional pyramid types layouts in a set of 2D simulations using the realizable k-ε turbulence model through CFD commercial software, STARCCM+. Further, the outcomes have been processed for combining pyramid profiles in 3D models to study frontal and lateral drag.

FINDINGS: The outcome of the study is twofold; the first is to show the extension of 2D simulation applicability for evaluating the aerodynamic behavior of different stacking profiles for 3D scenarios. Second, simulations demonstrated that various pyramid stacking could effectively reduce the lateral drag up to 22% compared to the full-load configuration while preserving loading capacity.

CONCLUSION: As such, the optimum pyramid layout is finally presented, whereas it could be applied in loading instruction to enhance mega container ship interoperability and maneuvering efficiency.

Keywords: Container Ship, Aerodynamic, CFD, Pyramid Stacking, Wind Load

[Naval Architecture & Offshore Technologies (Hydrodynamic-Aerodynamic)]
Hydrodynamic Comparison of Bow Forms for A Model Submarine

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PURPOSE: The bow geometry is possibly the most important feature for drag reduction. It is the first surface encountered with water flow and therefore its properties determine the types of flow regime over the submarine envelope. It is very important that the flow over the fore section, which houses the bow array, be as ideal as possible.

METHOD: A comparison study of different submarine bow forms is carried out under the fully submerged condition without any free surface effects for minimum drag characteristics. Initial geometry has been chosen as Darpa Sub-off generic submarine, AFF-1 configuration. Elliptic equations, Myring equations and DREA form have been implemented to obtain different bow forms keeping the rest (parallel midbody and afterbody) of the initial geometry as constant. In order to predict the hydrodynamic performance of defined bodies, an incompressible solver of open source CFD software OpenFOAM has been utilized.

FINDINGS: Various parameters are compared for each bow shape to understand the pros and cons of the bow shapes.

CONCLUSION: 15 different bow forms have been analysed using DARPA Sub-off parallel midbody and after body for 3.045m/s velocity.

Keywords: Submarine, Bow Form, CFD, Hydrodynamic, Resistance

[Naval Architecture & Offshore Technologies (Hydrodynamic-Aerodynamic)]
Comparison between AZIPOD Systems and Mermaid R.R.

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PURPOSE: The electrical circuits of the two systems give an overview of the system structure. Insulation and earthing devices are represented by electrical components. The concept of electric propulsion has become an alternative to many types of ships. Also the average speed engine took the place of low speed. In general, the small machinery room is important for those vessels where the load volume is limited to the design of the vessel, example, containers, tanks, ferries, luxury passengers. Another problem is the weight of propulsion machine, if this is low, it allows the ship a higher deadweight available to the goods. AZIPOD propulsions have gained ground on dishes where propulsion power is moderate and manoeuvrability is important. The use of frequency converters is intended to control the engine speed and torque constantly changing frequency in frequent variables. If electric propulsion is profitable, it means that AZIPOD propulsion is profitable. The technological development of semiconductors is very important and allowed the development of many types of converters.

METHOD: Presentation of the particularities of each type of propulsion.

FINDINGS: ABB uses thyristor with integrated switches RR uses isolated transistor with bipolar gate. Harmonic distortion that can affect the whole system.

CONCLUSION: ABB superior insurance in extraordinary situations, such as accidents or emergency maneuvers in bad weather. ABB superior propulsion efficiency at a better price. ABB enhanced maneuver time in ports and in natural channels

Keywords: Electric Propulsion, Average Speed, Frequency Converters

[Naval Architecture & Offshore Technologies (Hydrodynamic-Aerodynamic)]
A Comparative Analysis of Indoor Positioning Technologies in Shipyard Digitalization Context

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PURPOSE: In the last few decades, there has been an increasing growth in research into the use of positioning technologies in open environments. Most of the algorithms, techniques and technologies used have been successfully applied outdoors. However, how they do well indoors is completely different. Therefore, various technologies have been proposed and implemented to improve positioning and navigation indoors. These include Infrared, Ultrasound, Magnetic, Optical, Radio Frequency and Hybrid uses. Especially among the technologies based on Radio Frequency, Bluetooth, Ultra broadband, Wireless Sensor Network, Wireless Local Area Network, Radio Frequency Identification and Near Field Communication are widely used in different fields.

The indoor positioning system is a technology that has the potential to significantly improve work efficiency and safety in the shipyard area. It is difficult to achieve a successful digital transformation of the complex shipyard environment without identifying an Indoor positioning technology most suitable for the shipyard environment. In this study, it is aimed to determine a positioning technology that will be most suitable for the shipyard environment.

METHOD: This paper analyzes the challenges for the selection of Indoor positioning system for shipyards in evaluating Indoor positioning technologies. This article presents a state-of-the-art investigation of indoor positioning and navigation systems and technologies and their use in various scenarios. It analyzes different positioning technology metrics such as accuracy, complexity, cost, privacy, scalability and availability. This article has profound implications for future positioning and navigation studies.

FINDINGS: The work carried out here on indoor positioning systems and components makes a significant contribution to the shipyard. Because it has a great impact on the suitability of technologies, especially in relation to the shipyard environment. Both the evaluation model and solution method, and the Bluetooth-based positioning technology, which stands out at the end of the evaluation, are important contributions of the study.

CONCLUSION: To determine which indoor positioning systems are more suitable for the shipyard environment, both a detailed analysis of the shipyard environment and an evaluation were made to select the most suitable technology. The Blotooth-based technology proposed at the end of the evaluation is a new example of the benefits of the cyber physical system, thus providing a reliable remote monitoring platform to take advantage of strategic applications and enhancements in the shipyard environment.

Keywords: Shipyard, Shipbuilding, Positioning Technologies, Indoor Positioning Systems

[Maritime Crew Management]
Modelling the Maritime Officer Workforce in the European Labour Market

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PURPOSE: The maritime labour market is a complex system influenced by world trade, technology, changes in business practice, and government policy at regional and global levels. The aim of this study is to develop a workforce simulation model of EU maritime labour market in order to assess the gap between the present maritime workforce and future requirements to predict training and recruitment needs.

METHOD: Based on the level of abstraction of the maritime workforce system, the study took a systems-based approach to model and simulate the system through applying system dynamics (SD) method to conduct a scenario-based analysis of changes in the supply and demand for officers and the structures of the maritime workforce in Europe. Simulation scenarios, in which different entrant parameters were manipulated, were designed to quantitatively and qualitatively determine the maritime workforce structure from 2018 to 2030.

FINDINGS: Findings of the study suggest that the supply of officers in the EU could experience a decrease in the short term and an increase afterwards. At the same time, the demand for officers is likely to increase very slightly in the future because of the high international competition. However, the shortage of officers is predicted to increase.

CONCLUSION: The fact that there are so many imbalances between the supply and demand for maritime officers found in the study shows the importance for monitoring this system and addressing this shortage. The modelling tool developed in this study could help decision makers in governments, international organisations, and maritime authorities around the world to understand the issues of the demand for seafarers, and the education and training challenges to a better supply for adequately skilled seafarers.

Keywords: Maritime Workforce, Seafarers, System Dynamics, Supply And Demand

[Maritime Crew Management]

Glass Ceiling Perception in Turkish Maritime Sector: Career Pathway Survey

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PURPOSE: The "Glass ceiling" is a metaphor that refers to an invisible barrier that prevents women and minority communities from being promoted to managerial and executive-level positions within an organization. The expression is also often used to describe women's difficulties when trying to rise to higher roles in a male-dominated hierarchy. In the maritime sector in Turkey, barriers are usually unwritten, leading to further restrictions on women's advancement due to accepted norms and prejudices rather than defined institutional policies.

METHOD: In this context, it is aimed to measure the effect of different demographic characteristics on glass ceiling dimensions by applying the Career Pathway Survey created by Smith et al. Within the scope of the research, the glass ceiling perception was investigated with the data collected from 353 participants employed in 14 different sector branches. In order to evaluate the relationship between gender and perception, it was tested whether there was a significant difference between the distribution of the answers given by male and female participants through the DATAIKU program. In addition, the effects of education, age, marital status, position, and experience on female employee's perceptions in the maritime sector were investigated.

FINDINGS: Based on the answers given by the male and female participants in our survey, in which we examined the perception of the Glass Ceiling in 4 dimensions, we can say that the perception differs according to the gender demographic factor. When we look at the dimensions, we should state that there is a significant difference in Denial, Resilience, and Resignation, but we can see partially significant difference in the Acceptance dimension. For age factor, we can say that there is a significant difference in Denial, Resignation, and Acceptance, but partially significant difference in Resilience dimension. Moreover, we may mention for the other demografic factors «education level, marital status, having child, position, and sector branch» but not including «company type»,there is a significant difference in Acceptance dimension, which represents the belief of women who prefer a balanced life instead of dealing with career planning.

CONCLUSION: This research enabled the perception of the glass ceiling, which is accepted in practice by female employees in the sector, to be evaluated by male employees as well. In addition, it tested the reality of the perception based on the existence and degree of the glass ceiling and showed the sector's situation to the organizations.

Keywords: Glass Ceiling, Maritime Sector, Career Pathway Survey, Dataiku

[Maritime Crew Management]

The Effect of Emotional Intelligence on Seafarers' Work Performance

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PURPOSE: Maritime transportation is the most used trade channel in today's world. Ships have a complex structure in which psychology is constantly changing due to the fact that they are constantly in motion, that time zones are constantly changing, that they travel under variable or difficult weather conditions. It has been revealed by the researchers that the process managements differ among the people living in these situations together. When the reason for these differences was investigated, the concept of emotional intelligence was encountered and a connection was made with people's reactions to changing conditions, adaptive abilities, and controlling emotions. The aim of the study is to examine the emotional intelligence levels and to find the relationship between the emotional intelligence of seafarers and their work performance.

METHOD: 43 participants are participated in the study, working on bulk carriers, and other seaferars working on land. The Schutte Emotional Intelligence Scale was used to measure the emotional intelligence levels of seafarers.

FINDINGS: It is found that the sub-factors of the scale were directly proportional to the age. A significant difference is found due to the high scores of high school and university graduates on the scale. A directly proportional relationship was found between educational status and emotional intelligence. As the number of years worked increases, the level of emotional intelligence increases. There is a moderate positive correlation between emotional intelligence and job performance.

CONCLUSION: As a result of this study, it can be said that the emotional intelligence of seafarers should be high in order to get used to the closed system of the ship, to adapt, to protect mental health, to increase and maintain performance.

Keywords: Emotional Intelligence, Work Performance, Seafarer, Maritime

[Naval Architecture & Offshore Technologies]
Investigation of GateRudder's Effect on Containerships' Motion Using Potential Flow

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PURPOSE: The objectives of this study are to:
•Model containerships and their respective rudders in potential flow code,
•Investigate the effect of gate rudder on containerships' motion in regular waves,
•Estimate the added wave resistance in the presence of two different type rudders.

METHOD: Potential theory is applied. The fluid is assumed to be homogeneous, non-viscous, irrotational and incompressible.

FINDINGS: A new category of Energy Saving Devices (ESD) called Gate Rudder has been introduced by Sasaki et al and has been applied on a 2400 GT container ship named Shigenobu in Japan. The utmost benefit from Gate Rudder systems came from the duct effect employed by the working propeller. Not only the novel ESD provided a better propulsive efficiency owing to the accelerated duct flow, Gate Rudder systems also demonstrate favourable manoeuvring and seakeeping performance. It has been claimed that Gate Rudder can reduce ship's rolling motion by controlling the rudder angles [Sasaki, 2015].

CONCLUSION: Another exceptional performance of Gate Rudder systems that has been proven by the service performance monitoring that the new concept of this unconventional ESD had a better powering performance in rough seas up to 27% over her sister ship Sakura [Sasaki, 2018]. The port operation data also revealed that the bow thruster in Shigenobu can be used at up to 10 knots while the bow thruster in Sakura can be used only less than 5 knots. This difference is worthy of attention because the specification of bow thruster and the bow designs of both vessels are exactly the same. In addition, the difference occurred in the length of anchor chains required for anchoring. Shigenobu only requires 7 chains to keep the ship secure while Sakura prescribed a prolonged anchor chain to deploy. These findings have inspired the ship design engineers to investigate such unusual phenomenon.

Keywords: Gate Rudder, Seakeeping, ESD, Energy Efficiency, Potential Flow

[Naval Architecture & Offshore Technologies]
Study on Offshore Wind Farms and Maritime Capabilities of Turkey

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PURPOSE: Parallel to the exhaustion of fossil fuels and the adverse effects of climate change, energy production is shifting towards renewable green sources, such as wind power. Compared to on-land wind production sites, off-shore wind farms have important superiorities. With higher energy potential, better usage of land areas and overcoming a public disturbance, off-shore wind installations are gaining importance worldwide. Turkey has a substantial potential for off-shore wind farms, especially in Marmara, Aegean and the Mediterranean coasts, and this great capacity for the country is still at the beginning of the road. With land-based installations, various types of supply vessels and, of course, abundant seafarers, off-shore wind farms promise an excellent opportunity for maritime operations. The opportunities regarding the off-shore wind farm industry for the country needs a strategic approach and planning. Therefore, this study aimed to investigate Turkey's options and potential in terms of off-shore wind farms. After evaluating potentially suitable areas for off-shore wind areas, the current situation of ports and the maritime supply vessels is assessed for Turkey. Furthermore, the off-shore wind sector has an important impact on the employment and recruitment of seafarers. Therefore, the study aimed to put under surveillance Turkish seafarers, in terms of their readiness for this blue economy.

FINDINGS: There exist important potential, however a lack of readiness and awareness, regarding research question, in maritime sector of Turkey.

CONCLUSION: The current situation Turkey's maritime sector for off-shore wind farms.

Keywords: Off-shore Wind Sector, Maritime Sector, Seafarers,

[Naval Architecture & Offshore Technologies]
New Technologies in the Shipbuilding Industry: Wire Arc Additive Manufacturing

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PURPOSE: Increasing the competitiveness in the shipbuilding industry has led shipyards and researchers to generate solutions for reducing manufacturing costs and increasing production efficiency. Therefore, new manufacturing technologies have been started to be used in the shipbuilding process including difficult-to-built and labour-based complex parts such as propeller, bulbous bow or rudder. Wire Arc Additive Manufacturing (WAAM) is one of the promising, rapidly growing, flexible and low cost manufacturing technologies that can be implemented in the new generation shipyards.

METHOD: In this study, the WAAM method is reviewed using the existing studies and applications, and possible implementations for ship parts are discussed under the framework of design complexity, building material and cost.

FINDINGS: According to analysis, WAAM method is adaptable for the shipbuilding industry to decrease labor costs, produce complex ship parts precisely and offers flexible manufacturing solutions. Moreover, WAAM is a compact technology which requires less manufacturing areas.

CONCLUSION: Therefore, WAAM technology is a strong tool that will ease the transition of the shipbuilding sector to industry 4.0 or industry 5.0 aiming smart and cost-effective manufacturing.

Keywords: Wire Arc Additive Manufacturing, Shipbuilding, Ship Structures, Manufacturing Methods, Industry 4.0

[Seafarers Health & Environment]

Effects of COVID-19 on Fuel Gas Emissions from Marine Transportation

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PURPOSE: The COVID 19 pandemic still continues to show its impact all over the world in almost every aspect of life and sectors. While these effects were devastating for some sectors, they forced some sectors to be progressive in terms of operation. The aim of this study is to reveal the effect of COVID-19 on fuel gas emissions from marine transportation.

METHOD: For this purpose, the emissions of commercial vessels engaged in loading and unloading activities in ports, terminals, platforms and buoy systems in the Iskenderun Bay were estimated. Firstly, the ports in the Iskenderun Bay were divided into four areas as three ports sub-areas and one navigation sub-area. Secondly, fuel emissions of NOx, SOx, CO_2, HC and PM arise from cruise, berth accommodation and maneuvers of all maritime merchant ships arriving at these ports between 2019 and 2020 were calculated theoretically using by MS Office Excel Program. Third and last, these fuel gas emissions were compared with 2015-2018 data to reveal the impact of covid 19 on marine transportation.

FINDINGS: Study results show that, as a positive effect, while ship traffic has increased in the region in general, fuel gas emissions have also increased in the COVID 19 period and have been estimated as a negative effect.

CONCLUSION: Naturally, although the increase in ship traffic in the region during the COVID 19 period is thought to have positive economic effects, it is thought that the increase in fuel gas emissions may have negative consequences for air quality.

Keywords: Marine Transport, COVID-19, Fuel Gas Emission, Air Quality

[Seafarers Health & Environment]
Maritime Occupational Health and Safety Challenges in Canadian Arctic Shipping

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PURPOSE: The opening of the Arctic is expected to significantly increase maritime traffic, and expanding access to fishing resources. The increased maritime activities in polar waters will increase occupational health and safety risks for seafaring communities. Ice and low temperatures in Arctic waters impose threats to navigation safety and the health and safety of maritime workers. The COVID-19 pandemic further complicates the situation. This research aims to explore occupational health and safety challenges faced by Canadian seafarers involved in Arctic shipping.

METHOD: This paper adopts socio-legal interdisciplinary methods, including legal doctrinal analysis, media coverage analysis and semi-structured interviews with Canadian Arctic Seafarers.

FINDINGS: The research findings show that, sea ice, strong winds and currents are major environmental risks for navigation safety. The lack of terminal infrastructure in the northern communities and very restricted search and rescue services impose extra safety pressure for seafarers. The isolation on board, the lack of communication channels with families also lead to significant mental health pressures for seafarers. During the COVID-19 pandemic, the cancellation of shore leave and leave between voyages further exacerbate the fatigue risks experienced by the crew.

CONCLUSION: Drawing upon the findings from this study, we recommend that the development of marine infrastructure, including terminal infrastructure and search and rescue services, is the urgent issue to ensure maritime safety in the Arctic. Additionally, onboard supports, including mental health support program, and wifi access are strongly recommended to be provided by management to assist seafarers to over mental health challenges.

Keywords: Arctic Shipping, Seafarers, Occupational Health And Safety

[Seafarers Health & Environment]
Evaluation of the Effects of the Covid-19 Pandemic on Seafarers

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PURPOSE: Beyond the significant material damage caused by the COVID-19 Pandemic to the world economy, the problems experienced by seafarers, who have an important role in the functioning of the maritime transportation system, become another subject of study when considered from a global maritime point of view. Among the maritime industry stakeholders that were adversely affected by the COVID-19 Pandemic, there are many victims, including port workers, customs officers and other authorities' representatives, ship agents, pilots and suppliers.
The aim of this study is to reveal the effects of the COVID-19 Pandemic on seafarers, one of the most important elements of the maritime industry.

METHOD: For the purpose of this research, data were obtained by semi-structured interview technique from 10 Turkish seafarers at management and operational levels, and analyzed with content analysis and descriptive analysis techniques by using phenomenology model as a qualitative research method.

FINDINGS: Research findings indicate that the most important impact of the COVID-19 Pandemic on seafarers is "the concern for family members".

CONCLUSION: As a result of the research, based on the studies and research findings on the problems of seafarers employed on dry cargo ships, tankers and cruise liners that are employed in different geographies, caused by the COVID-19 Pandemic, solution suggestions are made for the maritime industry and ship managers to reduce the effects of the COVID-19 Pandemic on seafarers.

Keywords: COVID-19 Pandemic, Seafarers, Shipping, Ship Management

[Seafarers Health & Environment]
Towards Environmental Management of Biodiversity in Marine Ecosystems

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PURPOSE: This review concerns environmental management of the seas and oceans that are the greatest sources of biodiversity. The world water body covers 71 % of the Earth's surface and contains 90 % of the biosphere.

METHOD: Marine environment is a principal source for economic prosperity, the well-being of the society, and better quality of living. It constitutes a wealth of resources for greater economic potential. So, the protection of the marine ecosystem is paramount for the whole world.

FINDINGS: A primary keyword in environmental sciences is Biodiversity. It covers a wide range from research to management, natural resources conservation, governance, and consultancy. Biodiversity in itself is a comprehensive concept elaborating the extent of variety or variation within a natural system. The term biodiversity is principal to all the institutions that govern initiatives designed for the marine environment protection.

CONCLUSION: In this review we provide information for academic, government, and non-government policymakers on the specifics of the marine ecosystems-based management approaches. Also, it concerns means of mitigation and adaptation of human activities that leads to sustainability. Ultimately, such practices would help in the modification of the current procedures used for resource appraisal and the future governing regulations of marine resources.

Keywords: Maritime Environmental Management, Biodiversity, Sustainability, Marine Environment Protection, Governing Regulations

[Seafarers Health & Environment]

Determining a Correlation Between Port Activities and Emissions: A Review

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PURPOSE: It is aimed to determine the correlation between port activities and port emissions.

METHOD: The previous studies on port emissions were examined and the geographical distribution of the studies over three years was investigated.

FINDINGS: This article will be a review article so no experimental results will be obtained. In this study, previous 3-year studies will be examined port activities, port emissions and a research is made on what has changed and what attention has been paid in the studies conducted in countries with developing ports.

CONCLUSION: As a result of this study, a situation analysis between the development levels in ports and port emissions is made. In addition, an examination is made on the port researches in the regions that have developed due to the development of the ports.

Keywords: Ports, Port Emissions, Port Activities, Ship Emissions

[Shipbuilding & Offshore Technologies & Port Engineering & Other]
Impact of Oil Operation in Coastal Areas

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Nowadays, there is an increasing interest for using new types of energy on an international level in order to reduce pollution and to cut costs. Unfortunately these new concepts are not yet developed enough which is why the traditional types of energy continue to be used, meaning that oil and coal are still the basic fuels worldwide. Therefore the increased need for energy consumption runs in parallel at this moment with and increased consideration for the protection of the environment. The past presents an extended image of the events which involved oil pollution due to the fact that oil is the main fuel used in creating energy all over the world. Even small incidents involving oil products have a high impact on the environment as a whole. Such an impact does not only affect the environment but also the social and economic activities in the affected area. Considering all the issues above, our intention is to address the impact of VLCCs tankers on the coastal areas environment when operating in the off-shore. Our study will focus on Constanta port and the Romanian coastal area. We intend to analyse the accidents which occur during ship operation in the off-shore and the oil spill resulted along with their impact on the surrounding areas.

Keywords: Coastal Areas, Environmental Impact, Oil Spill, VLCC's, Off-shore Terminals

[Shipbuilding & Offshore Technologies & Port Engineering & Other]
Green and Sustainable Ship Recycling Industry Cluster for Indonesia

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PURPOSE: To propose a concept of a green and sustainable ship recycling cluster for Indonesia.

METHOD: Reviewing of related regulations, and bench-marking of several world-leading ship recycling centers as references, and the analytical hierarchy process (AHP) approach was used to assist in the decision-making.

FINDINGS: Seven potential locations for the cluster have been identified, based on their geographical locations, availability of access to the locations, the supporting industries and facilities, national and international market, and human resources.

CONCLUSION: The East Java cluster is the most suitable for catering to the local market, and the Batam cluster for the international market.

Keywords: Cluster, Green And Sustainable, Industry, Ship Recycling

[Shipbuilding & Offshore Technologies & Port Engineering & Other]
Toward Creation of Shipyard 4.0 in SEDEF Shipyard

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OBJECTIVE: Along with Industry 4.0, new opportunities and difficulties arising due to the economic and environmental changes occurring in the world deeply affect the Shipbuilding sector as well as every sector. An overall assessment is made by considering what kind of challenges this sector will face in the near future and how ready it is to face new threats and opportunities. In this context, within the scope of the development of the software platform and hardware that intuitively model multi-station open manufacturing sites and provide human-machine, machine-machine interaction, living and non-living assets and production-oriented CNC machining, Laser, Plasma, Twisting machines, cranes of different sizes It is aimed to develop hardware and smart manufacturing software that will provide human-machine and machine-machine interaction, and manage these hardware, welding machines and other devices in the shipyard.

CASE REPORT: In this study, digital transformation studies at SEDEF Shipyard, one of Turkey's leading and largest shipyards, are included as a case study. SEDEF Shipyard maintains a close cooperation with SİSTEMATIK OTVT INC, SADE Technology INC, Sakarya University and YAŞAR University within the body of SEDEF Research and Development Center.

CONCLUSION: As a result, by creating a "Smart Shipyard" model in SEDEF Shipyard, instant monitoring of functional operations such as location, tracking, interaction, security, work safety, production interaction-control of objects such as people, machines, carrier vehicles, etc., which constitute the basic elements of the shipyard, and a fully controlled operation. With Smart Shipyard model in SEDEF, important steps have been taken within the scope of increasing efficiency and applications have started to be implemented.

Keywords: Digital Transformation, Shipbuilding, Shipyard 4.0, Industry 4.0, Industrial Internet of Things

[Shipbuilding & Offshore Technologies & Port Engineering & Other]
Ships Mooring Analysis and Effects of Environmental Factors

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PURPOSE: Safety of cargo transfers on board ships in terminals can be ensured by fastening free movements of the ships as much as possible. A mooring arrangement, consisting of mooring ropes, is generally used for the fastening process. Purpose of the mooring arrangements is to keep ships at acceptable freedom of movement values against forces that occur under various environmental conditions. Due to these environmental conditions, forces occur on the rigid bodies of the ships. Analysis of effects of these forces on the ship mooring arrangement is called as mooring analysis.

METHOD: In this study, the development and accepted principles of the mooring analysis at the ship-port interface will be explained based on the literature.

FINDINGS: Mooring analysis can be static, quasi-static and dynamic. The related forces in the mooring analysis are significantly created by waves, winds, and currents. Secondly cause conditions are most likely case-port specific, and can be listed as passing ship effect, tide effect, gust effect and port-based events. All these forces work together and act as a resultant force and moment vector on the ship rigid body. The resultant force vector is covered by the mooring lines at different rates, depending on physical and angular properties of the selected line.

CONCLUSION: A properly done mooring analysis will enable a safe mooring arrangement to be selected for ships held in different environmental conditions. New effects of changing environmental conditions on the existing mooring arrangement can also be foreseen.

Keywords: Port-Ship Interface, Environmental Factors, Mooring Analysis

[Shipbuilding & Offshore Technologies & Port Engineering & Other]
Indoor Positioning Technology Selection for Shipyards by AHP-ROMETHEE Hybrid Method

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PURPOSE: Shipyard 4.0 refers to the application of Industry 4.0 principles to the shipyards. The shipyard industry, like other industries, strives to realize Shipyard 4.0 in their own industry in order to keep up with the challenges. Establishing a comprehensive positioning system to determine the positions of all living and non-living things in the shipyards and to follow their movements forms the basis of these studies by using positioning systems. The positioning systems are used to enable users to find and track the location of a particular object. The Global Positioning System is the most well known location tracking system, which is widely used in locating the location and position of the object in the outdoor environment. The Global Positioning System for locating and tracking the position of an object indoors is hardly recommended for indoor use, since the signals transmitted from a satellite to a device indoors are weakened due to obstacles indoors. Many different indoor positioning systems are being developed that track and position objects indoors.

METHOD: In this study, a hybrid AHP-ROMETHEE approach has been proposed to decide which indoor positioning system will be most appropriate at Shipyard sites. In this study, two of these scientific methods, AHP and PROMETHEE methods, were used together at the Selection and Ranking of the Indoor Positioning System for SEDEF shipyard.

FINDINGS: In this study, two of these scientific methods, AHP and PROMETHEE methods, were used together at the Selection and Ranking of the IPS for SEDEF shipyard. In the literature review, it is seen that these two methods are used separately or together to solve problems in many fields. However, there has not been a study in which these two methods are used together for the ”IPS Selection" problem.

CONCLUSION: By evaluating different technology options with the propsed model, the most suitable technology for SEDEF shipyard is determined.

Keywords: Shipyards, Shipbuilding, Indoor Positioning Systems, Positioning Technology Selection, Digital Transformation, MCDM, AHP, PROMETHEE, Visual PROMETHEE

[Polar Research & Machinery Maintenance]
The Effect of Changing Sea Ice on Shipping Routes

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PURPOSE: Sea ice is an element that ensures the continuation of ocean currents, which provides the world's heat balance. It has an undeniable role in maintaining the polar climate and in global climate change. While the polar oceans completely covered by sea ice in winter, more than half of these areas become open sea in summer. As the sea ice covers the entire area in winter, it becomes more difficult to follow up with local studies. In this context, satellites, which are today's technology, come into play, but some measurements, especially the thickness of the sea ice, are still not clear.

METHOD: This natural phenomenon is an obstacle to the navigation of ships on the trade routes used in the Polar Regions today. The thickness of sea ice, especially vertically height above and under water, is the first point to be considered in order for ships to navigate through the ice. Sea ice that does not melt for several summers known as multiyear sea ice, and almost all ships avoid entering it.

FINDINGS: Ships encountering frozen bodies of water must comply with the obligations of the Polar Code, which put into force by IMO. The foremost of these is the fact that the ships has ice class notation, that is, their capability to navigate through sea ice has been increased.

CONCLUSION: Contrary to popular belief, there is ship traffic at the polar waters, especially due to the new energy sources exposed, research stations, indigenous peoples and important trade ports. Ships frequently need meteorological-sea ice forecasts when navigating polar oceans. It was seen that the studies in this scope aren't sufficient. Today, new routes've been opened in these regions due to the sea ice, which is observed to melt especially in the Arctic Ocean, but the fact that sea ice is still a navigational hazard.

Keywords: Arctic, Antarctica, Sea Ice, New Routes

[Polar Research & Machinery Maintenance]
Remote Sensing with Turkish Satellites in Polar Regions

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PURPOSE: Polar Regions could be described as the regions that mankind has discovered last in the world and are least interested in today. However, thanks to the developing technology, many innovations such as adapting to the extreme conditions, ships operating in icy waters, airplanes and satellites used for many different purposes have occurred in the last century. Especially among the most important events of the last twenty-years, satellite technology and its developments could be shown. Satellites're generally used in natural disasters, meteorological-climatic events, military uses, and maritime affairs.

METHOD: Remote sensing studies with satellites play an important role in reducing the number of people on expeditions, as well as providing instant data flow, allowing hundreds of studies to be carried out without going to the polar regions. Satellites are used in the maritime industry for many different events such as tracking ships in polar regions, rescue operations, identifying and tracking ice that may interfere with ship navigation, meteorology and sea ice forecasts.

FINDINGS: Turkey's polar research has accelerated since 2017, are now carried out by TUBITAK under a single roof and scientific studies are increased by collaborating with hundreds of institutions. In this context, our satellites Göktürk 2 and RASAT, which receive optical images satellites, are used especially to support scientific studies, to reveal new studies, and to follow the changes in the polar regions.

CONCLUSION: The fact that Turkish satellites, whose number is planned to be increased in the future, continue to work by covering Polar Regions will also make a great contribution to world science. In addition, since the maintenance and operating costs of satellites are optimized and reduced, cube satellites are also popularly used today. Turkey also develops cube satellite projects in order to work in other regions of the world, especially in the polar regions that are difficult to reach.

Keywords: Arctic, Antarctica, Remote Sensing, Satellite

[Polar Research & Machinery Maintenance]
Antarctic Tourism and Related Regulations

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The polar regions have always been the center of attention throughout the history of exploration. Scientific and geographical expeditions began in the 1950s to be followed by tourism expeditions. With the increase in ship conditions and the attraction of the polar regions for adventure seekers, touristic expeditions have started to increase day by day. The Antarctic Continent has gradually increased its popularity in terms of tourism thanks to the unique ecosystem and navigable areas it hosts. As a result of this increasing trend, in 1991, seven companies together and established the International Association of Antarctic Tour Operators (IAATO). Antarctic Tourism, which is carried out with the procedures and guidelines of IAATO and International Maritime Organization (IMO) rules, has developed day by day and realized an increase of 51% in the 2019-2020 season compared to the previous season. The route planning of ships that will navigate in sea-ice in the polar regions has been determined by the IMO in 2007 with the "Guidelines on Voyage Planning for Passenger Ships Operating in Remote Areas". Although only one guideline for voyage planning is present, different categories are used by different organizations, such as Ice Class and Polar Class, to describe their ability to navigate on ice. Confusion between these categories has been resolved in 2017 by the "International Code for Ships Operating in Polar Waters (Polar Code)", in which the navigational zones of the ships and the features that the regions should have according to their current situation is defined. In the same Code, the safety and training schemes of those on board were determined for both polar regions. Although all the arrangements made do not seem to be an area of interest for tourists at first, safety and ship conditions have the potential to affect the increase in the tourist numbers.

Keywords: Polar Regions, Tourism, Vessel, Polar Code

[Polar Research & Machinery Maintenance]
A Study on Planned Maintenance Practices in Tug Boats

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PURPOSE: Tugs are the vessels that must be ready at all times for the purpose of use. The need for tugs to be ready at all times requires effective technical management. This is why the importance of maintenance activities becomes important. Preventive and corrective maintenance activities in the realization of planned maintenance implementations will ensure that both failures are minimized and that they are ready.

METHOD: Continuous and periodic monitoring of planned maintenance activities ensures timely operations such as wear, fatigue, change in machinery equipment. Early detection and analysis of determinations will help to save time and reduce costs for correction.

FINDINGS: Although the work of a healthy planned maintenance system is facilitated by the help of software programs, the human factor is still the most important factor.

CONCLUSION: In the study, planned maintenance activities for the tugboat were examined and suggestions were made for the maintenance and development of the tugboat.

Keywords: Planned Maintenance, Corrective Maintenance, Continuous Monitoring, Periodic Monitoring, Preventive Maintenance.

[Polar Research & Machinery Maintenance]
Towards Developing Autonomous Power Plants - An Approach for Performance and Reliability Monitoring

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PURPOSE: In recent years, a paradigm shift of the marine industry has been taking place towards the adoption of increased automation. The power plant, especially, requires advanced monitoring techniques not only for performance parameters, but also to assess the health state of its critical components.

METHOD: In this respect, this study aims to develop a monitoring functionality for power plants, that captures performance metrics, whilst considering the overall system and its components reliability. A hybrid power plant of pilot boat is considered as a case study. A rule-based energy management strategy (RB-EMS) is adopted, which makes decisions on the power distribution to the investigated powerplant components. Finally, a Dynamic Bayesian network (DBN) is developed to capture the temporal behaviour of the system/components reliability accounts for the power plant's operating profile.

FINDINGS: This study results demonstrate that the selected hybrid power plant monitoring capabilities can be enhanced providing a wider picture of the power plants performance and health state.

CONCLUSION: Furthermore, these extended monitoring capabilities can provide the essential metrics to facilitate decision-making that can enable the autonomous operation of the power plant.

Keywords: Hybrid Power Plant, Monitoring, Energy Management Strategy (EMS), Dynamic Bayesian Network (DBN), Autonomous Ship

[Maritime Economics]
An Analysis of the UK and EU Roro Ferry Market

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PURPOSE: The economies of the United Kingdom (UK) and the member states of the European Union (EU) are strongly reliant on commerce for growth. The Brexit and the Covid global pandemic events have so far continued to be a major concern. These events have raised concerns in the maritime transport sector that require immediate attention as well as long-term evaluation of the existing maritime transport and logistics links. The aim of this study is to carry out an industry level analysis of the ferry roro industry amidst the Brexit and Covid crisis between the UK, Ireland and continental Europe.

METHOD: The study is looking into the different strategies between the UK and ROI required to help coordinate national policies in the maritime transport and logistics sector by removing barriers to growing trade, enabling and making sure the continued movement of freight between Ireland, the UK and the European continent via designated vital routes for supplies and people. Survival analysis will be employed in order to assess economic and political issues in the ferry industry by grouping relevant independent and dependent variables in order to explore the hypothesized statement and explanation of findings.

FINDINGS: The findings provide knowledge that will help identify areas for improvement and best practises, allowing for strategic monitoring of the post-Brexit and post-Covid-19 transition periods.

CONCLUSION: There is a need for ongoing market monitoring due to the uncertainty and a sense of urgency to minimise disruptions by facilitating freight transportation services, logistics, and commerce through existing regional logistics gateways.

Keywords: Maritime, Ferries, UK, EU, Brexit, Pandemic

[Maritime Economics]
Evaluation of Yacht/Sail Training Centers' Social Media Usage

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PURPOSE: The impact of social media on services marketing is expanding as customers often discuss their experiences on their personal social media profiles. While social media has permeated people's daily lives, service providers have begun to adopt new strategic ways for utilizing social media technologies, recognizing the importance of this new era. The desire to share on social media grows as the services given become more experience-based and outside of regular routines.

METHOD: The aim of the study is to highlight yacht/sail training centers' social media usage patterns. There are two stages to the research: 1- Evaluation of all social media tools used by training centers, 2- Thematic analysis of Instagram posts. Instagram was chosen as the media to be studied due to the visual appeal of the service offered.

FINDINGS: Instagram was chosen as the media to be studied due to the visual appeal of the service offered.Most frequently used theme was a trainer on the wheel of a sail yacht steering full sail, followed by announcement texts.

CONCLUSION: The findings were utilized to develop recommendations for comparable establishments on how to use their social media accounts more effectively.

Keywords: Services Marketing, Marine Tourism, Digital Marketing, Social Media, Sports Marketing

[Maritime Economics]

Total Cost of Ownership in Shipping: A Framework for Sustainability

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PURPOSE: Shipping is pivotal for global commerce, yet its externalities are not yet fully understood, especially with reference to environmental impact. Shipping is a practise developed by humanity from the dawn of history. Its manifestation requires the introduction of relevant supporting industries as well, such as port, cargo, and logistics operations. The holistic shipping system has been growing with the main parameter of accounting cost minimisation, and portraying many returns to shareholders. Yet the shipping ecosystem has been able to exacerbate environmental, social, and health costs that in the end, prove that shipping, in the way that it is conducted, may not be as profitable as it may seem.

METHOD: This paper introduces a framework for the total cost of ownership in shipping, that includes a holistic approach as to the true costs associated with shipping practises. Through a structured literature review the relevant costs are identified and assessed, providing a complete and holistic framework as to the true cost of shipping.

FINDINGS: Shipping may appear to be profitable, but a bulk of its profit is based on practises that incur a plethora of costs that are externalised. This paper provides a clearer understanding of the total cost of shipping and the subsequent need of a paradigm shift, so that shipping may be able to portray its potential with reference to societal and environmental benefits.

CONCLUSION: Through frameworks such as the one presented in this paper, activities and practises may be assessed as to their true impact and footprint, and claim sustainability through a solid prism of holistic analysis and true profit for humanity, rather than focusing on accounting cost and turning a blind eye at other social, environmental, and health costs.

Keywords: Shipping, Total Cost Of Ownership, Environment, Social Cost, Health Cost

[Maritime Economics]

Forecasting Baltic Dry Index Using Time Series Models

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PURPOSE: In this study, time series models are developed to forecast the dry bulk index (BDI), which is a powerful tool for operators and investors to manage the market trend and avoid the price risky shipping industry. The Baltic Dry Index is published daily by the London-based Baltic Exchange. The BDI is a combination of Capesize, Panamax and Supramax Timeline Averages. It is reported as a general shipping market leader for dry bulk stocks worldwide.

METHOD: In this study the series are based on available BDI data from January 2009 to August 2021. The series was adjusted from trend and seasonality (independent of time) by applying the Augmented Dickey-Fuller (ADF) test. Then, ACF and PACF were calculated to perform the pattern determination of the time series. Seasonal Autoregressive Integrated Moving Average (SARIMA) models were used to model and forecast the Baltic Dry index. MAPE and RMSE were used to evaluate the performance of models.

FINDINGS: Model performance measures show that the SARIMA model has higher accuracy than other models. Results shows that SARIMA can be used to forecast the short-term trend of BDI. It is forecasted that the Baltic Dry Index will decrease for a short time until the first months of 2022 and then rise again.

CONCLUSION: A sharp decline is observed in the last quarter after the expectation of a correction in the index due to the excessive inflation of the freight price. It is forecasted that BDI will enter a rapid recovery period afterward.

Keywords: BDI, Forecasting, Maritime Trades, Time Series Modelling

[Maritime Economics]

A Profit Maximization Model in Liner Shipping

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PURPOSE: Container liner shipping still plays an important role for the continuity of world trade. During the pandemic period, freight prices in container liner shipping have increased excessively due to reasons such as decrease in vessel capacity supply, slowdown in operations and container shortage. Accordingly, liner carriers want to use their potential as much as possible. For that purpose, this study introduces a mathematical programming model that maximizes freight profits in container liner shipping.

METHOD: In this study, a Mixed Integer Linear Programming (MILP) model was developed, which takes into account the export/import rates at locations, vessel capacities in terms of TEU, freight profits and empty container repositioning (ECR) costs. Moreover, the model also considers the ECR costs in previous periods. The data used in the model were obtained from one of the biggest lliner carriers in the world. The problems were solved in CPLEX commercial solver.

FINDINGS: The model provides the optimum solutions in a very short computational time. In the results, it can be seen that the ECR costs of the past periods have a significant effect on the current decisions and freight profits.

CONCLUSION: The main purpose of container liner carriers is to make profit. In this regard, the model developed in this study can be used as a decision support tool for the real life applications of liner carriers.

Keywords: Freight Rates, Container Shipping, Profit Maximization, Mathematical Programming

[Projects I]

Introducing a Digital Training System for Safe Turkish Straits

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PURPOSE: Safety has always been a critical issue for maritime transportation, especially in narrow and critical waterways. Turkish Straits are considered as one of the most dangerous waterways around the world due to harsh physical environment. Strong currents, sharp turns, congested vessel traffic and variable weather conditions pose significant challenges for many vessels. The accidents that occurred in this area evidently show the difficulties and dangers of navigation, mainly for seafarers who have inadequate knowledge about the Turkish Straits. It can be clearly seen that a training system regarding the characteristics and dynamics of the Turkish Straits is necessary to reduce navigational risks. Therefore, considering the effects of the COVID-19 pandemic on learning and teaching activities, a project namely "Development of Training System for Safe Turkish Straits (SafeSTRAITS)" has been proposed by ITU and funded by the EU to support digital education readiness.

METHOD: The training needs of seafarers will be determined in accordance with the survey analysis which applying to Turkish Straits pilots, vessel traffic operators, oceangoing masters and shipping agents. Two training modules will be developed for international seafarers (masters, officers and engineers) and local traffic users (skippers of ferries, passenger boats, yachts, fishing boats etc.) In both modules, video training and course examinations will be given and certification will be generated according to the success of users.

FINDINGS: The project will show that the on-line training modules will be benefits of seafarers and local traffic users since the pandemic are not allowed to perform physical trainings. The future training approach is calling on-line training and will be open access around the world.

CONCLUSION: The project will contribute to promote the safe navigation of all commercial vessels using the Turkish Straits, prevent possible environmental pollution disasters, minimize the commercial losses of maritime companies and preserve the historical structure of the Turkish Straits.

Keywords: Turkish Straits, Safety, Navigation, Training, Seafarer

[Projects I]

Artificial Intelligence Robust Offshore Unmanned-System (AIROUS) for Autonomous Port-to-ship Deliveries

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PURPOSE: The shipping industry acts as a backbone of global trade, since more than 80% of goods are transported by ships. Therefore, various stakeholders aim to increase operational flexibility, enable safer port operations, and reduce gas emissions. A major contributor to the aforementioned challenges are port-to-ship deliveries that, currently are conducted by service boats, which result in slow delivery services, are dangerous for human transportation and contribute significantly to gas emissions.

METHOD: To this end, the AIROUS project proposes an innovative alternative to the existing port-to-ship delivery method by replacing service boats with swarms of autonomous drones. This work emphasises on the development of robust AI-based algorithms that are able to automatically determine the optimal drones' flight paths in order to deliver goods from ports to ships and vice-a-versa. The system is designed in order to dynamically reconfigure the flight paths in case the boundary conditions change. This is achieved by combining Genetic Algorithms (GA), that are able to identify otpimal global solutions in a non-linear objective function, and Fuzzy Logic (FL) in order to accelerate the algorithms convergence to a solution and consequently calculate quickly a safe flyable path of each drone in the swarm.

FINDINGS: In this paper, a rigorous literature review targeting the existing swarm-based path planning approaches is carried out. The architecture of the system's design is outlined. Initially the methods followed to define the system's specifications, based on end-users' requirements are explained. Thereafter, the research methodology that is followed to develop the path planning algorithms is discussed, the integration of the developed algorithms to experimental drones is described and finally the validation strategy is presented.

CONCLUSION: The last section of this paper informs the reader for the benefits of the proposed setup are also included compared to traditional methods.

Keywords: Offshore Delivery Problem, Path Planning Problem, Swarm Based Applications, Evolutionary Algorithms, Unmanned System

[Projects I]

Sea Cab Combined with the Solar Energy Systems

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PURPOSE: Fossil fuel engine vehicle costs considerably more than solar powered vehicles. Demands for energy saving and emission reduction, and due to the restrictions imposed by the authorities, as well as all published in the maritime field oriented towards renewable energy sources. As a solution to solar energy, new design is reducing both CO_2, SOX and NOX emissions and improving the ship's energy efficiency. According to those mentioned, a sea cab as a public transportation with the use of solar sources will save emission of the harmful gases from the vehicles and the amount of energy consumed. In this study, the new designed taxi is 14 meters long and 4 meters wide. Considering the average resistance value for 16 knots speed, it is thought that the motor to be used should provide approximately 200 HP power. Our evaluations provide that it is inevitable that the use of PV panels with 30 times less carbon footprint compared to fuel will become wide spread and be preferred to energies that can be consumed over time. Additionally, the recent applications on the use of energy resources have been examined in this study. The results of this study obtain that new generation ship designs contributing to the future predictions of the representatives of the maritime sector by mentioning the projects.

METHOD: This study's aim is finding alternative energy sources under current conditions for especially sea transportation. Sea cab has designed for 14 people, the sea cab is equipped with many batteries to increase its range.

FINDINGS: The planned taxi is 14 meters long and 4 meters wide. Considering the average resistance value for 16 knots speed.

CONCLUSION: In this study, to reduce fuel consumption, the design were made to produce a public transportation vehicle that is environmentally friendly and less costly by using solar energy systems for sea cab.

Keywords: PV Module, Renewable Energy, Sea Taxi, Eco-friendly Ship

[Projects I]

Development of Green and Sustainable Ship Recycling Industry for Indonesia

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PURPOSE: Indonesia is the world's largest archipelago state with 17508 islands. Therefore, it is essential for Indonesia to maintain a large fleet of ships to ensure sufficient sea transportation. Hence, the government gave shipping companies an incentive to import used ships which resulted in older ships moving to Indonesia. However, after completing their operational life, all these ships are required to be dismantled. Currently, there is no proper understanding & infrastructure for ship recycling in Indonesia yet. This lack of understanding causes serious contamination of the sea which affects the food chain and results in harming public health.

METHOD: Furthermore, the working conditions in ship recycling yards are extremely poor because the yards are not fit for purpose and workers are exposed to many. As the ship recycling workers are generally from a low-income and low-skilled demography, this sector harms the most disadvantaged members of the community which means Indonesian ship recycling sector requires urgent attention and support for a sustainable ship recycling.

FINDINGS: In order to tackle these issues, 'Sustainable ship recycling industry for Indonesia' project are established to develop an internationally compliant ship recycling framework and a concept design for ship recycling facility with the intention of: Enhancing the wellbeing of the local community and the workers through better practices for health, safety and environmental protection; Contributing to the economic development through internationally recognised SR practices and taking a bigger share from the international market; Ensuring implementation of developed concepts in Indonesia through creating a roadmap document for the government; Supporting stakeholders with guidelines, strategies, case studies, business models, training and tools.

CONCLUSION: Therefore, in this paper, the developed approach and outputs of this project are explained.

Keywords: Ship Recycling, Indonesia, Sustainable, HSE, Policy.

[Projects I]

SEAbrary; An Electronic Repository of Maritime Safety Knowledge

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PURPOSE: SEAbrary is an electronic repository of maritime safety knowledge related to maritime operations, management and design with a focus on Human Factors (HFs). It is also a portal, a common entry point, that enables users to access the safety data made available on the websites of various maritime organizations - regulators, service providers and industries. SEAbrary's main objective is to build a single point of source for maritime safety knowledge by making globally available and accessible the safety knowledge accumulated by various maritime organisations, entities and initiatives.

METHOD: SEAbrary adopts the concept of Media-wiki products – anyone, who has content access, can comment, propose modification to an existing article, suggest a new topic or submit a draft article. However, there is an important difference that distinguishes SEAbrary from other wikies. A robust content management and control process supported by appropriate user rights management ensures the needed quality, credibility and consistency of stored safety data.

FINDINGS: SEAbrary is being developed as part of Safemode project that is founded by European Commission. It is fully developed and User Acceptance Tests (UAT) are conducted through the Safemode project end users.

CONCLUSION: Initial validation results show that the proposed SEAbrary web platform is working effectively. This presentation will demostrate the current version of the platform and its functionalities to diseminate it to the maritime audiance.

Keywords: Maritime, Safety Learning, Knowledge Base, Shipping, Regulations & Standards, Human Factors

[Projects II]

Maritime Logistics Network Resilience: Evidence from Responses to Coronovirus Pandemic

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PURPOSE: The aim of the study is to identify potential coronovirus events that have positive or negative impacts on the maritime logistics and then how maritime logistics ensure resilience to pandemic.

METHOD: The raw data from social media is collected between January 2020 and August 2021. After finalizing the data collection, the total number of 9148 social media postings and 2.179.025 words have been examined. For analysing this data, both sentiment and regression analyses have been especially selected.

FINDINGS: The node "organization" is the mostly discussed topic in the whole coding. Following this topic, the nodes ("market position", "collaboration", "flexibility in sourcing", "organization", "recovery", "security" and "adaptability") have highly correlated.

CONCLUSION: These results are hoped to provide significant contributions both for practitioners and policy makers in terms of maritime logistics.

Keywords: Covid-19, Resilience, Maritime Logistics, Containerazation, Empirical Research

[Projects II]

Circular Economy Approach in the Maritime Industry: Barriers and Opportunities

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PURPOSE: While shipping is classed as one of the most energy-efficient transport modes, it currently lags behind sectors such as aerospace and automotive in terms of circular economy approaches, sustainability, accountability. Moreover, the applications of technologies that have seen the other sectors excel in those areas mentioned above. The Circular economy approach is not well-established in the maritime, and there is a need to "close the loop" to minimise waste and increase the revenue stream.

METHOD: This study aims to investigate the industrial and legal barriers to the successful implementation of circular economy principles. This study will include a stakeholder analysis to define industry-specific constraints and parameters for such a transition by taking the lifecycle of a vessel into account. Furthermore, it will identify and estimate potential gains for all stakeholders in the maritime industry through the circular economy approach. The study intends to improve the overall revenue stream of marine vessels while minimising the waste from the assets and decrease the environmental impact by investigating end-of-life solutions in accord with circularity metrics.

FINDINGS: The current linear consumption economy inherent in shipping (McKenna et al., 2012) results in increased costs, increased health, safety and environmental risks and harms efforts in achieving sustainability targets. Ship recycling contributes significantly to reducing the demand for intensive mining of iron ore and new steel production through steel scrap. However, a significant amount of materials and equipment from ships are currently underutilised in terms of their potential for reuse, remanufacturing and recycling (SEP, 2016).

CONCLUSION: Therefore, this study aims to reveal the potential benefits of circular economy in the maritime industry and identify the barriers to successful implementation.

Keywords: Circular Economy, Stakeholder Analysis, Lifecycle, Ship Recycling

[Projects II]

Impact of Covid-19 Pandemic's on Maritime Students' Perceptions of Profession

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PURPOSE: There is no doubt that the Covid-19 pandemic has formed global impact in many sectors. It is a notable fact that the maritime industry, which is an respectable part of the supply chain, is also affected by the Covid-19 pandemic. Along with these, it is thought that there are radical changes in the education sector with the Covid-19 pandemic. These changes, when combined with the changes of Covid-19 in the sector, created a considerable impact on maritime students' perceptions of their profession. In this study, it is aimed to investigate the effect of Covid-19 on students' occupational perceptions.

METHOD: In this paper, the impact of the Covid-19 pandemic on maritime students' perceptions of their profession is investigated using the Five Point Likert Type Survey method.

FINDINGS: Evaluation of Covid-19 pandemic effects on maritime students' perceptions of their profession

CONCLUSION: Recent developments resulting from Covid-19 have led to a renewed interest in maritime students' perceptions of their profession. Accordingly, the study provides a better understanding of maritime students' opinions in order to help maritime regulatory bodies construct future policies that best match seafarer needs.

Keywords: Impacts of Covid-19 Pandemic, Maritime Education and Training, Maritime Students, Perception of Profession, Survey Methods

[Projects II]

Curriculum Development and Capacity Building in Shipbuilding Engineering in Indonesia

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PURPOSE: Being an archipelago, developing a sustainable and successful maritime sector is key to Indonesia's economic development. Geographically situated on many international shipping routes, the Indonesian maritime sector has a great potential to become centre for numerous services such as shipbuilding, ship repair and ship recycling. All factors, such as geographical advantage, availability of suppliers and competitive labour costs, provide an excellent opportunity for Indonesia to establish the successful maritime industry.

METHOD: Importance of establishing a successful maritime industry has also been recognised by the government. Since the maritime sector is included as one of Indonesia's strategic priorities at the national level, this sector can provide key services to the local market to enable Indonesia's sustainable development through transportation of goods and people, fishing, offshore energy, etc. Furthermore, maritime internationally can become the centre for shipping services and contribute to the Indonesian economy by providing countless different job opportunities.

FINDINGS: In order to achieve the above goals and ambitions, it is extremely important to train individuals who are equipped with skills required from the industry to build envisaged successful maritime economy in Indonesia. Therefore, the overall aim of this project is to strengthen the quality and relevance of Shipbuilding Engineering education at PPNS in line with international best practice and industry trends, in a way that promotes student employment prospects, strengthens the capability of the institution and helps reduce the skills mismatch experienced by the industry.

CONCLUSION: The above aim will be achieved through the following three specific objectives
1. Strengthening Study Program “Shipbuilding Engineering” curriculum towards matching with industrial needs.
2. Capacity Building and Professional Development for PPNS Staff to develop cooperation in education and to improve TVET education quality to meet best education practice for international industry job market demand.
3. Enrichment of the Student Learning experience through Interactive Skills Development

Keywords: Education And Training, Ship Building, Economic Development, Maritime Education

[Projects II]

Proposing Conceptual Maritime Health on-line Trainings for Seafarers and Doctors

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PURPOSE: Seafarers, due to the diversity of risks involved and harshness of working conditions at sea, is acknowledged to be among the one of the most dangerous professions in the world. The limited medical means in particular, insufficient medical intervention and saving service may lead to a more critical nature for any potential accidents occurring at sea. The aim of this paper is to design web-based e-learning/training platform for seafarers and maritime doctors that focuses on advanced medical intervention practices on-board ship.

METHOD: The paper is based on the project entitled "Maritime Health Trainings for Seafarers and Doctors (MariHEALTH) which is funded by EU. In this context, medical training modules for seafarers is developed to improve their first aid skills and knowledge as well as keeping them up to date.

FINDINGS: A detailed surveys have been performed with seafarers and maritime doctors to determine gaps in maritime training.

CONCLUSION: The potential benefits of the projects are recognition of training program by European sea transportation operators will not only raise health consciousness of seafarers to the end of making them more knowledgeable, but it will also immensely contribute to train maritime doctors.

Keywords: Maritime Health, On-line Education, Training Modules

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