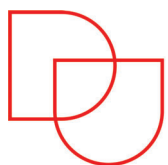


NAŠE MORE 2023

3rd International Conference of Maritime Science & Technology

BOOK OF ABSTRACT



SVEUČILIŠTE
U DUBROVNIKU
UNIVERSITY
OF DUBROVNIK

Dubrovnik, 14 – 16 September 2023

University of Dubrovnik
Maritime Department

3rd International Conference of Maritime Science & Technology

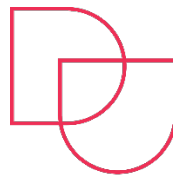
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Book of Abstracts

**Maritime Department
University of Dubrovnik**



**UNIVERSITY
OF DUBROVNIK
MARITIME
DEPARTMENT**



**SVEUČILIŠTE
U DUBROVNIKU
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METHOD FOR EVALUATION THE ECONOMIC EFFICIENCY DUE TO THE USE OF COMPOUND MARINE DIESEL FUELS

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UDK 621.436:62-6
338.314

Abstract

A method is proposed to estimate the economic efficiency due to the use of compounded marine fuels diesel + HFO and fuel treated with An StoTeh technology is proposed. The idea and method of the research are based on the experimental collection of relevant information. It should be noted that they are linked to a specific real object, i.e. a diesel engine, from which it follows that the results are valid for the specific diesel engine of the series and can only be considered in principle for other types of diesel engines. Formally, a comparison of the data on the impact of compounded fuels before and after treatment with An StoTech technology, depending on the load, on the mechanical and environmental characteristics and performance of the marine diesel engine individually is not possible due to the difficulty of achieving the same operating conditions of experimental research, and prevention from uncontrollable disturbances, etc. The method features high noise resistance. It is based on pre-compiled mathematical models of the characteristics and parameters of marine diesel engines when operating with both types of fuels, at different loads as well as on the evaluation of the economic efficiency for research objects, which enables experimental statistical analysis. A real application example is used.

Keywords: economic efficiency, marine diesel fuels, mathematical models, An StoTeh technology

THE MOST SIGNIFICANT PSC DEFICIENCIES

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Abstract

The port state control (PSC) regime has proven to be an effective means of preventing the exploitation of ships that do not comply with the rules and conventions stipulated by the International Maritime Organization (IMO). Moreover, they have contributed significantly to improving the safety of ships and ports. This paper investigates the most common deficiencies identified during the Paris MoU inspections. The deficiencies were analysed according to three criteria: type of ship, nationality, and area to which the deficiency belongs. The analysis of the obtained results revealed important findings, offered possible corrective actions and provided a basis for further reducing the number of deficiencies. The results of the data analysis show that the overall inspection control system is very effective and that the number of deficiencies found as well as the number of detentions are continuously decreasing. The decrease was particularly emphasised after the introduction of the new inspection regime (NIR) in 2011.

Keywords: port state control procedures, deficiencies, detentions, safety improvement, the new inspection regime

APPLICATION OF ARTIFICIAL INTELLIGENCE TO FACILITATE DECARBONISATION VIA JUST-IN-TIME BUNKERING

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UDK 004.8: 656.065.3

504.3

Abstract

The Port of Algeciras holds a strategic position in the Gibraltar Straits, serving as a vital link between the Mediterranean Sea and the Atlantic Ocean. Due to its location, the port experiences high volumes of vessel traffic, particularly as a major bunker fuelling stop. Over the years, the traffic in Algeciras port has been steadily increasing, making it the top supplier of bunkers in Spain in 2022. However, the surge in traffic has led to prolonged waiting times at anchorage. Vessels often wait for hours before being serviced by the bunker barge, resulting in unnecessary fuel burn and inefficiencies. The primary cause of this waiting time is the current practice of a "first- come, first-served" principle, which proves to be inefficient as it does not consider the readiness of service providers and the volatility involved in the port operations. To address this issue, Navozyme has collaborated closely with the Port Authority of Algeciras and together, they analyzed historical vessel traffic data. Based upon the findings, Navozyme developed an original AI-enabled machine learning algorithm with the expertise of leading mathematicians. The algorithm aims to provide an optimized Recommended Time of Arrival (RTA) for vessels, facilitating just-in-time (JIT) bunkering. Navozyme aims to share its experience in working towards facilitating decarbonization through JIT bunkering. By leveraging advanced technology and data analysis, a new paradigm is presented for optimizing the bunker service, reducing waiting times, and improving overall operational efficiency.

Keywords: Just In Time), AI (Artificial Intelligence), Decarbonisation, Bunkering, Port Congestion, RecommendedTimeofArrival

LEVERAGING BLOCKCHAIN ENABED E-CERTIFICATES (BEES) FOR MARITIME CERTIFICATIONS: EARLY ADOPTER EXPERIENCES FROM AROUND THE WORLD

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UDK 378.2 :656.61(079.2)
004(079.2)

Abstract

Seafarers play a pivotal role in the global economy, transporting more than 80% of commonly used goods. To work on ocean-going vessels, seafarers are required to possess valid certificates compliant with the International Maritime Organization's (IMO) Standards of Training, Certification, and Watchkeeping (STCW). Despite the IMO's endorsement of electronic certificates (e-certificates) since 2016 through the publication of the FAL Guidelines, the transition from paper to electronic certificates has been slow. Currently, the majority of the 1.89 seafarers continue to carry traditional paper certificates onboard, despite the evident inconveniences associated with their use. A whitepaper was produced from a pilot conducted between Navozyme and the Department of International Maritime Studies of the HSB Hochschule Bremen City University of Applied Sciences, Germany. The pilot examined the potential of blockchain technology in facilitating maritime e-certifications. The whitepaper showcases real-world examples from early adopters from across the globe, demonstrating how the implementation of e-certificates for seafarers' certifications alleviates administrative burdens, enhances safety measures, eliminates the risk of fraud, and modernizes an industry often labelled as "traditional." By harnessing the transparency, immutability, and distributed nature of blockchain technology, the adoption of e-certificates in the maritime sector offers numerous benefits. Blockchain ensures the secure storage of credentials, streamlines the verification process for various stakeholders such as crewing agencies, shipowners, managers, operators, and Flag States. It enhances the efficiency of certificate management, minimizes paperwork, and reduces the potential for fraudulent activities. This whitepaper serves as a valuable resource for maritime industry stakeholders, policymakers, and technology enthusiasts seeking to revolutionize seafarers' certification processes through blockchain technology.

Keywords: BEEs (Blockchain Enabled E-certificates), IMO (International Maritime Organization), STCW (Standards of Training, Certification, and Watchkeeping), FAL Guidelines, Blockchain technology, Seafarers' Credentials, Administrative burdens, Fraud risk, Digital Transformation, Transparency, Immutability, Distributed nature, MTIs (Maritime Training Institutes), Flag States, Certificate management, Paperwork reduction

CROATIAN COAST GUARD'S ACTIVITIES IN THE MARINE FISHERIES CONTROL

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UDK 347.79: 351.79(497.5)

Abstract

For the purpose of preventing increasingly frequent modern threats on the waterways of coastal countries, continuous control and protection of national interests at sea are maintained through implementation of legal provisions and through actions of state administration bodies. The Coast Guard is a body responsible for the implementation and protection of maritime interests of the Republic of Croatia. One of the tasks is to protect marine fisheries in the internal sea waters, territorial sea and in the area of the exclusive economic zone of the Republic of Croatia. The Coast Guard's authorised personnel are qualified and authorised to perform affairs and apply powers of the Coast Guard, which also presumes qualifications for carrying out inspection controls of marine fisheries. The objective of this paper is to look into the productivity of the Coast Guard of the Republic of Croatia analysing the period from 2018 to 2022. Procurement of technical assets in the form of floating assets represents a significant step forward in the increase of operational capabilities of maritime countries, especially for control of marine fisheries. The analysed model of furnishing of the technical equipment of the Coast Guard of the Republic of Croatia can serve as an example for all maritime countries with indented coastlines.

Keywords: Coast Guard of the Republic of Croatia, Control of marine fisheries, Operational capabilities

SUSTAINABLE SHIP RECYCLING – CURRENT SITUATION IN INDIAN SUB-CONTINENT

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Abstract

In the last decade, much has been done to improve the ship-breaking worldwide. It has become a necessary trend to recycle as many elements of a vessel's equipment and structure. Nowadays we talk about refurbishing and reusing spare parts, recycling a ship's steel structure and completely recycling a vessel. But such an ambitious endeavor cannot be accomplished without implementing an entirely new approach to the matter. Forming of a ship recycling industry to replace the traditional ship-breakings could prove challenging. The present article aims to present how much the process has evolved and what the main challenges and obstacles are in fully implementing the idea of ship recycling.

Keywords: Shipping Industry, ship recycling, Hong Kong Convention, EU RSS

LONG-TERM VWBM OF LARGE CONTAINER SHIPS ACCORDING TO THE NEW IACS REC. NO 34 REV 2

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Abstract

The new IACS Rec. No. 34 rev 2 (2023) is reviewed in the presentation and used to compute long-term extreme linear vertical wave bending moments (VWBM) for two large container ships. Transfer functions of VWBM are calculated using 3D panel method by employing HydroSTAR software. Long-term probability distribution is calculated according to the recently revised IACS standard procedure and extreme values are extracted and compared to the design Rule VWBM according to IACS UR S11a (2015). A discussion is provided about the comparison of the results and the possibility of replacing the Rule VWBM with the results of the direct hydrodynamic and statistical analysis. The discussion is extended also to the applicability of the IACS Rec. No. 34 rev 2 (2023) for fatigue analysis of container ships and for hydroelastic analysis of Ultra Large Container Ships.

Keywords: long term VWBM, container ships, IACS Rec no. 34 Rev. 2, Fatigue, Ultimate strength, Hydroelasticity

CONTROL OF SHIP STRENGTH DURING HULL REPAIR

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Abstract

In dry docking periods, ship hull repairs are very important; control of her strength and deformation. The paper deals with analyzing the proper cut-outs, the dimensions in the ship's hull during scale repair and section modulus according to bottom and deck. With BV software, MARS 2000 has developed general cargo midships sections models with ten real hull repair scenarios for hull repair. With the help of their section modulus on deck, bottom and hatch coamings, deformation is calculated and analyzed. For every one of the models and scenarios, it is possible to do it when the ship is afloat. The analysis showed that in 40% of cases the section modulus on deck is less than minimal, calculated by classification society rules. This means that during scale hull repair, control of cut- outs, their dimensions and areas in the ship's hull is an important problem. Steel repair without any control leads to hatch coamings deformation, disrupted hatch cover, water tightness, and additional work related to their proper condition.

Keywords: ship hull, repair, section modulus, deformation, strength

CHALLENGES TO THE EDUCATION OF MARITIME PROFESSIONALS BASED ON DIGITAL PLATFORMS

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Abstract

One of the most crucial foundational elements for effective and safe shipping might be considered the calibres of the maritime education system. The training of maritime professionals is undergoing a digital revolution, and with the introduction of artificial intelligence and rising levels of automation on the horizon, the rapid rate of change and innovation is anticipated to continue. These modifications offer several chances for innovation and enhancements to the current platforms, but they also create a number of difficulties for university-level maritime education. The article will examine the relationship between the use of traditional and digital learning management systems in the instructional process of maritime higher education institutions. The existing state of the education system, which should be receptive to contemporary trends, contributed to the need to find new digital tools, but it was not the only one. The COVID-19 epidemic also made things worse. In this article, we will conduct a comparative analysis, chosen as the primary research tool, making it possible to compare the online and offline ways in which higher maritime education institutions implement their educational programs. Additionally, we look at the purpose, structure, results, and success factors of maritime education. We pay close attention to the primary benefits and drawbacks of online learning platforms.

Keywords: maritime, education, training, digital platforms

INTERACTION BETWEEN MANAGEMENT UNITS OF SHIPPING COMPANIES VIA BLOCKCHAIN TECHNOLOGY

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Abstract

The operation of the marine merchant fleet and the technical maintenance of the ships are activities that require the participation of specialists with different specialisations. These activities are regulated internationally, therefore international standards have been introduced. Shipping control is carried out at several levels - starting with the International Maritime Organization (IMO) and ending with Port State Control. In this regard, all shipping companies have management structures in place that conform to industry regulations. Management responsibilities are distributed within shipping companies, and outsourcing is also used. At the top of the management "pyramid" are the company managers, and below them, in terms of ship management, are Commercial Ship Managers/Operators, Technical Managers, Designated Persons Ashore, Company Security Officers, and Personnel Managers. A hierarchical system of interaction is introduced between all units of management. Management is based on the International Safety Code (ISM Code), which has been mandatory since 2002 for all ships over 500 GT (gross tons). Thanks to the development of private maritime law and maritime commercial practices, the overall management of maritime merchant vessels can be distributed among multiple responsible companies located in different countries. This poses a potential risk of compromising the safety and security of shipping. It is a fact that organizations with a high motivation for growth and cost-effective operational efficiency always seek to integrate new technologies into their operations. These organizations are very sensitive to change and value driven. Blockchain technology is revolutionizing supply chain logistics. Digital currencies are already a method of buying products and trading goods. This in turn simplifies and improves maritime and global supply chains. But how could it help the interaction between management units in maritime shipping companies? The authors offer an answer in this paper by presenting an overview of the possibilities of blockchain technology in maritime shipping companies.

Keywords: shipping companies, management, maritime transport contracts, shipping logistics

POTENTIAL FOR COASTAL SHIPPING INTEGRATION IN THE SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

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Abstract

The Southern African Development Community (SADC) is one of the economic regions of the African Union (AU) whose objectives include achieving development, peace and security and economic growth and providing support to its people through regional integration. A resilient and dependable regional coastal shipping system is pivotal to the achievement of such objectives. This paper seeks to evaluate the prospect of cabotage as a coastal shipping system and its potential as a means of achieving the SADC regional coastal shipping integration. Through policy, legislation and the trade landscape lens, the work gleans the status quo of regional coastal shipping and overviews its framework. The findings show the bulk of SADC coastal trade in the pendulum route between Luanda to the west and Dar Es Salaam to the east. However, there is a dearth of discernible coastal shipping integration in this route. A concerted effort is required to systematically integrate regional cabotage articulation, particularly between Tanzania, Mauritius, Madagascar, Mozambique, South Africa, Namibia, Angola and, to some extent, the Democratic Republic of Congo. In addition, the coastal states that lie along the route must have immediate robust engagements, bearing in mind that South Africa and Mozambique are at fairly advanced stages in drafting their respective domestic cabotage policies. The conclusion is that there is potential for resilient regional coastal shipping integration. However, more effort is required to improve regional policies and support the aspirations outlined in the objectives of the SADC treaty if these are to become a reality in the foreseeable future.

Keywords: Southern African Development Community, regional integration, cabotage, coastal shipping

INTERNATIONAL OFFICIAL LANGUAGE OF MARINE INDUSTRY AND EDUCATION OF SEAFARERS

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Abstract

Seafarers require special attention in Croatian tertiary-level education institutions. Our schools have a long tradition and an excellent worldwide reputation. The first Nautical School in Dubrovnik was founded in 1852. The importance of Maritime English globally in the education of seafarers has been discussed because it is considered to be a contributing factor to the safety of human lives at sea. This paper deals with the features of Maritime English nowadays and compares the language of the Syllabus of the Nautical School of Dubrovnik from 1881/82 and the one from the Nautical Department of The University of Dubrovnik from 2019/20. The phenomenon of EMI (English Medium Instruction) has been explained as a new concept both in European and world universities.

Keywords: Nautical Studies, Maritime English, English Medium Instruction

OVERVIEW OF SHIP STABILITY AND HULL STRENGTH FROM PRACTICE ORIENTED AND DESIGN POINT OF VIEW

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Abstract

This paper describes the differences in how ship's officers and naval architects approach the subjects of ship stability and hull strength. While ship officers tend to solve all problems regarding ship's stability and hull strength in a simple and practical way, naval architects need to have a comprehensive knowledge of how to build ships and make them safe for carrying specific cargoes or passengers. The topics of ship stability and hull strength to be studied at management level and the depth of knowledge are recommended in the STCW Convention and the model course 7.01 Master and Chief Mate and proposed in international and national legislation. Generally, it is easy for ship's officers to comply with all regulations because they have stability booklets and loading computer systems (LCS) prepared by naval architects and approved by Register. However, without knowledge of basic physical principals, the possibility of mistake significantly increases and therefore it is necessary that ship officers are able to analyse results obtained from LCS. It is of the utmost importance that the ship's officers know what calculations are made with the LCS and stability booklet and what regulations must be followed for the ship for which they are responsible. During the training at management level, all tasks that have to be performed with LCS have to be calculated with the help of the stability booklet or at least explained theoretically. The depth of knowledge that should be achieved during the training process is a key to the safe operation of ships. Master and ship's officers need to know what is behind the LCS screen to operate the ship safely.

Keywords: ship stability, ship longitudinal strength, education, STWC

ASSESSMENT OF CRUISE SHIP SAFE ENTRANCE IN A PORT AS A PART OF THE DECISION SUPPORT SYSTEM

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Abstract

In the past few years, the increasing growth of the cruise industry has been noticeable, with an increased number and size of ships and a constant increase in the total number of passengers. In addition, cruise companies have included ports in their itineraries that were not offered before. The offers and activities of these ships are flexible and change over time. They often dock in ports to embark/disembark passengers or, if the port does not have the necessary built-in port infrastructure, this is done at the anchorage. Furthermore, smaller cruise ships can carry out research trips and even expeditions to polar or hard-to-reach areas of the world. Then they anchor in different natural "ports", like bays and protected areas. The embarkation/disembarkation of passengers in such regions is done by tenders or even by helicopters. In this sense, there are no specific criteria that ports must meet in order to accept cruise ships. Existing ports try to follow the trends in the construction of ships by modifying their capacities and thus ensuring the conditions for their safe reception. Port adaptation to the technological development of ships is not always easy, mainly due to the increase in the size and number of cruise ships, changes in technical and technological characteristics and the desire to dock in new attractive destinations/ports. Therefore, a more systematic approach is needed to assess the safety of navigation in port areas. This paper describes the method for determining the safety of navigation and possibilities for cruise ships to enter the port. Classification of the elements and hierarchical structure are made, and criteria for assessing the safety of navigation are determined. A flexible and adaptable model for assessing the safety of navigation for ships in the port area is developed, which enables the evaluation of the criteria of the safety of navigation and facilitates the decision-making process on the possibilities for a ship to enter the port. The Analytic Hierarchy Process (AHP) method is applied to evaluate the criteria for safe navigation. Relevant weight values are calculated, and the decision to enter the port is made based on the total weight values of the penultimate level assessment criteria, pairwise compared by alternatives yes (enter) or no (do not enter). The model is flexible as there is an option for assessment by using only a part of the model, for which there are new impacts, and it can be adapted to any ship and port. By applying the introduced model, the bridge team can decide on entering a port by quantifying the criteria for the safety of navigation.

Keywords: cruise ship, decision support system, AHP model, navigation safety

DETERMINATION OF MARITIME ROUTES AND TRAFFIC FLOWS IN THE IMPLEMENTATION OF MARITIME SPATIAL PLANNING

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Abstract

EU Directive on Maritime Spatial Planning (2014/89/EU) requires all coastal EU Member States to prepare cross-sectoral maritime spatial plans. Maritime Spatial Planning (MSP) is a process that aims to analyze and organize human activities in marine areas to achieve environmental, economic and social goals. Its objective is to promote the sustainable development of marine areas and to identify the usage of maritime space for different purposes and manage the use of space and conflicts in maritime areas. This paper emphasizes maritime transport routes and traffic flows, among other possible activities, uses and interests. Therefore, to determine the sea area occupied by maritime transport routes and traffic flows, it is necessary to identify the elements that most affect the safety of navigation. Based on these elements, it would be possible to determine the sea area that must be reserved and used for these activities. The most important factors affecting the safety of navigation, entry into ports and manoeuvring are connected to oceanological and meteorological conditions, technical and technological features of the ship, security conditions of the port and ship security elements. Elements of the safety of navigation that require additional assessment immediately before entering the port, depending on the actual conditions in the port, are (1) the width of the fairway – flat portion, (2) the width of the fairway – curved portion, (3) the depth of the waterway, (4) the area for turning the ship, (5) manoeuvring area, (6) docking maneuver, (7) the availability of pilotage service, (8) the availability of towing service, (9) collision avoidance (maritime traffic density), (10) maritime safety of the moored ship, (11) maritime safety of the anchored ship, and (12) activities of the ship at anchorage. Therefore, port arrival safety, manoeuvring safety, ship performance safety and safety of port stay should be assessed to ensure the safety of navigation within MSP.

Keywords: safety of navigation, shipping, traffic flow, sustainability

THE CONCEPT OF MARITIME DISCOURSE COMMUNITY: A SEA OF GENRES

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Abstract

In this paper, we aim to present the concept of maritime discourse community from the aspect of maritime genres featuring them. Since the establishment of the seafaring profession, maritime discourses and their genres have been evolving due to changes that have marked the global seafaring profession. However, the concept of maritime discourse has been, until recently, equated with the teaching of Maritime English or English for Special Purposes (ESP). Bearing this fact in mind, resting on the theoretical knowledge of discourse and genre embedded in linguistic theory, we argue that maritime discourse communities and their related genres are much beyond Maritime English, specialized communication, and as a limited technical register. Aware of the limitations of any classifications, in the first part of the paper we offer an insight into the notion of maritime discourse community based on previous research in this field. Then, we expand the existing classifications with the new ones, considering dynamic changes that have affected seafaring and seafarers in its focus. For this purpose, we introduce the reader to the variety of maritime genres in terms of communication domain, channel, tone of communication, and its participants. Then, we identify and depict a few maritime genres to prove how they fulfil the communicative needs of their members within the specific maritime context. The results of our paper are two-fold. Firstly, we present maritime genres as a dynamic communication tool of a specific maritime community that must be understood within the extra-linguistic setting or, more specifically, regarding changes in modern seafaring (digitalization, automatization). The other, pedagogical implication, rests on the future possibilities to apply discourse and genre-based approaches in exploring characteristic features of genres embracing the sea and seafarers.

Keywords: maritime discourse community, seafaring, discourse analysis, genres

ANALYSIS OF SHIPS AND BOATS ACCIDENTS ON THE CROATIAN PART OF THE ADRIATIC SEA

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Abstract

Maritime traffic on the east coast of the Adriatic Sea has increased significantly in the last ten years, and as a result, the number of collisions, groundings, other accidents and incidents has also increased. The growth of nautical tourism and the general increase in the number of recreational vessels have a significant share in the overall increase of maritime traffic, both in the total number and in the ratio of the number of residents per vessel. Due to the expansion of nautical tourism and the fact that the traffic of nautical vessels is most intense during the summer months, most accidents occur in the summer season. In this paper, the dependence of the number of accidents on changes in the state of maritime traffic will be determined, and the main causes of their occurrence and potential measures to reduce the risk of accidents will be analysed. The paper also gives an overview of the impact of the COVID-19 measures on the volume of maritime traffic and nautical tourism in the Republic of Croatia, taking into account the epidemiological measures that restricted the movement of people, and thus travel.

Keywords: Ship traffic, nautical tourism, ship accidents and incidents, COVID-19

CFD FIRE MODELLING IN A VIRTUAL SHIP ENGINE ROOM

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Abstract

Onboard fire is a major hazard that can occur on maritime structures and vessels. Although both designers of marine structures (integrated fire suppression systems etc.) and ships crews (fire drills) constantly strive to ensure fire safety, fire hazards still occur. In order to better cope with this type of hazard, numerical routines for predicting the spread of fire are invaluable because real fire experiments onboard are not possible. Fire (i.e. temperature) and smoke behave like a fluid, so computational fluid dynamics (CFD) is most commonly used for numerical fire behaviour modelling. Various software solutions are available on the market to simulate the thermodynamics of fire and smoke spreading in a predefined environment that matches real-life fire hazard situations. This paper presents a numerical study of the spread of fire in the ship engine room, typical for RO-RO, but can be found on any ship type. The fire spread is modelled using CFD and the finite volume method in SmartFire software. The parameters considered here are the time-dependent temperature and smoke density at various points throughout the entire engine room. The results of the temperature and smoke spread are visualized as in a video file. The obtained results can help in achieving better fire safety design of the engine room or in a training preparation of the engine room crew. The same results can potentially be transferred to extended reality (XR) environments. There they can serve as a basis for improved fire safety training using wearable XR technology. This concept is being used in the fire safety training in buildings, but is still waiting to be introduced in maritime education and training.

Keywords: computational fluid dynamics, CFD fire model, virtual engine room, marine fire hazard

ENERGETIC AND ECOLOGY EFFECTS OF THE EGR METHOD FOR NO_x REDUCTION ON THE DIESEL ENGINE POWERED SHIPS

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Abstract

By using the exhaust gas recirculation (EGR) method for the reduction of NO_x on the diesel engine powered ships, both the Tier III requirements for navigation in NO_x-emission control area (NECA) and the Tier II for navigation outside NECA can be met. There are two basic arrangements of the EGR system; EGR with bypass (bypass for engine with one turbocharger and bypass with simultaneous switching off one turbocharger for versions with two or more turbochargers) and the so-called EcoEGR (bypass without switching off any turbocharger). By applying this method, on the one hand, the fuel consumption of the main diesel engine is slightly increased and on the other hand, additional electrical power is consumed for the electric drives involved in the EGR system. This leads to a slight decrease in the overall energy efficiency of the ship's energy system and, consequently, to a moderate increase in the CO₂ and H₂O emissions. In this paper, the energy and environmental effects of the application of the EGR method on the diesel engine powered container ship in slow steaming conditions on the Hamburg-Shanghai route are analysed under estimated realistic conditions during one year of service, resulting in a slight decrease in the energy efficiency of the entire ship's energy system, as well a moderate decrease in environmentally harmful effects of NO_x, and a relatively slight increase in environmental harmfulness of CO₂ and H₂O.

Keywords: Exhaust gas recirculation, energy efficiency, ecological effect, slow steaming, fuel consumption

MICRO-CREDENTIALS IN MARITIME EDUCATION

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Abstract

Maritime industry has a great advantage having internationally recognized standards for seafarers' education. Formal education usually provides general knowledge of the total industrial environment and very frequently does not cover all the competences needed on board. Consequently, specific short courses that focus on the acquisition of competences needed in a working environment have been developed. These short courses can be incorporated in the degree programmes, or delivered as stand-alone short courses. Most of them require assessment, and conclude with a certificate, so they qualify to be micro-credentials in the general sense. STCW courses are not identified within EQF or the national qualifications framework. For example, in Croatia some of the short courses are incorporated in the secondary maritime school programmes, while others are incorporated in the bachelor maritime programmes. Moreover, the short courses required by STCW can be offered in Maritime Training Centres or in separate profit-oriented units at MET institutions. In that case MET institutions do not recognize the training offered in Maritime Training Centres and students usually have to complete the same curriculum twice. The main objective of the research is to identify the reasons for such a situation and to establish guidelines for the recognition of micro-credentials. In order to develop guidelines for the recognition of micro-credentials in MET, multinational cooperation is needed in all fields of the industry, especially between maritime higher education institutions and maritime training centers. The recognition of these programmes will improve the employability of students by creating a modern education and training for seafarers based on the needs of the maritime industry. Also, the recognition of these programmes will contribute to the standardization of seafarers' education and training process and to cooperation among maritime higher institutions from different countries, as well as between maritime higher institutions and other key stakeholders.

Keywords: maritime education, STCW, micro-credentials, MET institutions

EVALUATION OF THE EFFECTIVENESS OF THE ROBOTS' APPLICATION IN THE INSPECTION AND MEASUREMENT OF BULK CARRIER'S STRUCTURAL AREAS

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Abstract

Recognized international institutions and associations have undertaken numerous activities dedicated to the optimal design and maintenance of vessels with the aim of reducing incidents and accidents on ships in service. This resulted in numerous conventions, rules and guidelines aimed at increasing the security and safety of people, property and the environment. However, it is only in the last decade that thousands of accidents were recorded, resulting in hundreds of human deaths, and significant material damage and pollution. With this in mind and with the aim to reduce the above mentioned facts, significant efforts are being made to implement effective ship maintenance programs through inspections, surveys and specific nondestructive measurements of ship structures. Furthermore, additional efforts are being made to establish regulatory and technical aspects of applying new technologies in inspection and measurement. Applying the well-known methodology 4W&H for conducting ship inspections in this paper we analyze the possibility of using robots in the inspection and measurement of structural areas of bulk carriers. The role and significance of ship performance, variable affecting performance and current ship inspection access methods are thoroughly examined. Analyzing the projected lifetime of 25 years, the advantages and disadvantages of traditional and remotely controlled ship inspections and measures were considered. Additionally, the possibility of carrying out measurements with traditional or modern methods using robots in specific bulk carrier's sea regions was discussed and analyzed. In this way, the paper will identify the specific time period of desirable use of the robot and identify the areas where it is more beneficial to use modern remote control technologies. This is significant to maintain safety, optimize time and structure monitoring costs.

Keywords: damages, corrosion, robots, inspection, maintenance, bulk carrier

THE CAUSES OF PIRACY AS A SECURITY THREAT WITH REGARD TO FRAGILE STATES

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Abstract

Piracy as a phenomenon is still an unsolved issue that strongly affects international security. The article discusses the causes and consequences of piracy as a security threat, focusing on its relationship with failing or fragile states. Piracy is explored as an ongoing international security concern with economic, legal, and social implications. The historical development of the concept of piracy is presented, with its origins in the raiding of ships and getting booty at sea. The work highlights the prevalence of piracy in regions like the Horn of Africa, West Africa, the Indian Ocean, and Southeast Asia. The connection between piracy and failing states is examined, where the inability of states to provide security, economic stability, and basic services leads to the emergence of piracy. The article examines how pirates often emerge from impoverished local populations, driven by the lack of livelihood opportunities and weak governance in their home countries. Failing states are defined by signs of disunity, loss of legitimacy, instability, human rights violations, and economic failure. Examples from Somalia and Sri Lanka illustrate how state failure contributes to piracy. The aim of the study is to emphasize the challenge of combating piracy that arises from weak legal frameworks, problems with jurisdiction, and the limits of international cooperation. The consequences of piracy include economic impacts on trade, increased costs for insurance and security, as well as both positive and negative effects on arms dealers and destabilized regions. The overall complexity of the causes and consequences of piracy is acknowledged, with the conclusion that addressing the root causes of piracy remains a major challenge.

Keywords: piracy, security threat, failing states, fragile states, international law, causes of piracy, economic impact, state failure, maritime security, international cooperation

AUTONOMOUS ASPECTS FROM THE CAPTAIN PERSPECTIVE

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Abstract

The maritime industry is again radically changing because of new information technology introduced in ship operations and new, more stringent requirements for economy, environment and safety imposed by the society. The research and development have come closer to normal operations, autonomous shipping as a good example of this. M/S YARA BIRKELAND, a 120 TEU open top container ship, fully battery powered solution, prepared for autonomous and unmanned operation. For the first phase of the project a detachable bridge with equipment for manoeuvring and navigation has been implemented. When the ship is ready for autonomous operation this module will be removed. This concept works as this ship is planned as a part of logistics chain and sailing only at sheltered Norwegian waters. IMO decided to look at the regulation of autonomous ships. IMO's Strategic Plan (2018-2023) has a key Strategic Direction to "Integrate new and advancing technologies in the regulatory framework". The scoping exercise was seen as a starting point that would touch on an extensive range of issues, including the human element, safety, security, liability and compensation for damage, interactions with ports, pilotage, responses to incidents and protection of the marine environment. IMO agreed to the development of a non-mandatory goal-based maritime Autonomous Surface Ships (MASS) Code, which will become effective from 1st of January 2024, as an interim measure prior to the adoption of a mandatory code, expected to enter force 1st of January 2028. This paper will look deeper in the building of a newbuilding autonomous ship and her operation from classification point of view.

Keywords: Autonomous ships, MASS, building of a new building ship

DEVELOPMENT OF A NEURAL NETWORK BASED DECISION SUPPORT TOOL PROVIDING OPERATIONAL GUIDANCE ON SHIP STABILITY

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Abstract

The e-navigation concept that is promoted by the International Maritime Organization focuses on, inter alia, the display of important and relevant operational information for the ship's crew in order to enhance safety at sea. Thus, any safety-critical issues in marine navigation may and shall be comprised by tools constituting components of the e-navigation solutions. The ship stability is no exception and providing reliable information would be beneficial. To address this, the Second Generation Intact Stability Criteria may be adopted, especially the operational guidance, which refers to the operation of a ship in actual sea conditions and sailing conditions. The operational guidance is designed to be used for the prevention of the following four stability failure modes: excessive acceleration, pure loss of stability, parametric rolling, and surf-riding/broaching. The combinations of ship speed and heading relative to mean wave direction that are not recommended and that should be avoided in each relevant sea state are identified. In this paper the simplified operational guidance approach is utilized as it does not require model tests or numerical methods of high accuracy. The stability assessment adopts here the Level 2 vulnerability criteria with relevant thresholds provided by the IMO MSC Circular 1627. The case study presenting the potentials of the decision support tool providing aid to the ship master was carried out for a training vessel carrying trainees, thus safety sensitive. The resulting wave characteristics and corresponding sailing conditions were used to train an artificial neural network capable of assessing stability for any received weather forecast. The research reveals promising potential for practical applications of the proposed technique, which may replace the straightforward on the fly calculations of the ship vulnerability to stability failures.

Keywords: ship stability in operation, decision support tool, e-navigation, second generation intact stability operational guidance, artificial neural network

USE OF LOCATION THEORY OF TRANSPORT FOR DETERMINATION OF LIQUEFIED NATURAL GAS TERMINAL LOCATION

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911.3 :32

Abstract

Transport systems planning is a challenging and complex task. Basically, it involves planning the location of linear and surface infrastructure. In view of the above, the location of cargo transport centers is especially highlighted as a separate and extremely complex activity. As a rule, it precedes the preparation of strategic spatial planning documents and serves the purpose of defining the location as well as the urban planning conditions for the specified object at a specific location. One of the specific forms of cargo transport center is the import terminal for liquefied natural gas. In order to ensure the credibility of the conducted research, basic scientific methods developed for this purpose, known as "location methods in transport", are used. The theoretical scope of the paper is determined by the application of location methods in transport, articulated through the use of multi-criteria analysis with the Delphi decision-making method. In terms of application, the paper presents the activities that preceded the determination of LNG terminal location on the island of Krk, as well as the applied methodology. The aforementioned methodology has been applied in practice, as evidenced by the operational commissioning of the first phase of the LNG terminal on Krk.

Keywords: terminal, physical planning, location theory, multi-criteria analysis

USAGE OF SAFETY DEPTH SETTING IN ROUTE PLANNING

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004.89:656.61.052

Abstract

Safe navigation with Electronic Chart Display and Information System (ECDIS) depends on the proper use of several safety settings. If such use is impractical or time-consuming, it can have an adverse effect on the safety of navigation. Therefore, the safety depth calculated by navigational officers is used as an important setting in the route verification process. When calculating the safety depth, several factors have to be considered, including draft, squat, category of zone of confidence (CATZOC), list, the height of the tide, the height of expected waves and safety margin. Accordingly, there will be many different safety depth values for different legs during voyage planning, as values of the abovementioned factors will change throughout the voyage. However, the verification of the planned routes can only be done with a single safety depth at the same time, which is confirmed by testing several types of ECDIS. For this reason, this paper suggests recommendations and guidelines for the practical use of the safety depth used on ECDIS, taking into account the above-mentioned factors that affect the safety depth calculation.

Keywords: ECDIS; navigation; safety; route verification

ENVIRONMENTAL FRIENDLY SHORE POWER CONNECTION

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Abstract

Shipping is a significant source of pollution in the modern world. In port, when the ship is at berth, auxiliary engines are used for loading, unloading, and hospitality activity. The combustion of marine fuels is a major contributor to air pollution. Air pollution is released 400 km around the port area. The effects of the pollution affect the respiratory system, health, and the environment around ports. Ship emissions account for 3% of global CO₂, 15% of global NO_x, and 6% of global SO_x emissions. These gases have a key impact on human health and the environment. Pollution from ships is also affected by the fuel they use. Oceangoing ships are perhaps the largest source of port emissions, but they are not the only source. Ports use of tug boats to guide ships entering and leaving the harbour. Marine vessels have been required to use cleaner fuels (MARPOL Annex VI). Shore power connection can reduce the negative impact of ship activities on the port environment. A significant number of international documents regulate this area. Almost all of them advocate and emphasize the importance of shore power connections as a potential solution to environmental problems. We must preserve the planet for future generations while ensuring the continuity of maritime activities.

Keywords: shore power connection, green houses gasses emission, environmental protection

DESIGN AND DEVELOPMENT OF A NEW WEB PLATFORM FOR THE MANAGEMENT OF PHYSICAL FLOWS AND CUSTOMS DOCUMENTS AT PORT TERMINALS

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Abstract

This paper presents the functions a web platform with the purpose of managing documental and physical flows at port terminals. The platform was designed, for the Ligurian French and Italian coastal area, as part of the European project CIRCUMVECTIO and is currently under development in the CIRCUMVECTIO Plus European project, but it has a general applicability. As regards physical flows, the platform provides information on all possible intermodal alternative paths, from the shipment origin to the destination. In addition, the platform helps with the booking of rail and maritime services and trucking firms. Moreover, it allows to store the data of a shipment and share them among the actors involved. Finally, in the event of a disruption, such as an accident or a deletion of a maritime or a rail service, the platform allows to quickly send a notice to the stakeholders involved in the shipment, and provides the necessary information to change or delete the bookings of maritime and rail services. However, the most important feature of the platform is the documental flows management. The platform grants to upload, share and send the more relevant customs documents: not only cargo manifests and customs declarations, but also the rest of the important documents which follow the goods: bill of lading, certificates of origin, transport document, delivery order and the packing list. The platform manages not only the main European customs documents, but also those of some representative countries of the world commerce, for example: United States, China and Egypt. Customs declarations and cargo manifests could be generated and exchanged either in paper or “electronic” (that is xml) format, while other customs documents are generated and exchanged in paper format only. As a result, it is possible to upload and download on the platform the documents both as xml files and as scanned pdf or image files.

Keywords: Web platform, customs documents, physical flows, Ligurian Italian and French ports, physical flows management, customs documents management

ANALYSIS OF PORT INFRASTRUCTURE ON THE CROATIAN COAST OF ADRIATIC SEA FOR BERTHING SHIPS POWERED BY ALTERNATIVE FUELS

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Abstract

In this scientific paper, the authors analyze the current infrastructure of ports for RO-RO ships that serve major ferry routes. The analysis includes information on the currently available port infrastructure such as the presence of natural gas infrastructure, the possibility of delivering gas by tanker trucks ashore, and the power of the electrical connection available in the port. The authors connect the reason for the analysis with the future requirements of the International Maritime Organization for lower exhaust emissions, and therefore consider it necessary to plan infrastructure for ships powered by alternative fuels as early as possible. This application would reduce the environmental impact by using the synthetic methane. For the purposes of the research, the authors created a questionnaire that was distributed to the port area managers and port concession companies, and collected information on the current infrastructure, on plans and operations that need to be implemented, and on infrastructure development plans that are still in preparation and are expected to be implemented by 2030. In addition, information on the power of propulsion of deployed ships on certain lines was received from the main shipowners who have concessions on RO-RO lines in order to calculate the approximate power of electrical connections for night charging. After analyzing the collected data, the research results indicate that the construction of a modern port infrastructure is a prerequisite for environmentally friendly propulsion solutions and the stability of the lines. Future solutions must have a certain reserve of electricity stored in battery packs to use excess power from the grid during nighttime charging.

Keywords: methane, carbon footprint, port infrastructure, sustainable maritime transport

ACADEMIC BACKGROUND AND COMPETENCIES OF TEACHERS WHO TEACH MARITIME LAW ACCORDING TO THE STCW CONVENTION (MareLaw project)

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378:656.61

Abstract

According to the STCW Convention and national regulations, all seafarers should have knowledge in maritime law. This means that all maritime higher education institutions should consider maritime law as a mandatory part of seafarers' education. Courses on maritime law taught at maritime higher education institutions are specific and different from those taught at Law schools. Students at maritime higher education institutions acquire interdisciplinary knowledge during their studies, and maritime law is usually the only contact these students have with legal issues. Therefore, maritime law course is more complex for students at maritime higher education institutions compared to students at Law schools. Namely, students of Maritime Higher Education have no prior knowledge of law, so they must master the basic legal concepts and the specifics of the legal regulation of maritime affairs in courses on maritime law. The project titled Upgrading and harmonization of Maritime law STCW based curriculum for Maritime students lead by the University of Split, Faculty of Maritime Studies aims to answer the following question: How to teach social science i.e. maritime law at maritime higher education institutions? One of the project packages is a gap analysis with special emphasizes on the academic background and competencies of teachers who teach maritime law at maritime higher education institutions. The gap analysis was done by the project partners in Latvia, Spain and Croatia through online survey. The results of this task will identify the current state and serve as a starting point for improving the competencies of teachers.

Keywords: maritime law, STCW, Maritime Higher Education, academic background, competencies

SEAFARERS' ATTITUDES TOWARDS MARITIME SAFETY REQUIREMENTS: INSIGHTS INTO REALITY

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311.31

Abstract

According to numerous studies and available statistical reports, human error has been and continues to be the main cause of all reported maritime incidents and accidents. In order to reduce the undesirable impact of human errors on the safety of ships, two important instruments should be brought into the light. Firstly, the International Safety Management Code (ISM Code) introduced by the International Maritime Organisation (IMO). Secondly, the Maritime Labour Convention (MLC) implemented by the International Labour Organisation (ILO) in 2006 along with the Guidelines for implementation of the occupational safety and health provisions of the Maritime Labour Convention in 2015. In order to verify the success of the above-mentioned regulations on the human factor, the available statistical reports of the European Maritime Safety Agency (EMSA) on maritime accidents and incidents were examined and it was concluded that human error remains the most important factor. For this study, two identical questionnaires were distributed to professional seafarers, containing basic demographic data and nine questions. The first sample of seafarers surveyed were employed by different shipping companies and worked on different types of vessels. The second sample of respondents was employed by the same shipping company and worked on the same type of ship, namely a container ship. The aim of the study was to investigate the seafarers' attitudes towards the above-mentioned regulations with regard to their knowledge about its content, functionality and implementation quality. Spearman correlation analyses were used to identify meaningful patterns among the data obtained. The results obtained indicate interesting statistically significant correlations between the survey items, which can be considered as guidelines for improving safety on board.

Keywords: ISM Code, MLC, questionnaire, Spearman correlation analysis, ship safety

DATA-DRIVEN, PROBABILISTIC MODEL FOR ATTAINABLE SPEED FOR SHIPS APPROACHING GDAŃSK HARBOUR

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Abstract

The growing demand for maritime transportation leads to increased traffic in ports. From this arises the need to observe the consequences of the specific speed that ships reach when approaching seaports. However, usually the analyzed cases refer only to the statistical evaluation of the studied phenomenon or to the empirical modelling, ignoring the mutual influence of variables such as ship type, length or weather conditions. In this paper, a different approach to the issue is proposed, which summarizes the most important factors and leads to a probabilistic speed model for manoeuvring ships in the port of Gdańsk. For this purpose, data from the Automatic Identification System were used. This resulted in a dataset with almost 2.5k traffic scenarios. To obtain results from the dataset, three different machine learning algorithms based on Bayesian networks were then applied. The developed models can be used to predict the speed as a function of the given parameters as well as to determine the values of individual parameters for a given speed. In addition, the use of the constructed models allowed the analysis of the strength of mutual influences for two connected nodes or the sensitivity of changes for individual variables. The discussion also raised questions about the validation of the algorithms and measures to improve accuracy. The average predictive accuracy of the models of about 75% (depending on the learning algorithm used) achieved at this stage is promising, but further work is expected that can increase the predictive power of the models.

Keywords: Bayesian network, AIS data, ship speed, maritime transport, Gdańsk harbour

RISK OF FOOD POISONING ON SHIP AND PREVENTIVE MEASURES

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351.77:614.4

Abstract

A good and healthy life requires access to safe and quality food. Consuming unsanitary water or food can lead to food poisoning. Water is considered food in this context and should be healthy. Food poisoning can be caused by various biological or chemical agents and can be prevented by proper food production, handling, storage and preparation. Food poisoning can be caused by different types of microorganisms, especially noroviruses, which have recently become more common. The paper presents the clinical picture of food poisoning, the symptoms of illness and the procedures to be followed on board, as well as all the measures to be taken to ensure the safety of food and water on board and to eliminate or minimize the risk of illness. From an epidemiological point of view, ships are closed or semi-closed environments, depending on the type of ship, which pose a high risk for the possible outbreak of various epidemics. Although the food transportation and production chain is complex and subject to strict control, the preventive measures on board regarding food supply can be defined as follows: Procurement of safe food from reliable suppliers, transportation to the ship, loading, storage, preparation and serving. Food poisoning on cruise ships can be a major problem, which is why international recommendations have been developed and accepted for the safety and monitoring of food handling, especially on cruise ships. In compliance with all standards, regulations and guidelines, food and water should be healthy for consumption when provided both ashore and on board.

Keywords: food safety, food poisoning, ship, preventive measures

NUMERICAL AND EXPERIMENTAL SIMULATIONS IN DESIGN OF A TOURIST SUBMARINE

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629.5.01

Abstract

This presentation reviews numerical and experimental simulations performed in the design stage of an innovative tourist submarine with transparent acrylic hull. Numerical simulations include the finite element (FE) analysis based on “design-by-analysis” approach for yielding, buckling and fatigue analysis of the pressure hull of a submarine, FE analysis of a sealing between acrylic cylindrical parts, FE collision and grounding simulations, as well as computational fluid dynamic (CFD) simulations of the hydrodynamic resistance. Experimental model tests comprise resistance, towing and seakeeping tests, open water propeller tests, self-propulsion tests of diving, manoeuvring and emergency lifting using wire rope, and testing of submarine emergence in regular and emergency conditions by ballasting. The presentation is part of the project KK.01.2.1.02.0339 – Development of the multipurpose luxury tourist and research submarine, co-financed by the European Union from the European Regional Development Fund under the Operational Program “Competitiveness and Cohesion 2014-2020”. The design of the tourist submarine analysed is the property of Marine and Energy Solutions DIV d.o.o.

Keywords: tourist submarine, finite element method, computational fluid dynamics, model tests

SEAFARERS' EDUCATION AND TRAINING IN PRACTICE: MONTENEGRIN EXPERIENCE

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37:347.79(497.16)

Abstract

Well-qualified and competent seafarers accomplishing appropriate tasks on board ship are one of the key factors for safe navigation. Along with the international legal framework, established by the International Maritime Organization (IMO), through the enforcement of the STCW Convention, each State has an obligation to establish effective and efficient institutional, supervisory and legal mechanisms which should provide quality education and training through proper functioning and implementation. As a maritime state (which has about 6,000 seafarers), Montenegro has set an institutional and legal framework that presents the basis for the education and training of seafarers. The importance of Montenegrin maritime institutions and legal regimes for education and training is that they present key mechanisms in providing 'quality' education and training and thus supplement and improve the overall educational process. The necessity for quality education and training gets special significance when it is known that the majority of Montenegrin seafarers acquire their knowledge for future work on foreign ships, and that obtained competence and skills during the educational process are required for employment on those ships. This article presents the importance and role of the Maritime Administration in the education and training of seafarers in the context of set standards, with a special focus on the Montenegrin Administration. Additionally, it presents the Montenegrin legal framework for the education and training of seafarers by comparing the relevant laws and subsidiary legislation with the STCW Convention, in order to evaluate their conformity with the Convention, and give guidance on how to improve the existing Montenegrin legislation. Through case studies, the discussion has been raised about potential shortcomings in the education and training process, i.e. the actually obtained competence in certain areas is compared with that required by the STCW Convention. The case studies refer to several shipboard procedures that may affect safe navigation and safe work on board.

Keywords: MET quality and standards, detected shortcomings

ESTIMATION AND FORECAST OF GREENHOUSE GAS EMISSIONS FROM SHIPS AT PORTS

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Abstract

Shipping is an environmentally friendly and energy-efficient transport mode; nevertheless, its environmental impact is not negligible: 2.5% of global Greenhouse Gas (GHG) emissions (about 940 million t/year). The turnaround time spent by ships at ports is also not negligible: 0.70-2.05 days in average (2018). Therefore, the periods spent in ports represent a good chance to minimize the GHG emissions by offering technical options for emissions limitations and less constraints and complications than during the navigation. Moreover, it brings combined positive effects on local pollutions in a typical win-win Green Port challenge. Actually, many ports estimate emissions because of various reasons. Structured inventories of emissions producers can help identify areas to improve energy efficiency by cost-effective strategies. The paper starts from results of inventories carried out in various ports worldwide, available in the scientific and grey literature, to depict a methodology to develop emissions inventories and forecasting. It includes: analysis of existing datasets of emissions at ports; analysis of traffic data by ship typology, handling operations at ports, turnaround times; multivariable statistical analysis for cause-effect correlations; identification of correlations, quantification of their reliability and setup of typical emission factors; setup of a generalized systematic methodology for inventory; identification of integrative local measurements and estimations. The main findings will be the design of a systematic methodology for emissions estimation from typical data related to ships operation at ports, as well as the estimation of availability and reliability of data, carefully considered in the paper.

Keywords: Ports, Environment, Emissions, GHG

AN ANALYSIS OF SMCP USAGE IN VHF COMMUNICATIONS BY JAPANESE SEAFARERS

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656.61:811.111

Abstract

Ensuring safe navigation for vessels relies heavily on having clear and understandable VHF communications. In 2001, the International Maritime Organization (IMO) introduced Standard Marine Communication Phrases (SMCPs) and Message Markers to promote a common language during radio communications and reduce the risk of miscommunication and potential dangerous situations at sea [1]. It is typical for parties involved in radio communications at sea to come from very different linguistic and cultural backgrounds, roles in the maritime industry, and possess varying levels of English proficiency [2],[3]. The use of Standard Marine Communication Phrases (SMCPs), including Message Markers (MM) during radio communications are some of the methods IMO implemented in 2001 to ensure communications are conducted in a unified language that reduces the risk of miscommunications and subsequent dangerous situations [4]. This research aims to investigate the actual usage of SMCPs and MMs among Japanese seafaring officers, as well as the techniques they employ to address and overcome communication difficulties. The study administered a survey to 108 Japanese seafaring officers with an aim to identify and highlight inconsistencies in usage of SMCPs and MMs among seafarers in ship to ship and ship to shore VHF communications. Additionally, survey result analysis identifies methods used by these seafarers to overcome instances of miscommunication or other communication difficulties. By examining problematic areas and effective techniques for dealing with miscommunication, this investigation offers valuable insights into improving future training programs and increasing compliance with SMCP usage rates during ship to ship and ship to shore VHF communications.

Keywords: Maritime English, VHF Communication, SMCP, MET

SMART EQUIPMENT FOR THE PRESELECTION OF CARGO VEHICLES IN THE MARITIME PORT AREA

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Abstract

The socio-economic changes generated by the conflict in Ukraine had a strong impact on sea ports located in the eastern part of Europe on the Black Sea. Cargo flows from this country have been redirected to new, safer routes. The flow of cargo vehicles loaded with grain from Ukraine overloaded the capacity of Constanta port in Romania. The large number of vehicles present in this situation blocked the access of those scheduled for the unloading process for which the grain terminals had the maritime vessel at berth. Thus, the activity of loading the maritime vessels with grain was disrupted and some supplementary cost appeared. The paper presents smart equipment, developed by the authors, used for the pre-selection of cargo vehicles according to the access conditions in the port area. The structure of the innovative equipment, the data processing modules and the sensors used in their collection are presented in the paper. Its usefulness is tested with the help of discrete simulation model, evaluating different scenarios for the access rules and the cargo vehicles flow compositions. The obtained results will be used to promote this solution to the port authorities.

Keywords: smart equipment, maritime port access rules, discrete simulation

SHIP COMPONENTS IDENTIFICATION SYSTEMS

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Abstract

All seafarers in the world are familiar with the problem of the wrong spare parts being delivered to the ship, either because of incorrect information in the order or because of misinterpreted information from the supplier. This problem can be easily understood by analysing the ships' Computerized Maintenance Management Systems (CMMS), where it is obvious that there is no uniform method for coding the equipment and its parts. Currently, there are a number of different coding systems for ship components and parts. The decision on which system to use rests with either the equipment manufacturer or the end user. Multiple systems are often used simultaneously on ships, leading to various problems (confusion). In addition, there are no clear standardisation rules that would solve this problem. This article serves to present the identification of the problem and the announcement of future research on this problem. In this preliminary research, three selected ship identification systems were analysed and compared, and their advantages and disadvantages were reviewed. In this way, it was determined exactly which system should be improved and modernised in future work to try to solve the problem described.

Keywords: CMMS, codification system, standardization

A CONCEPT OF A HOLISTIC DECISION SUPPORT SYSTEM FOR MARITIME COLLISION AVOIDANCE – A FRAMEWORK WITH APPLICATION

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Abstract

At a time of continuous development in maritime transportation, both in terms of growth of the global fleet and technological advances, continuous improvements are still required to enhance maritime safety. One method of improving the navigator's decision-making process is the use of Decision Support Systems (DSS). The suggestions provided by the DSS based on the models depicting a situation at sea, and eventually selecting a recommended solution can provide valuable guidance to the officer of the watch, especially during multi-ship encounter situations. However, most existing DSS concepts focus exclusively on a single aspect of solving a close-quarters situation, while ignoring navigators' knowledge and preferences, bathymetry information, wave impact, or the ship's manoeuvrability. Therefore, it was necessary to address this issue and propose a system that takes a holistic approach. On the one hand, the expertise and preferences of navigators are used to detect a potentially dangerous situation, and on the other hand, the physics of object movements and the manoeuvring capabilities of the vessel are taken into account to execute an efficient evasive manoeuvre.

Keywords: collision avoidance, maritime safety, Decision Support System, Collision Alert System, ship domain, experts' knowledge

HARMONIZATION OF VTS TRAINING PROGRAMS – A CASE STUDY OF THE ADRIATIC-IONIAN REGION

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Abstract

This paper presents an example of harmonized training programs for Vessel Traffic Services (VTS) for a specific region controlled by more than one state. It is a result of the EU-funded Interreg EUREKA project, one of the goals of which has been to harmonise training programs for VTS operators in the Adriatic-Ionian (AI) Region. Therefore, this paper briefly describes the proposed training programs comprised of 15 modules and delivering two training levels - operational (VTS operators) and management (VTS supervisors). The modules were developed for educational content with specified training hours, based on the official and current requirements of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). In addition, the idea behind the harmonized training modules was to meet the specific requirements for VTS competencies which encompass the particularities of the Region. The Regional specifics taken into consideration included the geographical area, maritime traffic density, national legislations and requirements, and similar variables and specifics. An overall goal of the program development and harmonisation was to provide the operators with additional and tailored skills and competencies aiming to improve their overall performance and decision-making process.

Keywords: VTS training programs, VTS operator, VTS supervisor, harmonization, Adriatic-Ionian Region

MARINE RENEWABLE ENERGY

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502/504

Abstract

The aim of this paper is to provide a brief overview of the role of marine renewable energy (MRE) in generating renewable energy to reduce global dependence on fossil fuels and mitigate the associated negative environmental impacts. The social, environmental and economic benefits, as well as the opportunities for developing and applying new MRE technologies and related innovations, particularly in European countries, are examined. Some technologies, such as offshore wind, are mature and widely recognized as proven and reliable renewable energy sources. Technologies such as wave energy, tidal energy, Ocean Thermal Energy Conversion (OTEC), or salinity gradient energy are still at an experimental stage, but could open up new opportunities in the future. Nevertheless, ocean energy has the potential to provide reliable, sustainable, and affordable renewable energy. The key to successfully harnessing ocean energy is investing in research and development, while taking into account the impact on already degraded ecosystems. Considering all these facts, MRE technologies can significantly support the sustainable development of many sectors, as they have a great potential for providing renewable, affordable and clean energy, creating well-paid jobs and reducing negative impacts on the environment. Europe strongly supports the research and innovation efforts needed to achieve climate neutrality and MRE technologies offer European countries the opportunity to become leaders in MRE production.

Keywords: marine renewable energy, innovations, sustainable development, environmental impact, EU

DECISION-MAKING PROCESS FOR URBAN MOBILITY AND TRAFFIC MANAGEMENT¹

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Abstract

To develop quality solutions for urban mobility and multimodal transport in the city of Rijeka and to promote sustainable, clean and energy-efficient modes of transport a scientific research project Connected traffic was carried out. The goal of this paper is to present the research activities and the results achieved of the Connected Traffic project related to the improvement of urban mobility and traffic management in the city of Rijeka. The methodological approach of the research consists in determining the requirements for the vehicle recognition sensors as well as ecological and meteorological parameters. Furthermore, the traffic model of the city of Rijeka with the associated roads and intersections was developed, which serves as the basis for the implementation of traffic simulations. A macro-simulation of the traffic flow was performed based on the existing traffic demand and a micro-simulation modelling of the test area was developed. The following hypothesis has been set in the paper. The application of simulation tools for testing innovative scenarios and standard operating procedures can improve the decision support system for urban mobility and traffic management. The scientific contribution is to define the decision support system with application in transport that will upgrade the traffic management system. One of the outcomes of the project is the implementation of a data aggregation platform that develops the decision-making process in urban transport and enables the automatic distribution of data. The significance of the decision support system aims to reduce emissions of carbon dioxide and other harmful gases, thus ensuring the sustainability of urban transport.

Keywords: sustainable transport, urban mobility, multimodal transport, traffic management, innovative traffic solutions

¹ The paper is the result of research activities of the scientific project Connected Traffic implemented within CEKOM for smart cities (CEKOM – Center of Competence for smart cities, the city of Rijeka), funded by the EU ESIF fund, started in March 2020. and ended in March 2023.

FULLY AUTONOMOUS SHIPS - A FEW REMARKS ON REGULATORY APPROACH

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Abstract

The emergence of crewless vessels on seas seems to be an inevitable step in the future development of international shipping, rightly seen by many as far more revolutionary than containerization or other significant changes observed in the past. While ships that are remotely controlled from a shore-based center, or from other ships, still involve a human element in the control of the vessel, in the case of fully autonomous ships, a system based on Artificial Intelligence (AI) solutions will replace human decision-making. The presentation is divided into two parts. The first part considers a few critical problems related to maritime safety by examining components of navigational, construction and equipment safety of fully autonomous ships. Basic navigational rules related to watchkeeping, lookout, or the duty to render assistance to persons in distress at sea are analysed. Special attention is dedicated to studying the regulatory approach adopted by the International Maritime Organization in case of safety regulations. Among others, the suitability of a functional regulatory approach based on the Goal-Based Standards procedure (GBS) to challenges posed by fully autonomous ships is discussed. The second part investigates liability issues raised by fully autonomous ships. It will examine whether the emergence of new subjects like AI providers may potentially alter the liability schemes adopted under the IMO conventions. Other concepts like intent or recklessness in the knowledge that the loss would probably result and their relevance to AI-operated vessels will be examined. The authors will make preliminary suggestions on possible regulatory choices in liability conventions.

Keywords: fully autonomous surface ships, unmanned vessels, goal-based standards procedure, artificial intelligence providers liability

ANALYSIS OF INACCURATE DEPTH DATA ON NAUTICAL CHARTS AND RECOMMENDATIONS FOR IMPROVING ACCURACY

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Abstract

Much of the world's oceans, seas, and coastal waters are not surveyed as recommended by the International Hydrographic Organization (IHO). Therefore, the question arises as to how these specific areas can be accurately surveyed and nautical charts updated. Current methods of hydrographic surveying include the following: single-beam and multibeam systems, sweep systems, side-scan sonars, and more recently Light detection-and-ranging systems (LIDAR) and Laser Scanners. Aero-photogrammetry and remote sensing have always been used to collect spatial data and therefore occupy an important place in hydrography. With the development of technology, all these research and survey methods, together with satellite imagery, provide a high degree of accuracy and precision of spatial data. By means of consolidated data obtained through various survey methods and developed spatial-time databases, Geographic Information System (GIS) technology makes it possible to gain insight into the broader sea and coastal area and hence to define the risk areas for navigation and to set the priorities for more detailed hydrographic surveys. The paper analyzes the causes of inaccurate depth data on nautical charts, maritime accidents caused by incorrect depth data and provides a classification of the causes and recommendations to reduce the number of inaccurate depth data.

Keywords: nautical chart, hydrographic survey, depth

THE BRIDGE ACROSS KAŠTELA BAY AS A TRAFFIC SOLUTION: PROS AND CONS

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Abstract

Congestion, as the main issue of a transportation network in large cities, occurs when the intensity of traffic exceeds the predicted capacity of the current infrastructure. It is especially characteristic of cities that have limited entrances and exits and thus access roads. This causes additional costs, extends transportation time, and adds to the environmental burden. The aim of this paper is to analyze the impact of the possible construction of the bridge over Kaštela Bay. Based on the available data, the authors have prepared an overview of the main supporting and limiting factors in order to determine the justification of the project from different aspects. These aspects include the analysis of the operational traffic solution and related impacts on road and port activities, technical performance and requirements, climate impacts and other relevant factors. The Kaštela Bay bridging aims to eliminate congestion, increase efficiency and productivity, and improve the static capacity of the transport network in the city of Split. However, the implementation of the infrastructure project could have an asymmetric impact on the future development of the northern terminals of the Port of Split if implemented without considering the planned investments and future forecasts for passenger and cargo traffic. The necessity to include all the relevant stakeholders in the planning process of a capital traffic investment is considered as a high priority.

Keywords: traffic solution, bridge construction, Kaštela Bay, city of Split

SCUTTling – AN OVERVIEW OF THE IMPACT ON THE MARINE ENVIRONMENT

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Abstract

Scuttling is the act of intentionally sinking a ship by allowing water to flow into its hull. Over time, sunken ships have become a new habitat for marine organisms, which enriches biodiversity and makes the diving destination more attractive. A special underwater attraction for professional and recreational scuba divers are the locations of sunken ships. This paper examines the level of scuttling development in the world. In the case of intentional sinking of ships, environmental impact analysis studies are also included. The authors emphasize the importance of the ecosystem approach in the implementation of scuttling. Furthermore, the authors cite scuttling in Malta as an example of good practice. The special contribution of the article is reflected in the importance of understanding scuttling as a form of tourist offer which has a positive impact on marine environment protection. The locations of the sunken ships contribute to the sustainable development of the tourist destination, since fishing and especially trawling are strictly prohibited in these areas.

Keywords: scuttling, diving tourism, scuba divers, marine environment ecosystem approach, Malta

DEVELOPMENT OF LOCAL IMPORTANCE PORT AREAS IN THE CITY OF ZADAR

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Abstract

The successful and rational development of port areas of local importance implies the identification and assessment of all elements that directly or indirectly affect their functioning. As a basis for the analysis of future development possibilities, a state-of-the-art analysis of the port areas was carried out. Accordingly, the following parameters were analyzed for each port: geographical position of the port and port area, surface area of the port area and relation to the total area of other port areas, content and activities available and performed in the port, technical-technological characteristics of the operational shores and mooring places, mooring capacity for different types of vessels, state of the equipment provided for the safety of vessels in the port, existing traffic and potential future demand, navigational and meteorological-oceanological conditions of the port location and associated anchorages. Based on the state-of-the-art port areas analysis, port development models were defined using the Analytical Hierarchy Process (AHP) method, which determine development possibilities (directions) for each of the analyzed port areas based on the current state, spatial planning possibilities, and set criteria for their future development. Due to practical reasons as well as need for different investments in port infrastructure and suprastructure, three development directions were defined, i.e. three scenarios for the development of local importance port areas in the city of Zadar: development of public long-coastal and line transport and/or economy, development of the nautical/tourist function of the port area and development of the communal function of the port area. For all mentioned development scenarios two groups of criteria have been defined combining transportation-technical and socio-economic aspects of the evaluation of individual county development direction or scenario. Additionally, for each criterion, sub-criteria have been defined, expressed qualitatively or quantitatively with appropriate descriptive or numerical values in order to provide the evaluation and assessment of the realisation of a particular scenario.

Keywords: local, ports, development, Zadar, multicriteria, AHP

