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1.1 SHIP/STRUCTURE DESCRIPTION

2015010001

Jones Act Aframax gives new dimension to US shipbuilding.
_The Motor Ship_, v 95 n 1119, October 2014, p 39
[2 p, 1 fig] [http://www.motorship.com/]
Tinsley, D.
English

This article describes the 115,000dwt Aframax tanker LIBERTY BAY, the largest vessel built to date by Aker Philadelphia Shipyard. The vessel was contracted by Exxon Mobil Corporation's marine affiliate, SeaRiver Maritime, and is the first of two sisters designed to transport Alaskan North Slope crude oil from Prince William Sound, Alaska, to refineries along the US west coast in California and Washington state. LIBERTY BAY has a length overall of 251.0m, a moulded breadth of 43.8m, summer draught of 15.0m and a cargo capacity of 130,000m³.

_Tankers_  
_Vessel descriptions_

2015010002

Purpose-built for long endurance seismic survey anywhere.
_The Motor Ship_, v 95 n 1119, October 2014, p 40
[2 p, 2 fig] [http://www.motorship.com/]
Tinsley, D.
English

The 21,195gt seismographic research ship AMAZON WARRIOR is described. The vessel is the largest in the fleet controlled by WesternGeco, and has been conceived to work anywhere worldwide, including Arctic waters. She is the first of two sisters contracted for the UK-headquartered company from German shipbuilder Flensburger Schiffbau-Gesellschaft. At 126m in length and 28m-31m in width, the vessel has been developed as a large, powerful, manoeuvrable and stable platform that can maintain her data gathering role in inclement sea and weather conditions.

_Seismic data_  
_Special vessels_  
_Vessel descriptions_

2015010003

Offshore crew transport gets larger and faster.
_The Motor Ship_, v 95 n 1119, October 2014, p 43
[2 p, 2 fig] [http://www.motorship.com/]
No author given
English

Australian shipbuilder and designer Incat Tasmania has recently christened what it claims to the world’s largest and fastest crew boat. The 70m catamaran named Muslim Magomayev. The vessel will be used by Caspian Marine Services to operate fast crew transfers for up to 150 offshore workers to multiple installations in the Caspian Sea. The high speed of the ship is claimed to offer more efficient transport for passengers and cargo than helicopters or standard crew boats. Incat has opted for a semi-Swath (small waterplane area twin hull) design, along with active ride control, to reduce stress on passengers so they arrive at the oil platform relaxed and fit to work. Muslim Magomayev is of about 200 dwt capacity, and is able to carry 150 passengers and 14 crew, along with 130 tonnes of deck cargo, in up to 40 knot wind and seas of 3m significant wave height.

_Catamarans_  
_Crew boats_  
_High speed vessels_  
_Vessel descriptions_

2015010004

Port feeder barge: advanced waterborne container logistics for ports.
_TransNav Journal_, v 8 n 3, September 2014, p 411
[6 p, 6 ref, 1 tab, 9 fig] [http://www.transnav.eu/Article_Port_Feeder_Barge:_Advanced_Malchow,31,524.html]
Malchow, U.
English

The article describes the Port Feeder Barge, a new type of harbour vessel designed, firstly, for operation within the port of Hamburg. Other major and even minor ports could benefit from the operation of this innovative type of vessel which improves efficiency and at the same time reduces the ecological footprint of intra-port container haulage. Additionally it can even facilitate container handling at places which are not suited at all for this kind of operation. The internationally patented Port Feeder Barge is a
self-propelled container pontoon with a capacity of 168 TEU (completely stowed on the weather deck), equipped with its own state-of-the-art container crane mounted on a high column.

Barges
Container handling

2015010005

A multipurpose marine science and technology research vessel for full-scale observations and measurements.
AMT’13, 3rd International Conference on Advanced Model Measurement Technology for the EU Maritime Industry; 17-18 September 2013; Gdansk, Poland. Organised by Newcastle University, UK and CTO S.A., Gdansk, Poland. P 190 [27 p, 16 ref, 3 tab, 18 fig]
http://conferences.ncl.ac.uk/amt13/proceedings/
Atlar, M., Aktas, B., Et al

English

In order to support the marine research, teaching and consultancy activities in the North East region of England, Newcastle University recently replaced their aged, slow-speed mono-hull research vessel with a modern and relatively high-speed catamaran, the PRINCESS ROYAL. The hull form of the new research vessel was based on the catamaran application of the displacement type Deep-V hull forms with a novel anti-slamming bulbous bow and tunnel stern. The vessel was built in aluminium alloy. The PRINCESS ROYAL lends itself to be used as a multi-purpose science and technology platform with a flexible speed range for a wide variety of full-scale marine measurements and observations. Her main duties include conventional trawling, sampling, dredging, marine wild life observation, wind farm/renewable device support, performance monitoring, coating/fouling inspection, cavitation and noise research. She is equipped with a moon pool facility for the deployment of remotely operated vehicles and which is complemented by a wide range of hydraulic cranes and by a hydrographic winch. The starboard propeller shaft is fitted with a load cell to measure thrust, torque and shaft bending moment. A motion sensor combined with vertical wave radar, EM speed log, propeller observation windows, borescope apertures, hydrophone facilities and wide array of marine science equipment further complements the equipment on board. A general arrangement drawing is included in this paper.

Catamarans
High speed vessels
Multipurpose vessels
Research
Vessel descriptions

1.2 DESIGN

2015010006

Human-system integration within a multidisciplinary ship design.
International Conference on Marine Design; 3-4 September 2014; Coventry, UK. Organised by RINA, London, UK [8 p, 10 ref, 2 fig]
http://www.rina.org.uk/publications.html
Greenbank, C., Richards, D.

English

Good ship design has many facets but a key tenet is the understanding of the Operational environment and the practical challenges faced by Seafarers. It is important that their needs are taken into account, yet that also needs to happen within the associated engineering constraints and the limitations imposed by the regulatory framework, not forgetting the commercial considerations. This paper presents the Human-System Integration (HSI) view from within a multidisciplinary ship design team, and highlights the practical challenges and opportunities of adopting a HSI approach to ship design. A key element to this is balancing the user-centered approach with the real-world constraints of the project to achieve an optimum outcome for the client and the Seafarers who will live and work on the ship.

Human factors
Ship design
Investigation of the 2nd generation of intact stability criteria for ships vulnerable to parametric rolling in following seas.


http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786430

Krüger, S., Hatecke, H., Et al

English

The existing IMO intact stability criteria (IS-Code 2008) do not generally provide sufficient safety against dynamic stability failures such as parametric rolling for modern ships. Therefore, new stability criteria have been developed by IMO / SLF. These so-called Second Generation Stability Criteria shall ensure sufficient dynamic stability. The criteria are structured in a three level approach, where the first level consists of quite simple formulae. If a ship does not pass the first level, it is assumed that the ship is vulnerable to the phenomenon addressed, and the second level of criteria shall then be applied. This level consists of computations which are a little more complex, but they still treat the problems addressed in a strongly simplified manner. If now the ship does not pass the second level, a third level shall be applied to ensure that the ship can be designed and operated safely. This third level consists of direct calculation methods which shall be applied, however no criteria or procedures have yet been developed for this third level. The authors have applied the level 1 and level 2 criteria to a reference ship where a direct stability assessment has been performed during the design. The results showed extremely large scatter in the required GM-values of the criteria, and none of the criteria showed GM values roughly comparable to the direct assessment. The paper shows why the application of the criteria is challenging for the design of RoRo-ships and why a third level (direct assessment) is urgently required before the first two levels are put into force. Some conclusions are also drawn for the possible treatment of the new criteria in a stability booklet.

Design criteria
Ro/ro ships
Rolling
Stability

Allen and Jones revisited.

Ocean Engineering, v 89, 1 October 2014, pp 119-133


Razola, M., Rosén, A., Garme, K.

English

In this paper the prevailing semi-empirical design method, used to predict design slamming pressures for high-speed craft and which is implemented in the scantling rules of the classification societies, is reconstructed and evaluated using numerical and experimental methodologies. It is shown that the present formulations are relevant in terms of the predicted pressures, but that there is room for improvements, particularly in relationship to modern high-speed craft structures. The design method is therefore modified in relationship to these observations using the numerical methodology, and it is concluded that these modifications result in significant improvements regarding the predicted design pressures. Finally a discussion on the analysis methodology; the formulation of lifetime design loads; and the structural loads developed due to the simplified design pressure model is presented.

Design criteria
Finite element method
High speed vessels
Slamming

Ship synthesis model for the preliminary design of a fleet of compressed natural gas carriers.

Ocean Engineering, v 89, 1 October 2014, pp 189-199


Vernengo, G., Rizzuto, E.

English

The transportation by sea of compressed natural gas is a very recent subject, prompted by recent changes in the perspectives of a possible economic exploitation of relatively small quantities of this hydrocarbon, available as by-product of oil extraction in off-shore fields. An automatic and integrated preliminary design procedure has been established to generate and evaluate feasible technical solutions for a trade of this kind. A first trial application has been carried out for a specific case, for which various feasible solutions corresponding to fleets composed of a different number of equal ships are generated. In
the procedure, a parent hull shape is adopted in order to evaluate, through systematic variations of the main dimensions, all the elements necessary to perform the classical steps of the design spiral (like weight evaluation, buoyancy, trim and stability checks and motion resistance prediction) accounting for the mutual interaction between the various items. When possible and necessary, parts of the procedure have been calibrated with data from existing ships, in order to ensure realism in the predictions. This has been done with reference e.g. to the evaluation of weight items and in particular to hull weight. On the other hand, when setting boundaries to the range of variation in the ship dimensions, care has been given not to constrain the investigation domain only to existing dimensional ratios, but to let the procedure explore a wider range of solutions. A particular feature of the procedure is to include in the evaluation process the seakeeping performances in terms of added resistance in waves. This aspect interacts with the other part of the design process and influences the final outcome in terms of performance of the solution. The main implications of accounting for the increase in motion resistance are the capability of evaluating the reduction in the average speed, the corresponding reduction in the annual cargo delivery and the increase in fuel consumption (all aspects evaluated in respect to nominal conditions). The procedure, accordingly, is able to provide, in addition to several technical output identifying the various solutions (such as main dimensions, weight, power installed, seakeeping performances), indicators of the performances of the fleet in terms of annual cargo delivery, CapEx and OpEx that can be used to rank the various solutions.

Compressed natural gas
Gas carriers
Ship design

2015010010

Structural reliability based design and assessment acceptance criteria development for fixed offshore platforms in South China Sea under extreme storm conditions.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786192
Li, L., Li, P., Liu, Y.

English

This paper presents a reliability based methodology to develop the design and assessment acceptance criteria for fixed offshore platforms in the northern South China Sea under extreme storm events. Firstly, the atmosphere, ocean and wave coupled numeric simulation model with site measurements verification is used to generate the time series directional waves, currents and winds for each refined grid point in the studied area during the past 40 years. Secondly, the storm and response based load statistics method is adopted to investigate the long term distribution of the extreme environmental load considering the joint occurrence of wave, current and wind. Thirdly a structural reliability method is proposed to quantify the probability of platform failure subjected to extreme storms. The environmental load factors for new design platforms in the northern South China Sea with different exposure categories are calibrated. Finally risk assessment is performed to develop the acceptance criteria for the exiting platforms in terms of reserve strength ratio based on the failure consequence and failure probability of platforms. Case studies are presented to illustrate the applications of the proposed method and how the reliability analysis results can be used in development of long term structural integrity management strategies.

Offshore platforms
Platform design
Storms
Structural reliability
2015010011

Multiojective optimisation of a submarine hull design.
Ship Science & Technology, v 7 n 14, January 2014, p 27 [16 p, 23 ref, 9 tab, 4 fig]  
http://www.shipjournal.co/index.php/sst/article/view/92

Paz, J.D.M., Muñoz, O.D.T.  
English

A synthesis model for the concept design of a submarine is developed consisting of a parametric definition of the hull geometry, a manoeuvrability model based on slender-body theory, and a resistance formulation. This coupled model is suitable to be treated by a metaheuristic multiobjective optimisation technique (a genetic algorithm) to find a set of design options that satisfy the need to minimize simultaneously the turning diameter and the resistance generated. According to typical data found in submarines like the one analysed herein, the boundaries and some constraints are set for the design variables. Finally, some solutions for this design case are obtained considering the criteria adopted in this study.

Manoeuvrability  
Optimisation  
Ship design  
Submarines

2015010012

Designing for Arctic conditions.  
The Naval Architect, October 2014, p 26 [2 p, 2 fig]  
http://www.rina.org.uk/tna.html

No author given  
English

Arctic exploration is not only pushing into new territories, but also pushing the boundaries of vessel design. This article explains the challenges of designing modern ships that can not only withstand these harsh conditions, but can continuously operate within them.

Ice transiting vessels  
Ship design

2015010013

HHI’s moveable feast.  
The Naval Architect, October 2014, p 30 [7 p, 2 ref, 13 fig]  
http://www.rina.org.uk/tna.html

No author given  
English

Hyundai Heavy Industries (HHI) has developed a containership design with a moveable accommodation block, named SkyBench, which it says will help to utilise cargo space to the maximum possible capacity while allowing the crew to optimise the still water bending moment, allowing the vessel to operate at its most efficient set up. HHI says that a 14,000TEU ship will be able to load a further 350TEU while a 19,000TEU will increase its capacity by 450TEU by including SkyBench in its design.

Containerships  
Ship design

2015010014

Super SAVER paves the way to cleaner shipping.  
The Naval Architect, October 2014, p 42 [3 p, 3 fig]  
http://www.rina.org.uk/tna.html

No author given  
English

Highly efficient ships are de rigueur for the modern day shipowner. But, for owners that charter out ships, designing a vessel to fit all eventualities becomes a tall order. This article explains how leading container ship owner Seaspan went about building its latest vessel, the SAVER 10000. A general arrangement drawing of the SAVER 10000 is given.

Containerships  
Ship design  
Vessel descriptions
**2015010015**

**Is LNG a feasible fuel solution for short sea vessels?**

_Nieuwenhuis, J.J., Duursema, W._  
_English_

From 1 January 2015 the new sulphur emission regulations will come into force. This article explains the technical feasibility of LNG to meet the regulations.

*Liquefied natural gas*  
*Short sea vessels*

**2015010016**

**Theoretical design study on shafting alignment calculation for high speed craft.**

_Chang, M.H., Juang, S.G._  
_English_

The design reliability of the theory applied when calculating the sensitivity of shafting alignment must be determined especially at the initial design stage of shafting arrangement and calculation for the vertical static bearing loads (reaction forces) and pressures in order to obtain positive uniform values, which have to comply with the design requirements of the High Speed Craft Code of Classification Society. Any poor design of shafting arrangement for each vertical static bearing location and/or bearing off-set design value may cause a failed shafting alignment calculation and a non-uniform bearing load or over excessive bearing load and pressure on the propulsion shaft stern tube/strut supporting bearing and possible further damage, for example, excessive wastage and/or crack on a damaged aft shaft strut bearing for a high speed craft. The objective of this study was to find and verify the design reliability of the applied theoretical method for calculating the suitable design values of each vertical static bearing load and pressure on the propulsion shafting system at the initial design stage of shafting arrangement. The design values for each vertical static bearing load and pressure calculated by theoretical design methodologies of the finite element method (FEM) and the three moment equation method (TMEM) were compared with the shipyard original design values for the same design case of propulsion shafting system. The design deviation of the vertical static bearing from the shipyard original design values was determined in order to decide which design methodology (TMEM or FEM) would be adopted and developed for further numerical algorithm design on shafting alignment optimisation. According to the obtained results, both the FEM and the TMEM theoretical design accuracy and reliability were well matched with the shipyard original design values. In addition, the TMEM design results for each static bearing load and pressure proved to be more close to the shipyard original design values.

*Bearing capacity*  
*Finite element method*  
*High speed vessels*  
*Shaft alignment*

**2015010017**

**Least inertia approach to low-speed marine diesel propulsion shafting optimum design.**

_Magazinović, G._  
_English_

In this study, a novel approach to the low-speed marine diesel propulsion shafting design is proposed and examined. The proposed approach is based on the shafting least inertia principle, in which the design task is formulated and solved as a constrained nonlinear optimisation problem. The core of the approach is a cost function, which is defined as a weighted sum of the shafting, turning wheel, and tuning wheel inertias, because it is a suitable proxy of the propulsion shafting material and production costs. The constraint set is composed of the three mandatory constraints, where the crankshaft, intermediate shaft, and propeller shaft torsional vibration stresses should be lower than the corresponding stress limits, as well as a few additional constraints that help ensure that the plant behaviour complies with applicable regulatory and operational requirements. For optimisation purposes, a Recursive Quadratic Programming method is utilized, while the shafting torsional vibration response is determined using a standard vibration analysis program with slight modifications. Numerical experiments have shown that fast convergence can be achieved. Compared to
the classically obtained solution, the proposed approach provided more than 8% reduction in cost function as well as significantly reduced design time.

Design
Optimisation
Shafts
Slow speed diesels
Torsional vibration

2015010018
Development of practical integrated optimisation method for ship geometry with high performance in waves.
Journal of the Japan Society of Naval Architects and Ocean Engineers, v 19, 2014, pp 89-100
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_89/_article
Tasrief, M., Kashiwagi, M.
Japanese
To enhance the performance of a ship in waves, improvement of its geometry is important. For this purpose, a practical integrated optimisation method is developed to acquire improved ship geometry. Namely the Enhanced Unified Theory and the Binary-Coded Genetic Algorithm are integrated together to optimise the ship hull geometry of a basis hull through its sectional area curve. A modified Wigley model is firstly employed as a basis hull and optimised for some wavelength regions. From the obtained results, the added resistance of modified Wigley model decreases by a large amount at the desired wavelength region. Furthermore, optimisation with an actual ship e.g. SR-108 is also performed with the aim of illustrating the effectiveness of the present method for practical purposes. The obtained results show a large reduction of the added resistance while discrepancy in the steady wave resistance is negligible and the total resistance is confirmed to diminish accordingly.

Added resistance in waves
Hull form
Optimisation
Wave resistance

2015010019
Classification of design variables based on constraint conditions and structural optimal design.
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_149/_article
Hirakawa, S., Kitamura, M., Et al
Japanese
A structure optimisation of a mid-ship section is considered in this paper. A double hull oil tanker is selected for the optimisation target. Since there are many design variables in the mid-ship section, usually, design variables are divided into some groups from the viewpoints of design and manufacturing. When the classification of design variables is not correct, the optimal solution cannot be obtained. In order to overcome this drawback, a classification method of design variables is proposed. Influences of design variables to constraint conditions are estimated based on principle component analysis and used for classifying design variables. The classification of design variables obtained by the proposed method is different from a conventional group. The selected problems by use of the proposed method are solved, and it is shown that the proposed method can give a better solution than the conventional method.

Midship sections
Optimisation
Ship design
Variability

2015010020
Structural optimisation of mid-ship section of double hull tanker considering lifecycle holistic risk.
Journal of the Japan Society of Naval Architects and Ocean Engineers, v 19, 2014, pp 159-168
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_159/_article
Kawamura, Y., Ohba, Y., Kaede, Y.
Japanese
Recently, structural design of a ship considering various risks in the lifecycle of the ship has become increasingly important. The committee IV.1 (Design Principle and Criteria) of the International Ship and Offshore Structural Congress (ISSC) discussed that sustainability of ships and marine structures should be evaluated when the structure is constructed based on assessment of "holistic risk" which includes
assessment of safety, environment, social responsibility and etc. Based on the concept of holistic risk evaluation, lifecycle structural optimisation of the mid-ship section of a double hull tanker was carried out in this study. For the evaluation of environmental risk, the method of life cycle assessment is introduced to evaluate the CO2 emissions. Also, evaluation of environmental pollution is carried out by using the oil outflow calculation shown in MARPOL. For the evaluation of the risk of failure, structural reliability analysis of longitudinal strength of the ship was carried out. Then, the following five optimisation problems were carried out: (1) Minimization of construction cost, (2) Maximization of life cycle benefit (LCB) considering the risk of oil outflow, (3) Maximization of LCB considering the risk of CO2 emission, (4) Maximization of LCB considering the risk of failure, and (5) Maximization of LCB considering the holistic risk. Finally, the optimum solutions of these five problems are compared to discuss the advantage of the design of ship structures based on the holistic risk evaluation.

Double hulls
Optimisation
Risk analysis
Ship design
Tankers

2015010021
The analysis of motion dynamics and resistance of the multipurpose boat operating in shallow water. TransNav Journal, v 8 n 3, September 2014, p 359 [5 p, 3 ref, 2 tab, 15 fig]
http://www.transnav.eu/Article_The_Analysis_of_Motion_Dynamics_Kulczyk,31,517.html
Kulczyk, J., Górnicz, T.
English
The Polish market of small boats has developed very dynamically in recent years. Market competition forces the shipyards to build new more efficient hull forms and also to cut the cost of production. This is why modern computer simulation programs are used more often by naval architects. Another trend is to design more universal ships that may be used by larger number of diversified customers. This paper presents a project proposal of a multipurpose boat hull form. The boat was designed to fulfil the requirements imposed by public services like water police, fire brigades, and border guards. It is supposed to be operated on unexplored floodplains and other types of shallow waters. The analysis of the boat’s motion was based on computer simulations. The resistance curve was evaluated with two methods: comparison study of model test results of similar ships and CFD methods. The results obtained from Ansys Fluent and FINE/Marine systems were compared in this paper. It was shown that taking into consideration dynamic trim and sinkage has a significant impact on free surface capture and resistance values.

Hull form
Multipurpose vessels
Resistance
Shallow water
Ship motions

2015010022
Pearson, D.
English
This paper describes the approach taken to create a software model for the use of auxiliary wind propulsion on common ship types of the UK fleet, giving preliminary indications of the benefits achievable. The wind power technology modelled was Flettner rotors, a unique type of powered sail that has attracted more recent interest for its potential to reduce fuel consumption on ships. Consideration has been given to some of the practical limitations of retrofitting Flettner rotors to a ship, and also some negative side effects that have been incorporated into the model to attempt to give a balanced and conservative assessment of the potential benefits. The analysis process described within this paper is intended to provide an initial ‘first stage’ assessment of the viability of retrofitting Flettner rotors to a particular defined ship, before any progression on to analysing specific scenario benefits or other detailed investigations.

Auxiliary power
Rotors
Ship design
Wind propulsion
Conceptual design as a driver for innovation in offshore ship bridge development.
Kristiansen, H.T.

English

Development and innovation of new designs for ship bridges on modern offshore vessels is a considerable challenge for engineering and design professions. The purpose of this paper is to investigate how innovations in ship bridge design may benefit from design competency in the fields of e.g. industrial and interaction design. The Ulstein Bridge Concept (UBC) research project imply that using a strategic focus on design in a conceptual design process in front of a traditional development process has led to a radical, award winning vision of a future offshore ship bridge, acknowledged by the maritime industry of Norway. Through active participation and observation in the project by the author, research findings suggest that applying design based methods and techniques in some core activities described as domain insight, interpretation, translation and presentation, support the overall process of doing innovation. Additionally this conceptual design process produce externalizations that foster and communicate a future design vision, which further support the important design discussions between the various disciplines of designers, engineers, management, and users needed in order to fully understand the requirements for future commercialization. The conceptual design proposals presented in the UBC project have initiated several patents, ideas for new products ready for launch, and a complete new understanding of how to design for the mariners work environment on a ship bridge.

Bridges (ships)
Design

The use of network theory to model disparate ship design information.
http://www.snak.or.kr/eng/sub01_01.html
Rigterink, D., Piks, R., Singer, D.J.

English

This paper introduces the use of network theory to model and analyse disparate ship design information. This work focuses on a ship's distributed systems and their intra- and inter-system structures and interactions. The three systems to be analysed are: a passageway system, an electrical system, and a firefighting system. These systems are analysed individually using common network metrics to glean information regarding their structures and attributes. The systems will also be subjected to community detection algorithms both separately and as a multiplex network to compare their similarities, differences, and interactions. Network theory is shown to be useful in the early design stage due to its simplicity and ability to model any shipboard system.

Firefighting systems
Layout
Networks
Ship design
Ship spaces

Advanced method for ship structural design under slamming impact pressure loads.
http://www.snak.or.kr/eng/sub01_01.html
Kim, S.J., Paik, J.K.

English

This paper presents an advanced method to optimise bottom stiffened panel structures for ship structural design under slamming conditions. An advanced method (mathematical algorithms) to predict permanent deflection of panels under slamming loads is presented by taking into account the effect of peak pressure and duration time with impulse. This
method is verified by a comparison with nonlinear finite element methods of stiffened plate structures under impact loads.

Loads (forces)
Pressure
Ship design
Ship structures
Slamming

2015010026

Numerical modelling of propulsion, control and ship motions in 6 degrees of freedom.
http://pim.sagepub.com/content/228/4/373.abstract
Martelli, M., Viviani, M., Et al
English

This work presents the main steps for the development of a multi-physic simulation platform, able to represent the dynamics of a twin-screw ship in 6 degrees of freedom, taking into account the complete propulsion system including automation effects. The simulation platform has to be used in the preliminary design phase in order to study and design the propulsion plant and its control system. The ship motion model has been developed including roll motion, in order to capture the ship heel angles during tight turning circles, which may be significant for a fast naval vessel. Moreover, the simulation model includes a simplified representation of the asymmetric behaviour of the two propeller shafts during manoeuvres, which cannot be neglected when dealing with the propulsion plant behaviour. Several sub-models have been developed and calibrated by means of a set of experimental tests, in model and full scale. The sea trial campaign is finally used to validate and tune the developed simulator; thus, the final version may be adopted as an optimisation tool for other future designs (or sister ships) and training purposes. Although the presented case study has been validated on a specific ship, most of the discussed models have a general application.

Control systems
Manoeuvrability
Numerical models
Propulsion systems
Ship motions

2015010027

Design wave selection for strength assessment of floating structures.
http://www.snak.or.kr/eng/sub01_01.html
Derbanne, Q., De Hauteclouque, G., Et al
English

The design of a floating structure submitted to random environmental loads during its life time, has to be checked with respect to fatigue and extreme loadings. For extreme, the structure is checked for yielding, buckling and ultimate strength failure mechanisms. When using direct calculations, the concept of Equivalent Design Wave is often used to reduce the number of load cases to be checked. A design wave is defined to maximize a given load parameter. Hence the accuracy of the methodology highly depends on how the design parameters have been chosen. For conventional ships, governing parameters are usually chosen as hull girder loads and accelerations. However for non-conventional ships and floating structures, it may be hard to select a priori some governing loads. Four examples are taken in this paper: a conventional bulk carrier, a FSRU, a semisubmersible and a non-conventional circular FPSO. Stress response under the selected design waves are compared to long-term stress response based on stress RAOs, and the accuracy of the Design Wave method for extreme loadings is shown for those 4 units.

Design waves
Floating structures
Structural response

2015010028

Method for structural concept design of ‘open’ ships.
http://www.snak.or.kr/eng/sub01_01.html
Zanic, V., Preberg, P., Andric, J.
English

A method for the design support problem formulation
and solution in structural synthesis of ‘open’ ships
(one long undivided cargo hold) is presented for the
concept design phase. Open ships require special
considerations of the structural model, due to its
flexibility, particularly related to primary strength
(bending, torsion), unsymmetrical load cases
(racking) and required deflection tolerances for hatch
covers. Presented decision making procedure includes
NAPASteel fast CAD to FEM modelling for the
MAESTRO based response and adequacy analysis,
and OCTOPUS Designer multi-criteria synthesis.

Computer-aided ship design
Structural analysis

2015010029
The new result of approximation and computing
program for constructing the ship lines basing
directly on the geometrical parameters.
PRADS 2013, 12th International Symposium on
Practical Design of Ships and Other Floating
Structures; 20-25 October 2013; Changwon City,
Korea. Proceedings. Published by Society of Naval
Volume 1, p 323 [6 p, 11 ref, 4 fig]
http://www.snak.or.kr/eng/sub01_01.html
Quang-Minh, N.
English
After a prolonged period of work, inheriting and
developing much of the good ideas of previous
scientists, the author has got the results that allow to
affirm that all of the fundamental ship lines in the 2D
space (y, z), could been described exactly in view of
the power trinomial with real number of exponent. It
is clarified whether the concerned results provide the
best accuracy or the best application in every stage of
ship calculations and research. Realizing them as an
algorithm, partly, the small computing program for
automatically constructing the ship lines has been
firstly made by the author himself basing directly on
the chosen geometrical parameters, but not any given
points of the ship surface. Thus a new ship lines
programming product should be represented seems as
the main objective of this paper.

Approximation
Fishing vessels
Hull form

2015010030
Development of an economic and efficient
installation vessel for tidal stream energy
converter arrays.
OMAE 2013, 32nd International Conference on
Ocean, Offshore and Arctic Engineering; 9-14 June
2013; Nantes, France. Proceedings. Published by
Volume 8: Ocean Renewable Energy, Paper
OMAE2013-10663 [9 p]
http://proceedings.asmedigitalcollection.asme.org/pr
occeeding.aspx?articleID=1786726
Nicholls-Lee, R., Hindley, S., Parkinson, R.
English
In order for tidal stream technology to develop into a
viable and cost effective energy solution, the overall
cost of tidal array installation, operations and
maintenance must be driven down. The key issues
which drive the cost are the time required to conduct
operations and susceptibility to weather risk coupled
with the expense of marine assets. Current vessels
have limited operational windows due to weather and
tidal constraints, which result in considerable
cumulative costs due to high charges for such vessels.
The marine renewable industry is currently reliant on
vessels of opportunity from the offshore oil and gas
sector; which, while sufficient for single device
demonstration deployments, are not viable for array
installations. De-coupling the tidal sector from this
market place offers the opportunity to reduce the
volatility of vessel day rates. This paper presents the
concept design of an efficient and economic, fit for
purpose installation vessel for tidal stream energy
converters. The vessel has good dynamic positioning
capabilities for operation in strong tidal currents thus
broadening the operational window. The
environmental impact of the vessel is reduced when
compared to existing vessels. A key criterion
throughout the design process is minimizing the cost
of the vessel to tidal turbine site developers.

Installing
Ship design
Tidal power
Workboats
Content analysis of human factors in ships design.
Rumawas, V., Asbjørnslett, B.E.

Research shows that more than 80% of accidents at sea were caused by human related factors. Some experts implied that less than adequate design is one significant element that may lead to human errors. There are several ways to discover whether a design has considered human factors, i.e., to refer to the design specification, to consult the designers, to conduct a direct observation through a site visit or through a model, to interview the users, or to look into the system that regulates the design. This paper applied a content analysis methodology to explore how human factors have been covered in the design of marine systems. Various documents such as rules, regulations, design guidelines, standards and other texts have been analysed. The results indicate that there are extensive references that cover human factors in designing ships. They are published with different degrees of enforcement, some are prescriptive and some are obligatory but still optional. The topic is developing very rapidly. A more assertive measure is required from the regulators to endorse human factors into implementation.

2015010033
The quest for a safe use of FRP in shipbuilding.
Hertzberg, T., Evegren, F.

This article explains the advantages of using fibre reinforced plastic composites for shipbuilding.

2015010034
Development and practical introduction of a support system for cold bending work in a shipyard.
Matsuo, K., Fujimoto, S., Et al

This paper describes the development of a support system for press work in shipbuilding and its practical utilization in the actual production line of a shipyard. The paper begins by explaining the general and practical background of sheet metal forming work in Japanese shipyards. Then the authors analyse conventional press work and explain the theoretical background of the support system developed to improve press work. This system provides a set of indicating lines on the plate to instruct workers where and how much to press, and also gives quantitative information about the target shape after completion. An example is shown on how to organize the press work on an actual plate using the support system. Because the system makes some improvements to the press work, a comparison is made between the traditional and new methods of working. Finally, the
paper summarizes the support system and its introduction to the production line. Plans for further development are outlined.

Bending
Forming techniques
Metal sheets

2015010035

Comparison of hull construction quality standards.
http://www.snak.or.kr/eng/sub01_01.html
Gotoh, K., Aoyama, K.

English
Hull construction deviations are controlled according to the shipbuilding standards which are established by each society or the International Association of Classification Societies to maintain the structural integrity of hull constructions. However, most of these quality standards are not revised even though the hull structural design, the welding techniques and materials, and hull materials have been developing. Then, the improvement of hull construction quality standards is expected by considering the development of shipbuilding technologies. Comparison of nine hull construction quality standards is conducted in this paper. Although these comparisons cannot find significant difference among the standards, some characteristics and the historical background of each standard are confirmed and recommended revised parts of the quality standards are confirmed.

Comparison
Hull construction
Standards

2015010036

Application of welding simulation to block joints in shipbuilding and assessment of welding-induced residual stresses and distortions.
http://www.snak.or.kr/eng/sub01_01.html
Fricke, W., Zacke, S.

English

During ship design, welding-induced distortions are roughly estimated as a function of the size of the component as well as the welding process and residual stresses are assumed to be locally in the range of the yield stress. Existing welding simulation methods are very complex and time-consuming and therefore not applicable to large structures like ships. Simplified methods for the estimation of welding effects were and still are subject of several research projects, but mostly concerning smaller structures. The main goal of this paper is the application of a multi-layer welding simulation to the block joint of a ship structure. When welding block joints, high constraints occur due to the ship structure which are assumed to result in accordingly high residual stresses. Constraints measured during construction were realized in a test plant for small-scale welding specimens in order to investigate their and other effects on the residual stresses. Associated welding simulations were successfully performed with fine-mesh finite element models. Further analyses showed that a courtier mesh was also able to reproduce the welding-induced reaction forces and hence the residual stresses after some calibration. Based on the coarse modelling it was possible to perform the welding simulation at a block joint in order to investigate the influence of the resulting residual stresses on the behaviour of the real structure, showing quite interesting stress distributions. Finally it is discussed whether smaller and idealized models of definite areas of the block joint can be used to achieve the same results offering possibilities to consider residual stresses in the design process.

Distortion
Residual stress
Simulation
Welded joints
Welding
Strategies for customized shipbuilding with different customer order decoupling points.
http://pim.sagepub.com/content/228/4/362.abstract
Semini, M., Haartveit, D.E.G., Et al
English

The ship design and construction industry serves a considerable range of market segments, with different levels of required customization, different demand volumes, and other product and market variations. In order to effectively respond to various market requirements, strategies and related work processes need to be differentiated. An important strategic concept to make distinctions among strategies is the customer order decoupling point, that is, the point in the value chain where the product is linked to a specific customer order. This article aims to analyse and compare strategies for customized, low-volume ship design and construction from the perspective of the customer order decoupling point and to link them to product and market characteristics. It is based on a case study at the Ulstein Group, an established Norwegian ship designer and builder. The study allowed us to define ‘customized design’ and ‘standardized design’ as two different strategies that fundamentally differ in terms of the customer order decoupling point. In the former, customized ships are offered in a process where most activities are driven by the expectations and requirements of a particular customer. In the latter, the customer is given only a limited choice of predefined, standardized, and well-proved options. It is concluded that customer order decoupling point positions upstream in the value chain imply high levels of flexibility and customization, while downstream positions allow short lead times, high delivery precision, and lower prices. The customer order decoupling point perspective provides a useful framework in which to analyse the ship design and construction industry.

Market analysis
Ship design
Ship standardization
Shipbuilding

Tolerance analysis of ship block assembly considering welding distortion.
http://www.snak.or.kr/eng/sub01_01.html
Choi, W., Chung, H.
English

The shipbuilding industry has dedicated great effort to improve the quality of its products. One such effort has been directed at the dimensional quality management of intermediate products during the production process. Welding, as the primary joining process, inherently causes distortion and it accounts for most of the major geometrical variation in the intermediate products. This unavoidably affects the downstream assembly process. In previous research, the initial variation and welding distortion of nominal parts were described in terms of linear superposition using a modified compliant assembly model. However, this model neglected the effects of welding variations and residual stresses on the final assembly spring-back deviation. This paper proposed a compliant assembly theory which includes the welding deformation using method of influence coefficient. The proposed model is based on the sources of variation and a sensitivity matrix, and effectively represents the patterns of welding distortion typical of non-nominal plate parts.

Distortion
Tolerances (mechanics)
Welding

New shipyard layout design and simulation.
http://www.snak.or.kr/eng/sub01_01.html
Woo, J.H., Song, Y.J.
English

Shipbuilding starts with a shipyard construction with a large scale investment initially. Shipyard design and the equipment layout problem, which is directly linked to the productivity of ship production, is an
important issue in the production planning of mass production of ships. In many cases, shipyard design has relied on the experience of the internal engineer, resulting in sporadic and poorly organized processes. Consequently, economic losses and the trial and error involved in such a design process are inevitable problems. The starting point of shipyard construction is to design a shipyard layout. For this, four kinds of engineering parts required. That is civil, building, utility and production layout engineering. Among these, production layout engineering is most important because its result is going to be the foundation of the other engineering parts and determine the shipyard capacity in the shipyard lifecycle. This paper introduces a shipyard layout design method for preliminary phase and case study w.r.t. one of the newly planned shipyards in South America, which is going to build not only general commercial ships but also offshore structures. The proposed method and case study are differentiated from previous cases in that the theoretical background is established and the optimisation logic included.

**Layout**

**Shipyards**

2015010040

**Numerical and experimental study on plate forming using the technique of line heating.**


Zhoun B., Han, X., Et al

English

Nowadays manual and experiential technique patterns of line heating process could not meet the requirement of modern shipbuilding. Therefore, the automatic forming method is being an active research topic in manufacturing. An accurate and practical predicting method is an essential part of the automatic plate forming system. In this work a numerical elasto-plastic thermo-mechanical model has been developed for predicting the thermal history and resulting deformation and residual stress field of line heating process. A moving Gaussian distributed heat source was used in the modelling to create a realistic simulation of the process. The transient temperature distributions were predicted using temperature-dependent material properties. The deformation and residual stress field were predicted based on the transient temperature distributions of line heating. Experiments were conducted to prove the validity of the numerical thermo-mechanical model. The final numerical results of temperature, deformation and residual stresses are in good agreement with experiment results. The proposed method presents a valuable reference for the study of similar thermal process.

**Forming techniques**

**Line heating**

**Plates**

2015010041

**Manufacturing aspects of offshore fabrication installation.**


Sjögren, P., Bellgran, M., Et al

English

The research presented in this paper aims at identifying research commonalities between shipbuilding, offshore fabrication practices and manufacturing. As part of an exploratory effort a literature review and a case study of two offshore structures projects were performed. Research concerning shipbuilding and offshore fabrication, together with literature from other industries in construction, larger engineering projects and traditional manufacturing was reviewed. The two offshore structures projects were analysed by means of interviews and complemented by direct observations and document reviews. The study concludes that there are gaps in the research concerned with holistic perspectives on the fabrication and installation phases of shipbuilding and offshore projects. The number of actors involved in any project of this magnitude increase barriers and communication interfaces. The dynamic nature of these types of projects was also observed and the changeability should always be an accounted factor when dealing with projects of this sort. The interviews held as part of the verification of observed phenomena in literature was limited to two projects and a single company and actors perceptions. However the collected data served well in being complementary to the literature review. It could be the task of academia to patch the gaps for overall project success, in the cases where single industry
actors simply cannot see the benefit or do not have the resources to fill them themselves. This study combines findings from traditional manufacturing industries, shipbuilding, offshore structures fabrication and large engineering projects in general.

Fabrication
Installing
Manufacturing
Offshore structures

2.1 POWER SOURCES AND FUELS

2015010042

Glycerine – a fuel that’s gaining traction.

_Diesel & Gas Turbine Worldwide, v 46 n 8, October 2014, p 12 [2 p, 2 fig]

Cameron, I.
English

Cummins has recently run a marine engine on glycerine onboard a workboat in the UK. The demonstration was reported to have been successful, with monitoring providing strong evidence that glycerine offers lower emissions than diesel without producing any particulate matter from the exhaust.

Alternative fuels

2015010043

Climate of fear drives new fuel lines.

_Marine Power & Propulsion 2014, a supplement to The Naval Architect, p 4 [6 p, 3 fig]

Chryssakis, C.
English

Alternative fuel developments and changes in ship design and operations are taking place. In the past technological advances drove the process, but today regulation due to climate change is the driver. This article reports on the emerging alternatives to heavy fuel oils.

Alternative fuels
Heavy fuel oils

2015010044

Acid test for modern marine diesels.

_Marine Power & Propulsion 2014, a supplement to The Naval Architect, p 14 [2 p, 2 fig]

No author given
English

Adapting to increasingly rigorous emission controls has seen shipowners adopt engines that operate at higher pressures either by design or through slow steaming. The result has been an increase in the incidence of high corrosive wear. This article looks at owners’ options as low sulphur regulations are set to become more stringent.

Diesel engines
Emissions
Regulations

2015010045

Fuelling the next generation.

_Marine Power & Propulsion 2014, a supplement to The Naval Architect, p 18 [2 p]

Östlund, J., Bauer, B.
English

This article explains the challenges faced by shipowners and operators to maintain fuel quality at a time of tightening regulation.

Fuel oil quality

2015010046

US puts squeeze on lube polluters.

_Marine Power & Propulsion 2014, a supplement to The Naval Architect, p 20 [3 p, 1 fig]

Cumberlidge, P.
English

This article looks at how the US Environmental Protection Agency’s Vessel General Permit will impact the industry and what shipowners need to look for to meet the requirements.

Environmental protection
Legislation
Lubricants
**Energy storage, or the change of the light brigade.**
*Marine Power & Propulsion 2014, a supplement to The Naval Architect, p 23 [2 p, 1 fig]*

**Pestana, H.**

English

This article explains the developments of the use of battery power for marine propulsion.

*Electric batteries*

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**A step by step approach for evaluating the reliability of the main engine lube oil system for a ship’s propulsion system.**
*TransNav Journal, v 8 n 3, September 2014, p 367 [5 p, 11 ref, 1 tab, 12 fig]*
[http://www.transnav.eu/Article_A_Step_by_Step_Approach_for_Anantharaman.31518.html](http://www.transnav.eu/Article_A_Step_by_Step_Approach_for_Anantharaman.31518.html)

**Anantharaman, M., Khan, F., Et al**

English

Effective and efficient maintenance is essential to ensure the reliability of a ship’s main propulsion system, which in turn is interdependent on the reliability of a number of associated sub-systems. A primary step in evaluating the reliability of the ship’s propulsion system will be to evaluate the reliability of each of the sub-system. This paper discusses the methodology adopted to quantify reliability of one of the vital sub-system viz. the lubricating oil system, and development of a model, based on Markov analysis thereof. Having developed the model, means to improve reliability of the system should be considered. The cost of the incremental reliability should be measured to evaluate cost benefits. A maintenance plan can then be devised to achieve the higher level of reliability. Similar approach could be considered to evaluate the reliability of all other sub-systems. This will finally lead to development of a model to evaluate and improve the reliability of the main propulsion system.

*Engines*
*Lubricating oils*
*Propulsion systems*
*Reliability*

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**Reduction of fuel consumption in fishing fleet engines.**

**Klyus, O., Behrendt, C.**

English

The paper presents the results of tests of high speed diesel engines used in fishing boats and vessels. The reduction of unit fuel consumption and exhausts toxic emissions was possible by implementing preliminary fuel treatment that takes place directly in the fuel injector containing catalytic material. The catalyst works more effectively when fuel is turbulized in crossing fuel passages made in a part of the injector needle. Preliminary fuel treatment results in the average reduction of unit fuel consumption of those engines by 8%, while toxic emission of carbon and nitrogen oxides drops by 15%.

*Diesel engines*
*Fuel conservation*
*Fuel consumption*
*Fuel oil treatment*

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**As new engine technologies emerge, cylinder lubricants evolve to deliver additional protection and reliability.**

**Schakel, J.**

English

Slow steaming has emerged as a standard operational mode and major OEMs have introduced a number of engine upgrades in response. This paper uses performance data from the field and test engines to present a case to demonstrate how the Shell Slexia cylinder oil portfolio has evolved to offer products
that combat increased acid stress by providing additional protection and cost benefits to engine operators.

**Engine cylinders**

Lubricants

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**2015010051**

Practical experience of the impact of cold corrosion on cylinder lubrication in new engine designs.


Walker, S.

English

Cold corrosion impacts the operation of latest model two-stroke marine engines that run on heavy fuel oil and are designed to meet the latest emission Energy Efficiency Index criteria. This paper addresses the mechanism behind cold corrosion, exploring latest testing protocols and describes practical experience of lubricant solution to mitigate the problem.

**Corrosion**

**Diesel engines**

**Engine cylinders**

Lubricants

**Two stroke engines**

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**2015010052**

Computational fluid dynamics analysis of NOx reduction by ammonia injection in the MAN B&W 7S50MC marine engines.


Lamas, M.I., Rodriguez, C.G., Et al

English

Taking into account the importance of NOx (nitrogen oxides) emissions from marine engines and the current increasingly restrictive legislation, this work aims to develop a numerical model to study NOx reduction. To this end, direct injection of NH3 (ammonia) into the combustion chamber was proposed in the MAN B&W 7S50MC marine engine. The numerical model was employed to analyse several injection temperatures, injection timings and ammonia to fuel ratios, obtaining NOx reductions of almost 60%. Besides, a comparison between ammonia injection and water injection was done. The results showed that ammonia is more efficient than water to reduce NOx with a negligible influence on other pollutants such as CO (carbon monoxide) and HC (hydrocarbons). Nevertheless, ammonia is efficient in a very restrictive temperature and injection timing range. This numerical model was compared with experimental measurements, obtaining satisfactory results which validate the work.

**Ammonia**

**Computational fluid dynamics**

**Diesel engines**

**Emissions**

**Reduction**

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**2.2 EQUIPMENT AND INSTALLATIONS**

**2015010053**

Flushing ballast tanks.

Ocean Engineering, v 89, 1 October 2014, pp 157-172


Qi, Z., Eames, I., Greig, A.

English

The International Maritime Organization requires ballast water tanks to be flushed through with three tank volumes to remove aquatic species. The authors apply a network model for multiply connected compartments to analyse the influence of internal geometry and inlet–outlet positions on how much of the initial water of each compartment is flushed in time. A complementary experimental study was undertaken to quantify the flushing from 2×2, 3×3 and 5×4 tank configurations by an optical method. The agreement between the predictions and measurements is good. The results show that the flushing in a multi-compartment tank is generally more efficient than perfect mixing. The 95% reduction is met after three exchange volumes in all cases. The outlet needs to be positioned far from the inlet to reduce bypassing through the tank. These results are finally discussed in the context of international regulations for flushing ballast tanks.

**Ballast tanks**

Ballast water
2015010054

**Scrub up your EGC knowledge.**

*Marine Power & Propulsion 2014, a supplement to The Naval Architect, p 25 [2 p, 1 fig]*


Jenssen, S.

English

Fitting scrubbers for operating in environmental control areas is becoming essential. This article gives some pointers for entering the scrubbing business.

*Scrubbers*

2015010055

**Fighting fires effectively and efficiently.**

*The Naval Architect, October 2014, p 58 [2 p, 1 ref, 1 fig]*

[http://www.rina.org.uk/tna.html](http://www.rina.org.uk/tna.html)

Lovskar, S.

English

This article explains the advantages of water mist fire-fighting systems.

*Fire extinguishing systems*

*Water mist systems*

2015010056

**Availability model of communication network in connecting ship systems using optical fibre technology.**

*Brodogradnja, v 65 n 3, September 2014, p 17 [14 p, 16 ref, 2 tab, 12 fig]*


Jurdana, I., Ivče, R.

English

For an efficient operation of a ship it is essential that all its systems work properly and reliably. In order to be able to control and monitor the systems, it is necessary to connect all of the systems’ components with a communication network. To ensure effective and reliable connecting of ship systems, all the elements which constitute the optical communication network were analysed, and the elements which affect the most the overall system’s availability were identified. Based on these studies, a mathematical model of network has been developed. The model includes all the network’s elements, and, based on the failure data; it calculates the input data required for the analysis of network availability. A novel method of calculation has been introduced, which includes the impact factors based on the cable network construction mode. In order to enable the usage of the network model for networks of different topology, size, construction modes and purposes, a novel algorithm for calculating the communication network’s availability has been created. The availabilities of individual components and the whole network have been calculated, the impact of individual components’ availability on the availability of the system has been established, and the methods of communication networks protection have been defined. Based on the conducted researches, the behaviour of the system in the event of failures and the possibility of finding optimal and reliable modes of connecting ship systems have been determined, thus contributing to the overall reliability of ship systems and of a ship as a whole.

*Fibre optics*

*Networks*

*Optical communication*

2015010057

**Numerical study of building energy simulation of accommodation HVAC design of cruise ship and offshore platform.**


[http://www.snak.or.kr/eng/sub01_01.html](http://www.snak.or.kr/eng/sub01_01.html)

Yu, J.K., Koo, K., Choi, J.

English

Having relatively larger accommodation compared to conventional commercial ships, the Heating Ventilation and Air Conditioning (HVAC) system of a cruise ship takes a significant role in predicting energy efficiency. However, under various weather conditions, it is difficult to optimise the HVAC operation plan without simulating HVAC energy consumption in time. Additionally, the HVAC system of the living quarters of an offshore plant is designed to provide healthy indoor environments in both normal and emergency operation. For this reason, in designing the living quarter, it is essential to predict thermal comfort in normal operation as well as heat stress in an emergency situation. As a promising solution to estimate HVAC system energy efficiency and to analyse thermal ergonomics for occupants’ safety, Building Energy Simulation (BES) was applied to make numerical modelling of both the cruise ship and the offshore plant living quarter. By

ABSTRACTS
calculating transient heat balances of interior and exterior deck and bulk head and cooling/heating loads of the HVAC system simultaneously, the HVAC energy consumption can be simulated in consideration of occupancy schedule and HVAC operating schedule under various weather conditions. The authors also conduct occupants' thermal ergonomics analysis even when HVAC is off in emergency in terms of occupant's thermal comfort (Predicted Mean Vote (PMV) index) and heat stress (International Standard Organization (ISO) 7933). Numerical results of both models showed that BES shows important results for optimising HVAC system energy performance and investigating occupant's safety at muster area.

Air conditioning
Cruise ships
Heating
Offshore platforms
Ventilation systems

2015010058

Dynamic loads on mechanical azimuthing thrusters.
http://www.snak.or.kr/eng/sub01_01.html

Dang, J., Koning, J., Et al

English
Mechanical azimuthing thrusters have been applied in various ship operations in the past decades, such as low speed manoeuvring; dynamic positioning; bollard pull; high speed transit trips and at continuous full power as the main propulsion system of ships. The ship types on which these thrusters are used include tug boats, offshore supply vessels, pipe layers, drill ships, ferries, fast transport vessels, etc. Despite this widely spread use of such thrusters, however, damages on gears and bearings have been reported in some cases. According to the statistics of survey records of classification societies, gear and bearing failures are at the 2nd and the 3rd place on the failure list of parts of mechanical azimuthing thrusters, right behind the propellers as the No. 1 vulnerable parts, which are exposed directly to sometimes quite harsh environmental conditions. To help the industries to get insight into the failures, MARIN in the Netherlands has initiated a Joint Industry Project (JIP) on the hydrodynamic loads and shaft responses of mechanical azimuthing thrusters, called SHARES JIP. Thruster, gear and bearing manufacturers, shipyards, ship operators and classifications have been teamed up in the JIP. Studies have covered operational investigations, extensive dedicated model tests for dynamic loads and full-scale trials and monitoring on a ship - the largest pipe layer on the world: Allseas' SOLITAIRE with 10 sets of 5MW azimuthing thrusters. Results of the study are summarized and presented in this paper.

Damage
Dynamic loads
Thrusters
Ventilation

2015010059

A model assessing cost of operating marine systems using data obtained from Monte Carlo analysis.
http://pim.sagepub.com/content/228/4/398.abstract

McNamara, D., Cunningham, A., Et al

English
This article presents a methodology for analysing the cost of operating marine systems under varying conditions. Data obtained from a previously developed Monte Carlo analysis are applied to assess the operational costs for various maintenance and inspection policies. The concept of total insured value is also applied to determine the cost attributed to risk. The aim is to show that Monte Carlo analysis can be adapted to provide information on various factors affecting operational costs to be used for decision-making to optimise the efficiency of marine systems. A method of modelling the effects of lead times due to un-stocked items has also been included to increase the scope of the analysis.

Inspection
Maintenance
Monte Carlo method
Operating costs
Shipboard systems
2.3 MAINTENANCE, REPAIR AND CONVERSION

2015010060

Laser-guided robot to inspect steel ship hulls for weld defects and corrosion.

Materials Performance, v 53 n 9, September 2014, p 14 [4 p, 1 ref, 2 fig]
http://www.nace.org/Publications/Materials-Performance/
No author given

English

A laser-guided robotic inspection device that combines several nondestructive testing (NDT) techniques to inspect ship structures has been developed by the X-Scan project, an industry-driven collaboration of European Union (EU) companies and research organizations that was formed to develop novel, automated NDT techniques for the shipping industry and funded in part by the EU’s Seventh Framework Programme. The project, which began in 2011, is primarily focused on automatically inspecting thin gauge steel welds using laser, ultrasonic, and electromagnetic inspection techniques. Future development plans, however, include fitting the robot with an ultrasonic probe for corrosion mapping of ship hulls.

Hull inspection
Lasers
Robots

2015010061

Wet welding field trials in shallow waters for structural repairs in floating oil production units.

Volume 3: Materials Technology; Ocean Space Utilization, Paper OMAE2013-10097 [8 p]
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786212

Pessoa, E.C.P., Bracaranse, A.Q., Et al

English

Saving costs is a major attraction of wet welding applications in structural repairs of offshore installations. Nevertheless, improving the quality of wet welding to get it as close as possible to plain structural steel quality and also qualify welding procedures in AWS D3.6 class ‘A’ have been challenges not consistently overcome. This paper describes wet welding trials in shallow waters (5m and 10m) with a rutile and an oxy-rutile type, both commercial electrodes. Two different base metal compositions were employed in the preparation of butt and fillet joints. The main objective is to amend new results of wet welds properties to those already published aiming the application of this welding technique under more reliable conditions and the qualification of welding procedures. The weldments were tested by Vickers hardness, Charpy V notch, tensile, shear strength, bending and fillet weld break tests, chemical and macrographic analysis. Some of these properties and diffusible hydrogen, obtained in laboratory with a mechanized gravity system, will also be presented in order to complement or explain the field testes results obtained. Both electrodes produced class AWS E 70XX weld metals and overall results according class “B” requirements of the AWS D3.6M:2010 code. Some good elongation results obtained encourage future trials to achieve class “A”. Barriers to the class “A” qualification of welding procedures in shallow waters are also discussed.

Offshore structures
Repair
Underwater welding

2.4 CARGOES AND CARGO HANDLING

2015010062

On the safety evaluation of LNG bunkering between two vessels.

Journal of the Japan Society of Naval Architects and Ocean Engineers, v 19, 2014, pp 69-78
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_69/_article

Yukawa, K., Ishida, K., Et al

Japanese

The Japan Ministry of Land, Infrastructure, Transport and Tourism started a project for early introduction of LNG-fuelled ships, and published a safety manual and operative guidelines on LNG transfer. In that project, the safety evaluation of ship-to-ship transfer of LNG fuel using a flexible hose was undertaken. In order to prepare operative guidelines on LNG transfer between a bunker ship and a LNG-fuelled ship, a new safety evaluation process was proposed. Following the process, the limiting environmental conditions of LNG transfer was examined based on the results of
numerical calculations of the motions of two moored vessels and the LNG transfer hose, respectively. This paper presents the results of the above-mentioned safety evaluation.

LNG handling
LNG safety
Ship to ship
Transferring

2015010063

Cargo liquefaction and dangerous of ship.
Isiacik, T., Satir, T.
English

Cargo liquefaction is a serious problem for solid bulk cargo carriers. Liquefaction problems cause loss of life, total loss of ships and high cost insurance matters. Besides loss of life and total loss of ships; near miss accidents, cargo and ship structural damages often occur due to cargo liquefaction. During the voyage; motion of ships especially rolling, engine and deck equipment’s’ vibrations increase cargo liquefaction because of the moisture content of the cargo. In this paper the authors investigate the reasons for total loss of bulk carriers and loss of cargoes, the reason for loss of stability due to cargo liquefaction and Master and crew responsibilities for loading and during voyage under the IMSBC Code and SOLAS 74 Regulations.

Bulk carriers
Cargo liquefaction
Loading (cargo)
SOLAS Convention

2015010064

Containers movements cost analysis in a marine terminal.
Buxeda, A.I., Martinez, J.E.
English

In a marine terminal, logistics of container movements and arrangement can certainly affect the benefit that terminals, carriers and ship-owners can get. They may even lead to costs difficult to bear by the shipping companies. Container logistics management understood from the time that a container is discharged at a port, can be defined as a set of financial transactions, and based on the logistic principle that every movement generates a cost. Based on this principle, the question arises that can the cost of passage and stay of a container at a terminal be reduced through an efficient allocation of space. Given the land’s extension of a terminal, the costs of port land, the prices that placements and movements of containers involve, as well as their horizontal and vertical positioning, this work seeks to make an analytical study to check whether the assumption of an efficient allocation is fulfilled. From a given example, the authors consider the limit of practical resistance and safety, the maximum height of stacks, the containers before their new settings, the terminal size, the movement cost, the cost of getting the container below if other above (swapping of containers), and the ratio 'cost of movements and machinery / cost of space (ground)'. The authors try to find a reasonable optimum comparing several possible configurations.

Container operations
Container terminals
Cost analysis
Logistics
Research on natural gas hydrate vessels for clathrate hydrate transportation.


Yong, Y., Wenyong, T., Et al

English

To extract and transfer natural gas hydrate on the seabed, the propulsion system, the reliquefaction and compressor unit system for a new kind of vessel named a NGH ship are designed. The latest shipbuilding technologies are adopted in NGH vessels. Based on natural gas hydrate characteristics which vaporize with temperature rising, the NGH transportation system is especially designed to transfer clathrate hydrate. The vaporized clathrate hydrate is to be burnt by dual fuel engines or reliquefied by reliquefaction equipment. Sulphur emission is reduced greatly by means of dual fuel gas engines. To satisfy the IMO requirements for control of NOx emission, the SCR reactor is utilized to extinguish nitrifier pollution for environment and atmosphere protection.

Gas transportation
Multifuel engines
Natural gas
Reliquefaction

2.5 PORTS AND WATERWAYS

Noise measurements for studying propagation of harbour noise to residential areas close to ports.

AMT’13, 3rd International Conference on Advanced Model Measurement Technology for the EU Maritime Industry; 17-18 September 2013; Gdansk, Poland. Organised by Newcastle University, UK and CTO S.A., Gdansk, Poland. P 237 [12 p, 9 ref, 2 tab, 5 fig]

Zoet, P., Kellet, P., Et al

English

In the study, two sets of full scale harbour noise measurements were carried out close to port areas. Aim of the measurements was to identify the contributions from different sources, establish the propagation mechanisms and to evaluate measurement results through the current local and European noise regulations. Noise characteristics were recorded at the source and at a variety of receiver locations concurrently. This allowed for the propagation of the noise, and in particular the peak measurements to be fully mapped. These results were compared to predicted sound pressure levels at the receiver calculated using existing formulations. These existing formulations include simple geometrical spreading laws, as well as formulae which also account for atmospheric absorption and other causes of sound attenuation. This gave rise to a study of the differences in propagation as a result of variations in harbour and surrounding area geography, as a means of explaining the uncertainties.

Harbours
Noise

The analysis of hinterlands of intermodal terminals in Polish seaports.


Kotowska, I.

English

The main topic of the paper is the analysis and assessment of hinterlands of intermodal terminals in Polish seaports. The paper presents the results of research conducted in three container terminals, one Ro-Ro and one ferry terminal, which are located in Polish seaports: Szczecin, Świnoujście, Gdynia and Gdańsk. The research was based on questionnaire survey of over 1000 drivers, who deliver consignments to/from Polish terminals and information obtained directly in the terminals. This paper deals with the ports hinterlands structure covered by road and rail transport, the range of captive and contestable hinterlands. The analysis presents the average distance of pre-haulage. The research presented in the paper allows specifying the shape of the land-sea transport chains operating in the European transport system. Ratio of the pre-haulage distance to the sea distance has a significant impact.
on how short-sea shipping contributes to the internal and external costs of transport. The study may therefore be helpful to assess the role of short sea shipping in sustainable transport.

Container terminals
Hinterlands
Liner shipping
Marine terminals
Short sea trades

2015010068

An inland waterway option for sustainable freight transport in Southeastern Europe.


Corres, A., Tselentis, B., Tzannatos, E.

English

The Axios-Morava waterway project is closer to becoming reality than ever before. It was demonstrated that the potential of the Axios-Morava navigable link between the eastern Mediterranean Sea (via the Aegean) and River Danube for the transport of freight offers an energy and carbon favourable alternative to road, whilst it competes closely with rail. With regard to air quality, the waterway service was found to be better than the rail but significantly inferior to the road mainly due to the stricter emission standards applicable to trucks. Finally, it was demonstrated that it is necessary to build on the ongoing international interest in this project, as being the driver for implementing all the necessary infrastructural and operational changes which will make the proposed waterway service commercially and environmentally sustainable.

Emissions
Energy consumption
Inland waterways navigation

2015010069

Analysis of viability to promote a hub ro/ro terminal in Palma Mallorca port.


Galiano, F.X., Osés, M. de

English

The paper analyses the opportunity to develop a Ro/Ro hub in the Port of Palma de Mallorca. The state of art related to geographical, economic traffic and human; conditions, is reviewed; together with an in deep analysis of the port future capacities and main shipping lines crossing the western Mediterranean. At a first glance is it easy to understand that the competition with other container hub ports in Mediterranean does not afford Palma de Mallorca to be positioned in this market. But the chance to become a hub in rolled traffic will be studied. The final results of this paper identify the main particulars to be enforced to attract the main shipping companies that are providing transport services between the North and South coasts of the Mediterranean and the traffic between Italy and Spain.

Port planning and development
Ro/ro terminals

2.6 COASTAL/OFFSHORE ENGINEERING AND MARINE RENEWABLE ENERGY

2015010070

Noise prediction and control of floating, production, storage and offloading (FPSO).


http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786450

Song, K.B., Kim, H.T., Et al

English

Recently, the noise regulations are being reinforced to restrict the noise levels in the workplace and to
protect the operators on offshore structures. So, indoor and outdoor noise levels are one of the crucial barometers for determining the quality of offshore structures. In this paper, an efficient and accurate noise analysis method, which is used to calculate the indoor and outdoor noise levels for a Floating, Production, Storage and Offloading (FPSO) vessel, is introduced. The indoor noise level is calculated through summing up structure-borne noise, airborne noise from machinery, HVAC noise and transmitted noise from topside. Each noise level is predicted using appropriate methods by HHI’s procedures, which consider room acoustic theories, numerical methods like SEA and measured database at various ships and offshore structures. The outdoor noise level is predicted by using ray tracing method. Noise control procedures to improve acoustic properties of cabin/machinery room and to reduce the indoor/outdoor noise levels of offshore structures are also introduced: these procedures are produced by numerous experiments at the large scale acoustic test facilities like reverberant rooms and cabin mock-up. The established method has been applied to various types of real projects for FPSOs. The predicted results are confirmed to agree well with measurements results. It is expected to be very helpful to design the low noise FPSO.

FPSOs
Noise level

2015010071

Likelihood-weighted method of general pareto distribution for extreme wave height estimation.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786462
Wada, R., Waseda, T.

English

In designing ocean structures, estimating the largest wave height it may encounter over its lifetime is a critical issue, but wave observation data is often sparse in space and time. Because of the limited data available, estimation errors are inevitably large. For an economical and robust structure design, the probability density function of the extreme wave height and its confidence interval must be theoretically quantified from limited information available. Extreme values estimations have been made by finding the best fitting distribution from limited observations, and extrapolating it for the desired long period. Estimations based on frequentist method lack of generality in confidence interval estimations, especially when the data size is small. Another technique recently developed is based on Bayesian Statistics, which provides the inference of uncertainty. Previous studies use informative and non-informative priors and Markov Chain Monte Carlo (MCMC) simulation for estimation. The authors have developed a “Likelihood-Weighted Method (LWM)” to objectively evaluate probability density function of the extreme value. The method is based on Extreme Theory and Bayesian Statistics. The attempt is to use the ignorant prior to relate each parameter set’s likelihood to its probability. This method is pragmatic, because the numerical implementation does not require the use of MCMC. The theoretical background and practical advantages of LWM are described. Examples from randomly produced data show the performance of this method, and application to real wave data reveals the poor estimations of previous methods that do not use the Bayesian theorem. The quantification of probability for each extreme value distribution enables the probability-weighted evaluation for inference such as maximum wave height probability density function. The new inference derived from this method is useful to change structure design methodologies of ocean structures.

Extreme values
Probability density functions
Wave height

2015010072

On the importance of slamming during installation of structures with large suction anchors.
Ocean Engineering, v 89, 1 October 2014, pp 99-112
Naess, T., Havn, J., Solaas, F.

English

The dynamic loads experienced when deploying structures with large suction anchors from an offshore construction vessel has been studied. Both model tests and CFD-analyses have been used to calibrate a numerical model of a typical Integrated Template Structure (ITS). The numerical model has then been used in time domain analyses in order to study the dynamic loads in the main lift wire when the ITS is lowered through the splash zone. An overall conclusion from this study is that from a lifting point
of view neither the structural integrity of the ITS nor the crane will be jeopardized when crossing the splash zone in a typical deployment operation on the Norwegian Continental Shelf (NCS). The CFD analyses reveal the importance of entrapped air and water when the top of the suction anchor is crossing the splash zone. For the Gjøa ITS suction anchors used in the study, the openings on top of the suction anchors are quite large (perforation of 6%) which limits the amount of entrapped air during the water entry phase and also the amount of entrapped water in the water exit phase.

**Anchors**

**Dynamic loads**

**Installing**

**Offshore structures**

**Slamming**

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**2015010073**

**A general boundary-fitted 3D non-hydrostatic model for nonlinear focusing wave groups.**

*Ocean Engineering, v 89, 1 October 2014, pp 134-145*  

**Ai, C., Ding, W., Jin, S.**  
English

This paper employs a three-dimensional (3D) non-hydrostatic model to simulate nonlinear focusing wave groups. The non-hydrostatic model utilizes an explicit projection method to solve the Navier–Stokes equations. To accurately simulate the steep free surface involved in focusing waves, the model is built upon a general boundary-fitted coordinate system. This grid system allows for a great adaptability of the vertical discretization and meanwhile maintains the boundary-fitted properties of better fitting the bed and free surface. The advantage of the general boundary-fitted model is first validated by two test cases of nonlinear waves, including nonlinear standing waves and two-dimensional (2D) focusing freak wave. Then, the model is applied to simulate 2D focusing waves in deep and intermediate-water depths and 3D focusing waves in deep-water depth. By comparing with experimental data, the model results well reproduce the main characteristics of 2D deep-water focusing waves and 2D intermediate-water focusing waves as well as 3D deep-water focusing waves, demonstrating the model's capability to resolve 2D or 3D focusing wave groups. Furthermore, in the test of 2D intermediate-water focusing waves, the downstream shifting of the focusing position and time is also studied numerically, which is not presented in the experiments.

**Freak waves**  
**Numerical models**  
**Wave groups**

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**2015010074**

**Stochastic modelling of long-term and extreme value estimation of wind and sea conditions for probabilistic reliability assessments of wave energy devices.**

*Ocean Engineering, v 89, 1 October 2014, pp 243-255*  

**Ambühl, S., Kofoed, J.P., Sørensen, J.D.**  
English

Wave energy power plants are expected to become one of the major future contributions to the sustainable electricity production. Optimal design of wave energy power plants is associated with modelling of physical, statistical, measurement and model uncertainties. This paper presents stochastic models for the significant wave height, the mean zero-crossing wave period and the wind speed for long-term and extreme estimations. The long-term estimation focuses on annual statistical distributions, the inter-annual variation of distribution parameters and the statistical uncertainty due to limited amount of data. The stochastic model for extreme value estimation covers annual extreme value distributions and the statistical uncertainty due to limited amount of available data. Furthermore, updating based on new available data is explained based on a Bayesian approach. The statistical uncertainties are estimated based on the Maximum-Likelihood method, and the extreme value estimation uses the peaks-over-threshold (POT) method. Two generic examples of reliability assessments for failure due to fatigue and extreme loads show how the stochastic model can be implemented in reliability assessments.

**Extreme values**  
**Stochastic processes**  
**Wave height**  
**Wave periods**  
**Wind**
Efficient dynamic analysis of floating bodies nonlinear behaviour in wave energy conversion.


http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786189

Spanos, P.D., Richichi, A., Arena, F.

English

Floating oscillating-bodies are a kind of wave energy converter developed for harvesting the great amount of energy related to water waves. In this paper a particular energy converter model is considered. A nonlinear analysis of its dynamic behaviour is conducted both in the time and the frequency domains. The model involves a tightly moored single-body floating wave energy converter. It captures motion in the horizontal and vertical directions. The nonlinear stiffness and damping forces are functions of the horizontal and vertical displacements and velocities and make the system a nonlinear one. In addition to the time-domain analysis of the nonlinear behaviour of the system, the method of equivalent linearization is used to determine iteratively the effective linear stiffness and damping matrices and the response of the buoy in the frequency domain. The analysis pertains to the surge and the heave directions response of the wave energy converter under harmonic mono-frequency excitation (regular waves). The reliability of the linearization based approach is demonstrated by comparison with time domain integration data. This approach offers the appealing feature of conducting efficiently a variety of parameter studies which can expedite preliminary evaluations, inter alia, of competing design scenarios for the energy converter. Suggestions for extending this approach to the case of fully nonlinear and random irregular waves are also included.

Dynamic analysis
Floating bodies
Wave energy conversion

On safety and reliability for platforms that are unmanned during severe storms.


http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786194

Hagen, Ø., Solland, G.

English

The paper addresses safety and reliability issues for platforms where an unmanned strategy is premised. The standard NORSOK N-006 recommends how to deal with the specific aspects that engineers meet when assessing existing structures, including life extension. A possible mitigating measure for structures that do not meet today’s structural requirements for environmental loads is to unman the platform during storms. The basis for the unmanning criteria in this standard is that the safety for personnel on a platform that needs to be unmanned during storms is consistent with the safety for personnel on platforms that satisfy structural requirements for manned platforms. The prevailing metocean conditions at a North Sea location is modelled by a storm statistics approach. The capacity waves according to the codes checks are calculated for a jacket structure and the limiting metocean conditions that comply with the acceptance criterion are established. The expected frequency of unmanning events is determined, and the issue of forecast uncertainty discussed. The annual maximum wave height distribution for the location is compared with the corresponding distribution that applies when the platform is manned, i.e. for metocean conditions that do not trigger unmanning. The probability of failure for important limit states is calculated on condition that no unmanning is required, and for a platform that satisfies the requirements for manned platforms. The most likely realizations of sea state variables and extreme wave cycle are determined for the different cases. Parts of the structure may be loaded into the non-linear range and consequently the load-carrying resistance of the structure against future load cycles may be reduced. In such cases it is required to carry out a check of the cyclic capacity of the structure. The statistics for the second highest wave during storm conditions is investigated for unmanning scenarios and for a platform that satisfies the requirements for manned platforms. It is normally acknowledged that the structural failure probability associated with normal statistical variations is considerably less than
the failures that are due to gross errors. The difference in risk due to gross errors between platforms that are operated as unmanned during storms compared to the gross error risk level for manned platforms is discussed.

Platforms safety
Storms
Structural reliability

2015010077

The use of INS and GPS and the post-processing method in field measurement of mega jacket launch.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786495
Chen, Y., Li, X., Et al
English
This paper presents the post-processing method used for field measurement of mega jacket launch. The Liwan 3-1 mega jacket was successfully launched at a water depth of 190 meters in South China Sea on August 30, 2012. In order to study the influence between the jacket and the launch barge, the field measurement is designed to record the trajectory of both the jacket and the launch barge. Both Inertial Navigation System (INS) and Global Positioning System (GPS) are used to ensure the accuracy of the field measurement. The GPS has a higher accuracy but cannot work underwater. Therefore the INS is used to measure the trajectory motion of the launched jacket when the jacket completely goes into water. Since only INS can record the accelerations in 3 degrees in inertia coordinate system when the jacket is completely under water, a special method will be used to transfer the initial acceleration data to those in the geographic coordinate system, combined with the position data recorded by GPS when it works, a relatively accurate launch trajectory of the jacket can be obtained. This paper focuses on the method used for transferring the initial data recorded by INS and GPS to the trajectories of both jacket and barge.

Global positioning systems
Inertial navigation
Jacket structures
Launching
Offshore structures

2015010078

Modelling of vessel and equipment cost for the maintenance activities of an offshore tidal energy array.
http://www.snak.or.kr/eng/sub01_01.html
Lazakis, I., Turan, O., Rosendahl, T.
English
Tidal energy is one of the most promising sectors of energy conversion that can be extracted from renewable sources, taking into account the uninterrupted flow of tidal currents regardless of the surrounding environmental conditions. In this case, a detailed analysis of the planned and unplanned maintenance attributes has been developed in order to examine the various O&M parameters influencing the cost elements. Major features for both planned and unplanned maintenance include the identification of the transportation, labour, workshop and equipment/tools cost. The above are estimated for different operational scenarios as well as for the maintenance of a single device per day. Overall, the O&M cost per device is estimated as well as the cost per MW (gross and net) and the cost/kWhr. The results show that the overall O&M cost is not prohibitive compared to other renewable energy applications while it may vary according to the initially selected O&M scenario.

Arrays
Costs
Maintenance
Tidal power

2015010079

Joint distributions of wave heights and wave periods (directions) in the North of South China Sea.
http://www.snak.or.kr/eng/sub01_01.html
Wang, Z., Dong, S.
English
There are two main segments researched in this
paper. For long term analysis, wave fields are simulated in the north of South China Sea (SCS) from 1986 to 2005 using wave model WAVEWATCH-III. The significant wave heights and mean wave periods show a positive correlation. The joint distributions take on a double-peak or multi-peak form. On the other hand, the results show a double-peak form between significant wave heights and mean wave directions. Wave fields during Typhoon Damrey (2005) are simulated by SWAN wave model. The results show that wider directional spread is to the left of the typhoon and narrower spread is to the right of the typhoon. The joint distributions show a multi-peak form between significant wave heights and mean wave periods. The marked mean wave directions are focus on south-east and north to the right of typhoon centre, while further south and north-west to the left.

Storms
Wave height
Wave periods
Wave spectra

2015010080

Designing process and motion characteristics of spar type offshore wind turbines.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786285
Nihei, Y., Ikoma, T., Et al
English

This paper discusses the designing process and the motion characteristics of spar type offshore wind turbines. When considering a spar type structure for offshore wind turbines, it is important to take many elements into consideration which have not yet been considered in the case of oil and gas platforms. In this research, the following standards were used to conduct the tests. The limit of the heel angle was 5 degrees when the wind turbines are generating in the rated state. When designing the substructure for this research a substructure that operates in depth of 100m or more was selected. Following the conditions above a spar type offshore wind turbine has been designed for this research. In order to compare the simulated result a scale model was created and tank tests were performed under various conditions. Also unexpected motion characteristics in certain mooring arrangements were observed.

Design
Motion
Offshore structures
Wind turbines

2015010081

Wave power extraction by an oscillating wave surge converter in random seas.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786697
Sarkar, D., Renzi, E., Dias, F.
English

This paper investigates the behaviour of a bottom hinged flap-type wave energy converter (WEC), namely the Oscillating Wave Surge Converter (OWSC), in random seas. The semi-analytical model of Renzi and Dias (2013b) for an OWSC in the open ocean is considered to analyse the performance of the device in random incident waves. The modelling is performed within the framework of a linear potential flow theory, by means of Green’s integral theorem. The resultant hypersingular integral equation for the velocity potential obtained from the above formulation is solved using a series expansion in terms of Chebyshev polynomials of the second kind. The behaviour of the device is investigated for six different sea states, generally representative of the wave climate in the North Atlantic Ocean at the European Marine Energy Centre test site. A Bretschneider spectrum is considered in order to reproduce the sea climate. The analysis is made for sea states where the spectral energy contribution from large periods, which cause excitation of body resonance of the flap - not modelled by the linear theory - is almost negligible. The power take-off damping is optimised for each individual sea state to calculate the captured power. The investigation is undertaken for two flaps of different widths, resembling the Oyster1 and the new Oyster800 version of the Oyster WEC, respectively. Comparison is made between the performances of the two converters. The effect of varying the width and the
The characteristic parameters of the flap on the capture factor in random seas is then discussed. The results of the analysis show that the performance of the device is fairly consistent for the sea states considered. Also an enhancement in the overall average capture factor is shown for the latest version of the wave energy conversion device.

Surges
Wave energy conversion

2015010082

Development of 3MW tidal energy platform.
http://proceedings.asmedigitalcollection.asme.org/Proceeding.aspx?articleID=1786706

Brake, E. ter, Todman, M., Armstrong, J.
English

The Triton-3 platform is a novel tidal energy harvester capable of producing 3MW from tidal flow. The platform is a floating structure moored to the seabed by a single-point fully articulated anchorage, and carries three power trains and a number of marine auxiliaries. The driver for the design as developed by TidalStream Ltd is to reduce the cost of energy production in order to compete with the current cost of offshore wind. Independently audited cost modelling shows that tidal stream energy can become competitive with offshore wind, achieving a generating cost as low as 10p/kWh at the best sites. This generating cost is estimated to be less than half that which could be achieved at a similar site from a single seabed-located turbine. The driving aspects for the competitive cost are maximising the capacity per mooring point, reducing installation costs by float-out solutions and by providing easy access to the tidal equipment. Access is achieved by allowing the platform to come to the surface by means of de-ballasting. By doing so, there is no need for large workboats and/or diver activities to perform regular inspection and maintenance on the tidal equipment, reducing the cost significantly. The technical aspects that arise when developing the tidal turbine platform for a typical offshore location are investigated by Houlder Ltd and discussed in this paper. A number of technical challenges have been addressed where the rotational stability in both roll and pitch are of interest. The roll of the platform is heavily affected by the performance of the turbines; sudden increase or reduction in thrust will induce significant rolling moments that must not impair the integrity of the platform. Pitching of the platform allows it to reach the surface when de-ballasted for maintenance and inspection. During normal operations, the platform remains aligned with the current and in doing so maximises the performance of the turbines. The paper illustrates how these aspects have been achieved by means of passive solutions. By means of positioning and shaping the main body of the platform, a working configuration has been developed where the rotations of the platform remain within a limited window maximising the potential power production. The concept has been tested by TidalStream during a large-scale model testing campaign where the unit was subject to different current speeds and different turbine configurations and fault cases. This publication compares the results of the large scale model testing with numerical models developed in OrcaFlex and shows the effectiveness of the passive solutions.

Offshore platforms
Tidal power

2015010083

Numerical simulations for installation of offshore wind turbine monopoles using floating vessels.
http://proceedings.asmedigitalcollection.asme.org/Proceeding.aspx?articleID=1786765

Li, L., Gao, Z., Moan, T.
English

Monopiles are the most commonly used support structures for offshore wind turbines with up to 40m water depth due to the simplicity of the structure. The installation of turbine support structures can be carried out by a jack-up vessel which provides a stable working platform. However, the operational weather window using jack-up vessels is very limited due to the low sea states required for jacking up and down. Compared to jack-up installation vessels, floating vessels have more flexibility due to fast transportations between foundations. However, the vessel motions will affect the motion responses of the lifting objects, which might bring installation difficulties. Therefore, it is necessary to examine the dynamic responses of the coupled system to ensure safe offshore operations. In this paper, the
installation operation of a monopile using a floating installation vessel is studied by a numerical model. Time domain simulations were carried out to study the installation process of a monopile, including lowering phase, landing phase and steady states after landing. Sensitivity studies were performed focusing on the effects by the gripper device stiffness and landing device stiffness. Comparisons of critical responses by using floating vessel and a jack-up vessel were also studied in the paper.

Installing
Offshore structures
Wind turbines

2015010084
Design requirements for floating offshore wind turbines.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786776
Chen, X., Yu, Q.
English

This paper presents the research in support of the development of design requirements for floating offshore wind turbines (FOWTs). An overview of technical challenges in the design of FOWTs is discussed, followed by a summary of the case studies using representative FOWT concepts. Three design concepts, including a Spar-type, a TLP-type and a Semisubmersible-type floating support structure carrying a 5-MW offshore wind turbine, are selected for the case studies. Both operational and extreme storm conditions on the US Outer Continental Shelf (OCS) are considered. A state-of-the-art simulation technique is employed to perform fully coupled aero-hydro-servo-elastic analysis using the integrated FOWT model. This technique can take into account dynamic interactions among the turbine Rotor-Nacelle Assembly (RNA), turbine control system, floating support structure and stationkeeping system. The relative importance of various design parameters and their impact on the development of design criteria are evaluated through parametric analyses. The paper also introduces the design requirements put forward in the recently published ABS Guide for Building and Classing Floating Offshore Wind Turbine Installations (ABS, 2013).

Design
Floating structures
Offshore structures
Wind turbines

2015010085
A novel concept for self installing offshore wind turbines.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786783
Wåsjø, K., Rico, J.V.B., Et al
English

The paper describes a novel concept of a self-installing offshore wind turbine. A concept for combined installation of the substructure and turbine in one single operation without the need of expensive installation vessels is described. The stability of the concept during transport and installation is obtained by two structurally connected standard barges with dimension 92 × 32 m. The concept proves to be stable with weather window equal Hs = 4 m for transport and Hs = 1.5 m for installation in the waiting of more accurate analyses. A cost saving potential in this early phase of 17% is identified compared to the more common steel jacket solution. The cost saving is related to the installation process.

Installing
Offshore structures
Wind turbines
2.7 SAFETY AT SEA

2015010086

Lessons from marine accident reports.
UK Department for Transport, Marine Accident Investigation Branch, Safety Digest 2/2014 [86 p, 40 fig]
No author given
English

This Safety Digest draws the attention of the marine community to some of the lessons arising from investigations into recent accidents and incidents. It contains information which has been determined up to the time of issue. This information is published to inform the shipping and fishing industries, the pleasure craft community and the public of the general circumstances of marine accidents and to draw out the lessons to be learned. The sole purpose of the Safety Digest is to prevent similar accidents happening again. The content must necessarily be regarded as tentative and subject to alteration or correction if additional evidence becomes available. The articles do not assign fault or blame nor do they determine liability. The lessons often extend beyond the events of the incidents themselves to ensure the maximum value can be achieved.

Accident descriptions
Accident investigations
Marine accidents

2015010087

Probability analysis of vessel collisions and groundings in Southeast Texas waterways.
Transportation Research Record: Journal of the Transportation Research Board, v 2426 2014 – Marine Environment, Marine Safety, and Human Factors, pp 44-53
http://trb.metapress.com/content/mnr7t4x021465553/?p=55f689742dd34e32a46a116b4d871838&pi=5
Wu, X., Rahman, M.H., Zaloom, V.
English

The Sabine-Neches Waterway (SNWW) connects the Texas ports of Beaumont, Port Arthur, and Orange with the Gulf of Mexico. The SNWW can be divided into three navigation routes, although they share some channels. The first route is the waterway from the Neches River, north of the port of Beaumont, to the port of Port Arthur, and then to the Gulf of Mexico. The second route is a part of the Gulf Intracoastal

Waterway (GIWW), west of Port Arthur, which extends east of the port of Orange. The third route is from the port of Orange to the Gulf of Mexico. The SNWW plays an important role in its support of the economic growth of southeast Texas. Safe navigation in narrow waterways is one of the most important concerns of maritime authorities and researchers, while collisions and groundings are two of the most common kinds of vessel accidents. In the study reported here, the grounding and collision analysis toolbox was employed to analyse the probabilities of collisions and groundings in multiple segments along the SNWW. The impacts of vessel traffic on the probabilities of collisions and groundings were studied, respectively. The high-risk zones of potential collisions or groundings were identified in the SNWW.

Collision risk
Groundings
Probability
Ship collisions
Vessel traffic

2015010088

Comparison of dynamic games in application to safe ship control.
Polish Maritime Research, v 21 n 3, 2014, p 3 [10 p, 20 ref, 1 tab, 13 fig]
http://www.bg.pg.gda.pl/pmr/pmr.php
Lisowski, J.
English

The paper introduces methods of dynamic games for automation of ship control in the collision situation, the game control processes in marine navigation and the fundamental mathematical model of the game ship control. First, state equations, control and state constraints and then control goal function in the form of payments: the integral payment and the final one are defined. Multi-stage positional, and multi-step matrix, non-cooperative and cooperative, game and optimum control algorithms for a collision situation, are presented. The considerations are illustrated with an exemplary computer simulation of algorithms to determine a safe own ship’s trajectory in the process of passing the ships encountered in Kattegat Strait.

Automation
Collision avoidance manoeuvres
Control systems
Game theory
Mathematical models
2015010089

**LSA gets innovative about safety.**
The Naval Architect, October 2014, p 63 [2 p, 3 fig]
http://www.rina.org.uk/tna.html
No author given
English

This article describes a new marine evacuation system that will be significantly lighter, smaller and safer to use.

*Evacuation*  
*Lifesaving*

2015010090

**Use of accident precursor event investigations in the understanding of major hazard risk potential in the Norwegian offshore industry.**
http://pio.sagepub.com/content/227/1/66.abstract
Vinnem, J-E.
English

The recent offshore accidents at the Macondo and Montara fields in the US and Australia have demonstrated the importance of learning from major accident precursors in order to appraise the risk potential involved in critical offshore operations. This is fully realised by the Petroleum Safety Authority in Norway, which has a specific requirement for such learning in its regulations. However, an unfortunate practice has been developed by the major players in the Norwegian offshore industry, whereby potential is severely and systematically downplayed, probably to limit the negative exposure if the actual potential consequences were known. This article analyses 45 major accident precursor investigations in order to demonstrate the effect of downplaying the potential of major accidents. It demonstrates how the risk potential classified in investigation reports has a random relationship to the more objective risk potential, as shown in the national risk indicator project conducted by the Petroleum Safety Authority. This is further demonstrated by comparing company investigations with authority investigations in four cases where parallel investigations were performed.

*Offshore platforms*  
*Platform accidents*  
*Risk analysis*

2015010091

**Accident modelling and risk assessment framework for safety critical decision-making: application to deepwater drilling operation.**
http://pio.sagepub.com/content/227/1/86.abstract
Rathnayaka, S., Khan, F., Amahyotte, P.
English

Rising global energy demand is encouraging oil companies to invest in deepwater drilling. However, there are numerous engineering and safety challenges involved in this activity. The BP Deepwater Horizon accident (Macondo well blowout) has raised serious concerns about the safety of deepwater drilling. The major reasons for such a catastrophic blowout event are the lack of continuous assessment of risk and the lack of risk-based decision making to take timely and adequate preventive actions. This work proposes an accident modeling and risk assessment framework based on accident precursors (early warnings). This framework uses the system hazard identification, prediction and prevention methodology to model the unwanted situation. The proposed risk assessment framework generates results that can be used to: (1) analyse the dynamic performance of safety barriers, (2) analyse the probability of occurrence of different severity levels, (3) analyse the dynamic risk profile of different severity levels and the aggregated risk profile, and (4) help to make safety-critical decisions based on aggregated risk profile. This work provides an assessment of offshore deepwater drilling risk assessment and a basis to make timely and precise safety critical decisions. The risk assessment methodology is demonstrated on the Macondo well blowout accident. This case study highlighted the applicability and advantages of using the proposed method in drilling operations.

*Offshore platforms*  
*Platform accidents*  
*Risk analysis*
2015010092

Expert elicitation of a navigation service implementation effects on ship groundings and collisions in the Gulf of Finland.
http://pio.sagepub.com/content/228/1/19.abstract
Hänninen, M., Mazaheri, A., Et al
English

When considering the implementation of a novel risk-control option, the estimation of its possible effects often relies on expert elicitation. This article presents an expert-knowledge–based preliminary assessment of how the deployment of Enhanced Navigation Support Information navigation service would affect the ship collisions and groundings in the Gulf of Finland. Experts probabilistically assess the service’s direct effects on various factors, which are then utilized in collision and grounding probability Bayesian network models. The results indicate that implementing the Enhanced Navigation Support Information service could decrease the number of accidents. However, a comparison of the model outcomes to the experts’ qualitative opinions reveals some discrepancies, which suggest that the elicitation procedure or the applied models might require further improvement. Nevertheless, with the proposed Bayesian approach, the model can be updated and uncertainties in the estimates reduced after more evidences are available later from longer and wider use of the service.

Groundings
Probability
Ship collisions
Traffic control

2015010093

Modeling the risk of ship grounding - a literature review from a risk management perspective.
WMU Journal of Maritime Affairs, v 13 n 2, October 2014, pp 269-297
Mazaheri, A., Montewka, J., Kujala, P.
English

Ship grounding accidents, being one of the major types of maritime accidents, are significant failures putting in danger maritime transportation systems. Moreover, the risks associated with those failures can be catastrophic for the system, society, and the environment. This highlights the importance of appropriate methodology for assessing and managing the associated risk. Many scholars have introduced a wide range of methods for modeling the risk, utilizing the concept of the probability and the consequence of an accident; however, those models very often employ critical assumptions on the behaviour of maritime transportation systems, which may seem not to be supported by evidences. This in turn limits models' ability to mitigate the risks, as those simply remain unknown. Therefore, this article has three aims. First, it proposes a methodological framework suitable for knowledge-based risk modeling, fulfilling the recommendations given by the Formal Safety Assessment issued by the International Maritime Organization. Secondly, it thoroughly reviews and discusses all the existing risk models available in the literature developed for ship grounding risk analysis in light of the proposed risk perspective. Third, the models that are more appropriate for risk management and decision making are highlighted and the recommendations are given to future model developments.

Decision making
Groundings
Literature reviews
Probability
Risk management

2015010094

Influence of automatic identification system on safety of navigation at sea.
TransNav Journal, v 8 n 3, September 2014, p 337
[5 p, 16 ref, 3 fig]
Stupak, T.
English

Detection of small craft/targets, in particular, sailing yachts with the ship's radar is not always possible. Radar reflectors are used to improve their detection. The Automatic Identification System (AIS) transmits position, motion vector and identification signals of a vessel to other ships and vessel traffic services centres. This system significantly increases the possibility to detect small crafts. The paper presents results of comparative study of using information from the AIS and from radar to determine the
accuracy of tracking the position and motion vector of ships in the Gulf of Gdansk. Possibilities and limitations of the AIS are also presented.

Navigational safety
Ship identification
Traffic control

2015010095

Maritime piracy humanitarian response programme (MPHRP).
TransNav Journal, v 8 n 3, September 2014, p 419
[3 p, 2 ref, 1 fig]
Dimitrevich, A., Torskiy, V.G.
English

In recent years nearly 5000 seafarers have been hijacked and detained for months often in appalling conditions, while thousands of others have been the victims of a pirate attack. Given these numerous concerns, a pan-industry alliance of ship owners, unions, managers, manning agents, insurers and shipping- and welfare associations (maritime, labour, faith or secular) has come together to establish the "Maritime Piracy: a Humanitarian Response Programme" (MPHRP). The objectives of this Programme address the three phases of "pre-, during and post-incident", with the aim of implementing a model of assisting seafarers and their families with the humanitarian aspects of a traumatic incident caused by a piracy attack, armed robbery or being taken hostage.

Human factors
Piracy

2015010096

Possible e-Maritime applications for improved safety, security and environmental protection in maritime transport.
Vanem, E.
English

E-maritime can be considered as an extension of the e-Navigation concept currently being discussed at the International Maritime Organization (IMO). It can be construed to include e-Navigation and promotes the use of all maritime data and information, distributed by way of information and communication technologies, to facilitate maritime transportation and provide value added services. This paper investigates possible e-maritime services related to safety, security and environmental protection of shipping and for interaction with class. The paper reviews a number of existing services and current initiatives and relevant research projects and discusses if and how the value of such services could be increased if they could be offered as e-Maritime services to the industry. Based on this survey, it can be suggested that there are great potential for offering a number of existing and future services related to safety, security and environmental protection as e-Maritime services. However, standardisation of the framework and of specific maritime data types, messages and codes might be necessary to facilitate a development towards widespread adaptation of e-Maritime solutions.

Environmental protection
Information exchange
Navigational aids
Safety
Security

2015010097

Determination of the reaction limit situation between two vessels to prevent a collision.
Rasero, J.C., Endrina, N., Piniella, F.
English

A collision takes place when a succession of errors results in two vessels coming into contact with each other. A certain period of time elapses from when such a situation commences until the collision actually happens. A particular moment will be reached when, no matter what either vessel does, it will not be possible to prevent the collision. That moment is designated as Reaction Limit Situation (RLS). The objective of the study is to determine the SLR to prevent collision between two vessels. The expected results will be obtained by running simulation tests for cases involving two vessels. The principal results will be to determine the RLS for
models of simulated vessels in different conditions; to demonstrate that, with knowledge of this datum by both vessels, a collision could be avoided; and to determine the appropriate evasive manoeuvres to be taken if both vessels knew the RLS.

Collision avoidance
Simulation

2015010098
The probabilistic ships domain study and incidents model on the route between Swinoujscie and Ystad – for Ro-Pax ferries.

Marcjan, K., Gucma, L.
English

Swinoujscie Ferry Terminal is the largest and most modern of the four Polish ferry terminals and is also one of the most modern ferry terminals on the Baltic Sea. In recent years, the largest number of ferries that departed from Swinoujscie proceeded in the direction of the Swedish port of Ystad. There are three routes intersections with heavy ships traffic crossing the examined route between Swinoujscie and Ystad of ships proceeding from the direction of Arkona in the direction of Gdansk, with direction Arkona - the North of Bornholm and from the Danish Straits towards the North of Bornholm. The density of vessel traffic in areas of route intersections may be associated with the decrease in the distance between passing vessels which is particularly important because of the large number of ferries departing from Swinoujscie to Ystad. This paper aims to analyse the route from Swinoujscie to Ystad in terms of the passing distances between passenger vessels and other ships. The analysis is based on a probabilistic ships domain designated on the route and the amount of incidents which are understood as a close encounter between two vessels, during which the designated ships probabilistic domain is exceeded.

Navigational safety
Passing vessels
Ship domains
Ship encounters

2015010099
Single window for MSI.

Wawruch, R.
English

The paper describes questions connected with collecting, processing and exchange of the Maritime Safety Information (MSI) in the process of e-navigation. It presents the idea and scope of MSI, information transmitted and institutions and organisations participating in the exchange of this type of data and suggests Maritime Assistance Service (MAS) defined in IMO Resolution A.950 (23) as a single point of contact for collecting and dissemination of this type of data.

Information exchange
Information processing
Navigation systems
Safety

2015010100
Safety management system for restricted and open sea areas.

Bak, A.
English

The main task of the management system in marine areas is to increase the level of safety in restricted and open sea areas. The presented system is based on scientific research which focused on reasons for sea accident occurrences as well as the favourable factors. As a result the set of main factors responsible for safety improvement was obtained. The presented model of optimal technical solution choice is the result of a range of research led within management on marine areas safety project. It includes array of analysis and algorithms which can indicate the areas and factors influence in a negative
manner. On the basis of performed simulations of new designed marine areas the model can estimate and optimise the safety level in order to minimize the risk of sea accident.

Management
Navigational safety
Open water
Restricted waters
Risk

2015010101
Safe passage.
*Marine Log*, v 119 n 10, October 2014, p 22 [2 p, 1 tab, 1 fig]
Latorre, R.
English

This article discusses estimating ro/ro ferry time between the accident and capsize/sinking.

Capsizing
Ferries
Marine accidents
Ro/ro ships
Sinking

2015010102
Casualty risk investigation for hulls of inland vessels and river-sea going vessels.
[http://www.snak.or.kr/eng/sub01_01.html](http://www.snak.or.kr/eng/sub01_01.html)
Egorov, A.G., Nilva, A.E.
English

The analysis of failures with hulls of inland navigation (INV) and mixed river-sea navigation vessels (RSV) occurred since 1991 till 2012 is executed. 1492 emergency cases were analysed. Basic dangers, resulting both in failures and casualties, are exposed. Steady growth of breakdown is observed for vessels older than 13 years with peaks of accidents at 22-25 and 30-34 aged vessels. Solving problem of sufficient reliability and safety providing for INV and RSV with keeping of acceptable level of economic efficiency is possible only while system approach providing at all stages of life cycle of these vessels, including classification, Rules requirements, design, building, operation, surveys, repair and modernization.

*Inland waterways vessels*
*Marine accidents*
*Oceangoing river vessels*
*Risk analysis*

2.8 ENVIRONMENTAL PROTECTION

2015010103
The most recent noise & vibration assessment of the European fleet, within the framework of the “SILENV Project”.
*Ship Science & Technology*, v 7 n 14, January 2014, p 43 [24 p, 7 ref, 16 fig]
Palomo, P.B.
English

The EU’s new “Green Policy” to reduce the environmental impact of all types of vessels is generating new Directives that shall affect the Shipbuilding Industry. As a direct consequence, an intense debate has been opened with the participation of all the players involved: the European Commission, Marine Institutions, Shipbuilding Industry, Marine Sector, and Scientific Community. Participation of the authors in the SILENV, BESST, and AQUO projects within the FP7 has permitted noticing that for the complete assessment of the ships’ environmental impact it is essential to introduce the new so-called Noise & Vibration – Full Signature indicator. In addition to the well-known topics of Noise & Vibration (N&V) on board, it includes new ones: Noise Radiated to Harbour and Underwater Radiated Noise (URN) by the ships. Both, but especially the latter (URN) became the most outstanding novelty and the biggest challenge to be technically solved. In this sense, it is essential to know the “Starting Point”: How far is the current European Fleet from the Standard Regulations and from other Directives that will soon be compulsory? And which are the technical reasons and root causes of these deviations? To address these issues within the framework of the SILENV Project, the most recent N&V database compiled with 171 ships from the European Fleet and 12,000 N&V experimental data have been assessed. It became the largest ever N&V database in the marine sector, as well as a complete novelty. Therefore, the results, conclusions and recommendations obtained from it are of paramount importance to support current policies of
the EC and other Marine Institutions that focus their efforts on combating the environmental impact of the ships.

Environmental effects
Noise
Vibration

2015010104

Monitoring of air emissions on ships.

Spinner, R.
English

This paper addresses the latest online technology to support emission compliance in the form of continuous integrated emission monitoring systems to meet upcoming legislation.

Air pollution
Emissions
Monitoring

2015010105

What has Europe learned after the Deepwater Horizon/Macondo Incident?
International Oil Spill Conference Proceedings, v 2014 n 1, May 2014, p 348 [13 p, 2 tab, 2 fig]

Bluhm, B., Xirotiri, L.
English

The Deepwater Horizon incident and the response thereto generated significant interest in Europe, in particular with regard to the safety of offshore oil and gas operations, existing oil spill response arrangements, and the potential impacts of surface and subsurface dispersant application. This paper presents the main relevant developments and actions undertaken in Europe in the years following the Macondo incident, focusing primarily on the work of the European Commission, European Maritime Safety Agency, and European Union Member States, as well as the work undertaken within the established Regional Agreements in Europe.

Offshore platforms
Oil spills
Recommendations
Risk analysis
Spill risk

2015010106

Developing a guideline for oil spill risk assessment and response planning for offshore installations.
International Oil Spill Conference Proceedings, v 2014 n 1, May 2014, p 314 [14 p, 6 ref, 6 fig]

Nissen-Lie, T.R., Brude, O.W., Et al
English

Following the April 2010 Gulf of Mexico (Macondo) oil spill and the 2009 Montara incident in Australia, the International Association of Oil and Gas Producers (OGP) formed the Global Industry Response Group. This Group identified nineteen oil spill response recommendations (OGP, 2011) that are being addressed via an Oil Spill Response Joint Industry Project (OSR-JIP) during 2012-2014. The OSR-JIP is managed by IPIECA on behalf of OGP, in recognition of IPIECA’s long-standing experience with oil spill response matters. One of the nineteen recommendations concerned the development of an international guideline for offshore oil spill risk assessment and a method to better relate oil spill response resources to the risk level. Consequently, the OSR-JIP has published a guideline covering oil spill risk assessment and response planning for offshore installations. This paper describes the development and content of the guideline, including how the oil spill risk assessment process provides structured and relevant information to oil spill response planning for offshore operations. The process starts by defining the context of the assessment and describing the activity to be assessed. Thereafter it addresses a series of key questions: 1) What can go wrong, leading to potential release of oil? 2) What happens to the spilled oil? 3) What are the impacts on key environmental - both ecological and socio-economic - receptors? 4) What is the risk for environmental damage? 5) How is the established risk utilised in oil spill response planning?

Offshore platforms
Oil spills
Recommendations
Risk analysis
Spill risk
2015010107

The principles of effective post-spill environmental monitoring and their application to preparedness assessment.

International Oil Spill Conference Proceedings, v 2014 n 1, May 2014, p 572 [16 p, 24 ref, 2 tab]
Kirby, M.F., Gioia, R., Law, R.J.
English

Understanding the fate and effects of spilled oil or chemicals in the marine environment is essential if the scientific and response communities are to develop best practices for the future. The timely and successful deployment of survey specialists, sampling strategy and scientific techniques to monitor the environmental consequences of an incident can be a complex challenge and, in the same way as for spill response and clean-up, requires effective planning and coordination. However, the delivery of the necessary guidance, skilled personnel and coordinated management are often not pre-identified, are rarely in the same organisation and the levels of preparedness to undertake complex monitoring programmes are often low. This paper identifies the 8 principles of effective post-spill monitoring programmes as: Scientific Guidance, Skills & Knowledge, Equipment, Funding, Responsibility & Management, Integration & Coordination, Support & Buy-in and Practice. Drawing on experience from the Premiam (Pollution Response in Emergencies: Marine Impact Assessment and Monitoring; www.cefas.defra.gov.uk/premiam) programme in the United Kingdom these principles are described and the approaches taken and challenges faced in the UK to improve post-spill monitoring practices are outlined. This paper goes on to describe how these principles can be used as the basis for the assessment of monitoring preparedness through the generation of a Monitoring Preparedness Assessment Score. This assessment approach can be used by local, regional or national authorities to establish the level of environmental monitoring and impact assessment preparedness for incidents in their areas and to highlight areas for improvement. In addition it is of use to responders, policy makers, environmental scientists and planners as a tool through which to assess preparedness and capability for specific scenarios. The use of the approach is demonstrated through the assessment of previous incidents and potential future scenarios.

Chemical spills
Environmental effects
Monitoring
Oil spills

2015010108

Simulating the behaviour and fate of an oil spill using a coupled three-dimensional hydrodynamic model.

International Oil Spill Conference Proceedings, v 2014 n 1, May 2014, p 901 [18 p, 16 ref, 1 tab, 11 fig]
Stronach, J.A., Hospital, A.
English

Oil behaviour and fate have been simulated extensively by several spill models. These simulations can be greatly enhanced by the use of a coupled three-dimensional model of currents and water properties to determine oil transport and weathering, both on the water surface and in the water column. Several physical and chemical processes such as vertical dispersion in response to wave action, resurfacing when waves die down, sinking through loss of volatiles and dissolution are essential in assessing the impact of an oil spill on the environment. Dissolution is especially important, considering the known toxicity of several of the constituents of liquid hydrocarbons. For this study, a three-dimensional hydrodynamic model of coastal British Columbia was coupled to an oil trajectory and weathering model in order to simulate the complete fate and behaviour of surface, shoreline-retained, dissolved, sunken and dispersed oil. Utilization of a three-dimensional model is the key to adequately modelling the transport of a spill in an estuarine region such as in the Strait of Georgia, B.C., where the distribution of currents and water properties is strongly affected by estuarine processes: the Fraser River enters at the surface and oceanic waters from the Pacific enter as a deep inflow. Three-dimensional currents and water properties were provided by the hydrodynamic model, H3D, a semi-implicit model using a staggered Arakawa grid and variable number of layers in the vertical direction to resolve near-surface processes. Waves were simulated using the wave model SWAN. Winds were obtained from the local network of coastal light stations and wind buoys. Stochastic modelling was conducted first,
using only surface currents, to determine probabilistic maps of the oil trajectory on water and statistical results were extracted, such as the amount of shoreline oiled and the amount of oil evaporated, both for the ensemble of simulations constituting the stochastic simulation, as well as for any particular individual simulation. Deterministic scenarios were then selected and the fate of the oil, such as the dissolved and sunken fractions, was tracked over a 14 day period on the three-dimensional grid. This method has been used for environmental impact assessment and spill response planning.

Oil spills
Spill behaviour
Spill models
Wave models

2015010109

Shoreline planning and response in ice-dominated environments.
*International Oil Spill Conference Proceedings, v 2014 n 1, May 2014, p 1186 [14 p, 28 ref, 1 tab, 1 fig]*
Owens, E.H., English

Many existing or developing offshore production areas and transportation routes are in the Arctic or in marine areas that have seasonal ice. In many respects, the shoreline types of cold-climate or ice-dominated regions are similar to those of ice-free environments. Our knowledge and understanding of shore zone materials and coastal landforms from warmer regions is applicable to these environments in most respects, with the addition of ice and snow and the presence of arctic tundra, glaciers and ice sheets. Oil behaves differently in cold climates depending on the source of the oil, the oil character, and the presence and character of ice and/or snow. A shoreline would be protected from direct contact by oil when ice is present in the shore zone. Ice is impermeable so that oil deposited on the surface remains there unless there are cracks in the ice, the ice conditions are floes grounded on the shore, or during the formation of shore fast ice. Shoreline cleanup methods are not significantly different and no more difficult that in warmer, ice-free regions, except on ice and low-lying arctic tundra. The key challenges for a shoreline response in ice-dominated environments typically are associated with remoteness, safety and logistics. As a result, the emphasis for shoreline cleanup strategies is on in situ treatment techniques that require minimal equipment and manpower resources and generate little or no waste.

Ice conditions
Oil spills
Spill cleanup
Spill countermeasures

2015010110

Oil behaviour in ice-infested waters.
*International Oil Spill Conference Proceedings, v 2014 n 1, May 2014, p 1239 [12 p, 52 ref, 1 fig]*
Fingas, M.F., Hollebone, B.P.
English

The current knowledge of the physical fate and behaviour of crude oil and petroleum products spilled in Arctic situations is reviewed. Oil in and under ice undergoes a variety of processes depending on location and environmental conditions. Modelling of oil in such environments becomes complex by the addition of these processes. Spreading was evaluated for oil on ice, under ice, in snow, in brash ice, and between blocks of ice. Oil transport under sheet and broken ice are considered, both for sea and river conditions. The movement of oil under the ice may be governed by the undersea roughness as well as the relative velocity of the water with respect to the ice. The effects of oil on a growing ice sheet are examined, both for its effects on ice formation and for the thermal effects of oil inclusions in ice. The migration of oil through ice is examined, focussing primarily on the movement through brine channels. The effects of oil on the surface of ice are considered, with emphasis on the effects of surface pools on ice melt. Similar consideration is given to the effects of oil on snow on the surface of ice. The quantitative studies of oil in open and dynamic ice conditions are reviewed. Observations of intentional small-scale spills in leads and ice fields are reviewed and compared with observations from real spills. The most common ultimate fate of oil in an ice field is release onto water. Some of the measurements made
in earlier years suffered from the lack of good measurement techniques. Further research is needed to improve the understanding of oil behaviour in ice-infested waters.

**Ice conditions**
**Oil spills**
**Spill behaviour**

### 2015010111

**The environmental monitoring of Finnish ports – case port of HaminaKotka.**


Pekka-Brunila, O.

**English**

Different regulations in the European Union influence the functioning and management of European ports. In Finland, environmental monitoring is carried out in connection to the environmental permit of the port and to the requirements set by legislation and other forms of regulatory measures. When environmental information is collected, the basic principles for all the collected data are comparability, balance between problematic questions and opportunities, continuity, clarity and understandability. It must be noted that the comparison of information must be possible so that the changes in the level of environmental protection can be established. The Port of HaminaKotka is the biggest universal port in Finland. In this case, the development of the emissions to air, amount of waste, water monitoring and noise levels in the past years have been examined. According to the results, the emissions levels have decreased, but there is still a lot to do in the field of environmental protection. Environmental monitoring is often criticized as being expensive and wasteful. In this case, the total costs of environmental monitoring in the port of HaminaKotka have been calculated.

**Emissions**
**Environmental protection**
**Monitoring**
**Ports**

### 2.9 GENERAL OPERATION

**2015010112**

**Operability assessment of high speed passenger ships based on human comfort criteria.**


Tazdogan, T., Incecik, A., Turan, O.

**English**

The growing popularity of passenger cruise lines means continual challenges are faced concerning both a vessel’s design and its operational ability. Vessel dimensions, service speeds and performance rates are rapidly increasing to keep pace with this expanding interest. It is essential that vessels demonstrate high performances, even in adverse sea and weather conditions, and ensure the comfort of passengers and the safety of cargo. A vessel’s operability can be defined as the percentage of time in which the vessel is capable of performing her tasks securely. In order to calculate a vessel’s operability index, many key parameters are required. These include the dynamic responses of the ship to regular waves, the wave climate of the sea around the ship's route, and the assigned missions of the vessel. This paper presents a procedure to calculate the operability index of a ship using seakeeping analyses. A discussion of the sensitivity of the results relative to three different employed seakeeping methods is then given. The effect of seasonality on a ship's estimated operability is also investigated using wave scatter diagrams. Finally, a high speed catamaran ferry is explored as a case study and its operability is assessed with regards to human comfort criteria.

**High speed vessels**
**Passenger ships**
**Ride comfort**
**Seakeeping**
**Ship operation**

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**ABSTRACTS** 41
Long-term potential to reduce emissions from international shipping by adoption of best energy-efficiency practices.

Maritime shipping is highly fuel-efficient, but its sheer volume and rapid growth make it a major source of carbon emissions. Industry and governments seek to reduce the energy use and carbon footprint of shipping. Yet the reasons for the variation in shipping efficiency observed in the world fleet's embrace of best technical and operational practices to increase efficiency remain unexplained. The research reported in this paper offers a novel analysis that connected 2011 in-use fleet characteristics, first-ever global satellite data on ship movement, and technical literature on ship efficiency technology to assess the long-term prospects of increased shipping efficiency. This study also investigated how each ship characteristic influenced the efficiency of the shipping fleet. A ship stock turnover model was developed to track technical and operational efficiency practices in ships independently. The findings indicated that industry-leading ships were about twice as efficient as industry laggards across major ship types. If the available technical and in-use practices of the low-carbon industry leaders of today were fully embraced, the potential would exist to reduce carbon dioxide in absolute terms by more than 300 million metric tonnes by 2040, even while business-as-usual freight movement doubled. On the basis of the data in this assessment, the potential exists to develop a tool for shippers to quantify, evaluate, and compare their supply chain carbon footprints in a manner that does not rely on more aggregated fleet-average simplifications. The methodology, data, and findings of this study should benefit industry as it looks for ways to reduce energy consumption; researchers, who are examining ship operation; and policy makers, who want to curb the climate impact of international shipping.

Analysis with automatic identification system data of vessel traffic characteristics in the Singapore Strait.

The study reported in this paper aimed to analyse vessel traffic characteristics in the Singapore Strait. Real-time vessel automatic identification system (AIS) data, with about 4 million records, were collected from Lloyd's Marine Intelligence Unit database for analysis. The results showed that containerships made up the largest proportion (36.36%) of vessel traffic in the Singapore Strait, while roll-on-roll-off and passenger ships made up only a small percentage (4.77%). The analysis of the vessel characteristics suggested that special attention should be paid to tankers, bulk carriers, and ships that transport liquefied natural gas and petroleum gas, because of their bigger gross tonnage and draught. It was also found that vessels in traffic headed eastbound usually sailed at slightly higher speeds than those in the westbound traffic. The spatial distribution of vessel traffic flow indicated that the area between longitudes 103°48'E and 104°05'E had a larger traffic flow, with the highest traffic density. The ship density of the westbound traffic was higher than it was for the eastbound traffic. The AIS data collected between longitudes 104°10'E and 104°35'E were incomplete so that the corresponding traffic flow was underestimated. The advantages and limitations of AIS data were considered in detail in this study.

Efficiency
Emissions
Energy consumption
Ship operation
2015010115
Liner ship fleet deployment with uncertain demand.
Transportation Research Record: Journal of the Transportation Research Board, v 2409 2014 – Marine Transportation, Terminal Operations, and International Trade, pp 49-53
http://trb.metapress.com/content/x06tkw207480123h/?p=818d486c847d43a388134e018393205b&pi=6
Wang, S., Wang, T., Et al
English
This paper points out that the deployment problem of the liner ship fleet with uncertain demand is different from other logistics problems with uncertain demand (e.g., truck transport and airlines) because container ships operate 24 h a day and 7 days a week. This difference is largely ignored in the literature. To address this problem, a multi-level optimisation model is developed. In addition to liner ship fleet deployment, the model is applicable to other liner shipping decision problems, such as network design with uncertain demand, and to port operations planning problems, such as berth planning with uncertain ship arrival times.

Deployment 
Liner shipping 
Optimisation

2015010116
The influence of wind, wave and loading condition on total resistance and speed of the vessel.
Polish Maritime Research, v 21 n 3, 2014, p 61 [7 p, 10 ref, 2 tab, 5 fig]
http://www.bg.pg.gda.pl/pmr/pmr.php
Szefangiewica, T., Wiśniewski, B., Żelazny, K.
English
Optimising the ship route is one of the most important tasks related to the operation of the vessel, its safety, and economic aspects of transport. Nevertheless, from a mathematical point of view, this problem has not yet been solved sufficiently precisely due to very high complexity of the model to be used to describe the motion of the ship along the shipping line, and time- and space-dependent average values of statistical weather parameters recorded during ship sailing. That is why various approximate methods are used, which, among other procedures, utilize ship speed characteristics, having the form of very simple relations between basic dimensions of the ship and the expected speed decrease at the assumed weather parameters. The paper presents a new method of calculating the speed decrease depending on technical and operating parameters of a given vessel. A computer code prepared based on this method is used for research on forecasting ship speed in real weather conditions.

Ship operation
Ship speed
Speed reduction
Waves
Wind

2015010117
Stability of ships with a single stranding point.
Ship Science & Technology, v 7 n 14, January 2014, p 15 [12 p, 5 ref, 10 tab, 9 fig]
http://www.shipjournal.co/index.php/sst/article/view/91
Sousa Bastos, P.C. de, Reyes, M.C.T.
English
During rescue operations of stranded vessels, it is essential to make immediate and reliable decisions to optimise the successful salvage potential and minimise risks of environmental damages and cost impacts. Pursuant to this scenario, the need arises for a numerical tool, which can more accurately forecast the stability conditions experienced by a vessel after running aground and help in the refloating operations of the unit. This study seeks to develop an adequate calculus systematization, which provides analytical capabilities for operational situations in case of stranding, thereby, supporting the decision making process in these risk situations.

Groundings
Refloating
Stability

2015010118
Evaluation of wind and wave environment adaptability of ships.
Brodogradnja, v 65 n 3, September 2014, p 59 [15 p, 8 ref, 14 tab, 7 fig]
http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=188448
Sun, S-Z., Ren, H-L., Et al
English
The environment adaptability especially integrated sailing performance in rough sea of ships is very important. In this paper the evaluation index system and method of wind and wave environment adaptability were proposed. Then the relative importance of the given indices was analysed, and the
weighting coefficients of the indices were given by estimation matrices. Besides this the evaluation equation was built. And the AHP method and the method based on fuzzy theory were used for evaluating the environment adaptability of a hybrid monohull and a round bilge monohull. Furthermore, the effect of different models and weighting coefficients given by different matrixes for evaluation results were analysed. The research indicated that the choice of evaluating parameters had great influence on the evaluation results, and the weighting coefficients were the difficult point but critical point for environment adaptability evaluation of ships.

Adaptation
Fuzzy sets
Waves
Wind

2015010119

Challenges to ship hydrodynamics in the XXI century.
TransNav Journal, v 8 n 3, September 2014, p 353
[6 p, 5 ref, 1 tab, 6 fig]
http://www.transnav.eu/Article_Challenges_to_Ship_Hydrodynamics_Kobyliński,31,516.html

Kobyliński, L.
English
The beginning of twenty-first century is characterized with important changes in world shipping and exploitation of ocean resources. Three important trends are clearly visible: environment protection, safety and economy. They materialize in important changes in the structure of world fleet where some existing ship types are going to disappear and new ship types emerge. Increasing the size of some ship types is another visible tendency. Stress on environment protection has serious impact on the hydrodynamic characteristics of ships whether with regard to safety zero accident rate is the goal. Important challenges to ship hydrodynamics caused by those tendencies are discussed in the paper.

Efficiency
Environmental protection
Ship hydrodynamics
Ship hydrostatics

2015010120

Approximate method of calculating forces on rudder during ship sailing on a shipping route.
TransNav Journal, v 8 n 3, September 2014, p 459
[6 p, 7 ref, 2 tab, 11 fig]

Żelazny, K.
English
Service speed of a ship in real weather conditions is a basic design parameter. Forecasting of this speed at preliminary design stage is made difficult by the lack of simple but at the same accurate models of forces acting upon a ship sailing on a pre-set shipping route. The article presents a model for calculating forces and moment on plane rudder, useful for forecasting of ship service speed at preliminary stages of ship design.

Forces
Rudders
Service speed
Ship operation

2015010121

Failure mode and effect analyse in high speed crafts.

Merayo, P., Martin, A.
English
The aim of this paper is to identify the correct procedures when facing anomalies which could put a high speed vessel at risk. In so doing, the basic workings of this type of ship, in terms of its propulsion and evolution, are explained.

Failure
High speed vessels
Safety
Energy efficiency design index vs. safe manoeuvring in adverse conditions.
Sames, P.
English
This paper documents that the current interim guideline is in conflict with the EEDI regulations for smaller ships. Noting the current discussion on the determination of adverse conditions, the paper presents an application of the simplified assessment following IMO draft guidelines.

2015010123

The economic viability of Northern Sea Route as a seasonal supplement for container shipping between Europe and Asia.
Kiiski, T.
English
This paper quantitatively assesses the Northern Sea Route’s (NSR) competitiveness against the main Europe-Asia trade route, Suez Canal Route (SCR), in container shipping. The main objective is to evaluate the annual economic viability of the NSR as a seasonal supplement to the SCR with various navigational period lengths (120, 150 and 180 days) using two vessel sizes (4,000 and 8,000 TEU) on the Hamburg-Yokohama-Shanghai-Busan-Hong Kong rotation loop. This research is a part of the ongoing PhD study focusing on the broader implications of newly reinforcing and gradually developing Arctic Shipping into a global shipping market. The results show that the seasonal NSR operations can be economically viable but not comparable to the year-round SCR service. The most profitable seasonal combination would be 120 days of NSR and 240 days of SCR operation with profit levels approximately 20 percent lower in smaller vessel size category and respectively 15 percent lower in the larger vessel size category compared to year-round SCR traffic. It was also pointed that the shipping costs of the ice-optimised NSR vessels are 23–34 percent higher during the NSR navigational season compared to open-water ships operating in the SCR. In contrast, in open-water conditions, outside the navigational season of the NSR, the cost difference is only three to four percent.
Arctic regions
Arctic transportation
Containerised shipping
Profitability

2015010124

Resizing study of main and auxiliary engines of the tanker vessels and their contribution to the reduction of fuel consumption and GHG.
De Melo, G., Echevarrieta, I.
English
The maritime industry has great potential for improving energy efficiency in both new builds and existing ships. It is, therefore, necessary to identify the areas where improvements can be made to reduce fuel consumption, and influence shipowners, shipyards and ship designers to implement these improvements in energetic efficiency and to achieve a reduction of between 25% and 75% of CO2 emissions as IMO report 2009 provides, making ships even more environmentally friendly. A study was conducted focusing on one type of ship such as tanker vessels, compiling a database of these ships built from 2000 to 2014. The ships in the study were taken from the database of Lloyd’s Register of Shipping. With all the technical data on each of the ships, the main and auxiliary power was related with the operating speed of the vessel, its displacement and GT, by size, age and generation ships. All the above comparisons were made according to ship sizes, graphically and analytically in which interesting conclusions could be drawn in the relevant dimensioning of the main and auxiliary engines, as well as the operation of the ship. Because of the current crisis some owners have already begun to change their size criteria of propulsion and auxiliary
engines of these vessels, their management and operation as well as their speed. Another significant finding was the identification of some shipyards that build their ships with an oversize and exaggerated power of the main and auxiliary engines, regardless of the effect on increasing fuel consumption and impact on the environment. Finally, a comparative study of EEOI of these vessels by size and age was performed to determine the environmental signature and their evolution. All this leads to determining a set of measures to be applied, for example, power reduction or derating, etc. on existing ships and applied to new designs, thus reducing the propulsion and auxiliary power of these ships and collaborating to reduce greenhouse gases.

Efficiency
Emissions
Energy consumption
Energy conservation
Fuel consumption

2015010125
Review of legislation of rules on noise and vibration in merchant ships.
Rodriguez, F.J.B., Molina, R.H., Et al
English
This paper describes the evolution of noise regulations for merchant ships over the last four decades, analysing the most important aspects with respect to crews, passengers and exposed populations in cities in line with the requirements of the European Union to reduce the environmental impact of transportation. The paper also analyses the changes in regulations aimed at not only regulating noise and vibration inside the ship, but also noise emitted to the port and underwater radiated noise. Classification Societies are also included, given the importance of their standards in ensuring increasing levels of comfort on board ship.

Legislation
Noise
Regulations
Vibration

2015010126
The energy efficiency indicators of fishing cutters for the Polish fishing fleet.
Behrendt, C.
English
Aspiration to reduce energy consumption and to pro-ecological operation of vessels’ energy systems requires the energy indicators to be analysed. The energy efficiency, in the case of fishing cutters, is not always the objective indicator for energy consumption, in particular during the fishing process. EEOI (Energy Efficiency Operational Indicator) appears to be useful in the analysis of the environmental hazards associated with the emission of harmful exhaust gases. The indicator allows for the energy efficiency assessment of vessel energy system on current basis. This paper presents determined energy efficiency indicators for the energy systems of the selected Polish fishing cutters using the results of the research conducted thereon. The specificity of the operational tasks for fishing vessels has been taken into consideration when determining the indicators and during their analysis.

Efficiency
Energy conservation
Energy consumption
Fishing vessels

2015010127
Energy audit structure dedicated to fishing cutters operating at the Baltic Sea.
Szczepanek, M., Rajewski, P.
English
Fishing limits, necessity to cope with competitive fishing of other countries, and the lack of financial resources to purchase modern vessels have caused
more than 30% of the Polish fishing vessels operating in the Baltic Sea to be withdrawn from operation between 2003 and 2012. Uncoordinated modernizations of the fishing cutters prevent a comparison of the obtained results. A research team gathered opinions of shipowners regarding the effects of the modernizations performed and conducted research which constitutes the grounds to develop optimal directions for modernization and operation of the fishing vessels. Commencing in 2013, commercial vessels have been obliged to implement the SEEMP. The development of an energy efficiency audit programme, dedicated for this specific vessel group, will be practical to improve energy efficiency during fishing vessel operation. The idea to carry out an audit is to identify solutions, which would reduce energy inputs for vessel operation, and present them to fishermen starting from the simplest ones which do not require funding to more complex requiring considerable financial investment, but improving significantly the energy efficiency of vessels as well as the consequent competitiveness. This paper presents a proposal of energy audit developed for the Polish fishing fleet in the Baltic Sea.

Efficiency
Energy consumption
Fishing vessels

3.1 GENERAL HYDRODYNAMICS, HYDRAULICS AND OCEANOGRAPHY

2015010128
New methods and insights in advanced and realistic wave modelling.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786493
Schmittner, C., Scharnke, J., Et al
English
For model tests, the correct generation of the most realistic representation of the natural wave field is of greatest importance as the environmental conditions denote the starting point for all following analyses of any behaviour of a marine structure. Thus, it has to be defined first what “reality” is, followed by a thorough analysis of the inherent limitations of basin wave fields. Furthermore, all realistic aspects of the wave field have to be modelled at sufficient accuracy involving the wave maker control, flap geometries and appropriate analysis techniques. This paper gives an overview of the most recent developments in advanced basin wave modelling including a wide range of aspects as realistic wave spreading, deterministic wave generation, focusing waves, directional wave analysis, spurious waves and shallow water wave generation.

Model basins
Waves

2015010129
What is the apparent angle of a Kelvin ship wave pattern?
http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9377077&fulltextType=RA&fileId=S0022112014005308
Pethiyagoda, R., McCue, S.W., Moroney, T.J.
English
While the half-angle which encloses a Kelvin ship wave pattern is commonly accepted to be 19.47°, recent observations and calculations for sufficiently fast-moving ships suggest that the apparent wake angle decreases with ship speed. One explanation for this decrease in angle relies on the assumption that a ship cannot generate wavelengths much greater than its hull length. An alternative interpretation is that the wave pattern that is observed in practice is defined by the location of the highest peaks; for wakes created by sufficiently fast-moving objects, these highest peaks no longer lie on the outermost divergent waves, resulting in a smaller apparent angle. This paper focuses on the problems of free-surface flow past a single submerged point source and past a submerged source doublet. In the linear version of these problems, the authors measure the apparent wake angle formed by the highest peaks, and observe the following three regimes: a small Froude number pattern, in which the divergent waves are not visible; standard wave patterns for which the maximum peaks occur on the outermost divergent waves; and a third regime in which the highest peaks form a V-shape with an angle much less than the Kelvin angle. For nonlinear flows, the authors demonstrate that nonlinearity has the effect of increasing the apparent wake angle so that some highly nonlinear solutions have apparent wake angles that are greater than Kelvin’s angle. For large Froude numbers, the effect on apparent wake angle can be more dramatic, with
the possibility of strong nonlinearity shifting the wave pattern from the third regime to the second. The authors expect that the nonlinear results will translate to other more complicated flow configurations, such as flow due to a steadily moving closed body such as a submarine.

**Gravity waves**
**Kelvin waves**
**Surface waves**
**Wave patterns**

**2015010130**

A simple approach to the study of wave patterns.

Dand, I.W.

English

The paper revisits some pioneering work of Sir Thomas Havelock on wave patterns with particular attention focused on his graphical method of analysis. Motivated by a desire to explore this method further using numerical methods, it is extended in a simple manner to give three-dimensional illustrations of the wave patterns of a point disturbance in deep and shallow water. All results are confined to the sub- and trans-critical regimes with some obtained very close to the critical Depth Froude Number. Some conclusions are drawn on the wave types produced when operating close to the critical speed and their decay with distance off.

**Numerical analysis**
**Wave patterns**

**3.2 RESISTANCE AND PROPULSIVE PERFORMANCE**

**2015010131**

A CFD model for the frictional resistance prediction of antifouling coatings.

Demirel, Y.K., Khorasanchi, M., Et al

English

The fuel consumption of a ship is strongly influenced by her frictional resistance, which is directly affected by the roughness of the hull surface. Increased hull roughness leads to increased frictional resistance, causing higher fuel consumption and CO2 emissions. It would therefore be very beneficial to be able to accurately predict the effects of roughness on resistance. This paper proposes a Computational Fluid Dynamics (CFD) model which enables the prediction of the effect of antifouling coatings on frictional resistance. It also outlines details of CFD simulations of resistance tests on coated plates in a towing tank. Initially, roughness functions and roughness Reynolds numbers for several antifouling coatings were evaluated using an indirect method. Following this, the most suitable roughness function model for the coatings was employed in the wall-function of the CFD software. CFD simulations of towing tests were then performed and the results were validated against the experimental data given in the literature. Finally, the effects of antifouling coatings on the frictional resistance of a tanker were predicted using the validated CFD model.

**Antifouling coatings**
**Computational fluid dynamics**
**Frictional resistance**
**Hull roughness**

**2015010132**

A numerical optimisation method to determine propeller skew distribution.

Cai, H-p., Chen, C., Et al

Chinese

Better skew distribution is beneficial for propeller blade sections to access the non-uniform ship wake non-synchronously, so the vibration and noise induced by a propeller operating in the ship wake can be decreased. In this paper, an artificial intelligence optimisation algorithm and a prediction method of unsteady hydrodynamic characteristics of propeller based on the surface panel method are provided to optimise the propeller skew distribution. The propeller skew distribution curve is described by B-spline, and the curve fairing is ensured; Aiming at reducing unsteady axial forces, an improved particle swarm optimisation combined with the prediction method of propeller unsteady hydrodynamic performance is utilized to optimise and analyse propeller skew distribution. The parallel optimisation algorithm based on OpenMP is also developed for multi-cup computers in order to improve the computation efficiency. Numerical optimisation results show that the propeller skew optimisation method provided in this paper can reduce propeller
unsteady thrust amplitude, the method is effective, reliable and practical, and the parallel computing can improve the optimising efficiency greatly.

**Optimisation**  
**Propeller efficiency**  
**Skewed propellers**

2015010133  
**Numerical analysis for sheet cavitation noise characteristic of contra-rotating propeller.**  
*Journal of Ship Mechanics, n 7, 2014, pp 786-793*  
**Wang, X., Cai, F., Et al**  
Chinese  
In order to study cavitation noise characteristic of contra-rotating propellers, the numerical analysis of contra-rotation propeller cavitation was accomplished by using Schnerr-sauer cavitation model, RNG k-ε turbulence model and dynamic mesh model. The open-water performance was done with DTMB4381 propeller cavitation, the predicted cavity shapes were in agreement with both the experimental observation and numerical simulation result on open literature. And, by calculating and analysing the contra-rotating propeller cavitation, the sound pressure and power spectrum density of different monitors was solved. The result shows that line-spectrum which is related to the blade frequencies of front and rear propeller existing in the power spectrum and the non-uniformity of rear propeller flow is more obviously than front propeller.

**Cavitation noise**  
**Contrarotating propellers**  
**Numerical analysis**  
**Sheet cavitation**

2015010134  
**Model test study on hybrid monohull with in-tilted low-freeboard.**  
*Journal of Ship Mechanics, n 7, 2014, pp 809-814*  
**Sun, S-z., Zhao, X-d., Et al**  
Chinese  
The researched ship is a hybrid monohull based on a round-bilge ship using in-tilted low freeboard, wave piercing bow, and longitudinal stability built-up appendage. In this paper, the model test on this new hybrid monohull is researched including the resistance test in calm water and seakeeping test in regular and irregular waves. The model test results are compared with the round-bilge original ship and the regular hybrid monohull, and indicate that the resistance performance of the new hybrid monohull is better than the original ship, and the resistance is reduced by more than 3% at 36kns. The seakeeping performance is even better, and the pitch amplitude is averagely reduced by 50%. So the sailing performance of the new hybrid monohull is much better than the original round-bilge ship and even better than the regular hybrid monohull.

**Model tests**  
**Monohulls**  
**Resistance**  
**Seakeeping**

2015010135  
**Numerical analysis of the unsteady propeller performance in the ship wake modified by different wake improvement devices.**  
**Bugalski, T., Szantyr, J.A.**  
English  
The paper presents the summary of results of the numerical analysis of the unsteady propeller performance in the non-uniform ship wake modified by the different wake improvement devices. This analysis is performed using the lifting surface program DUNCAN for unsteady propeller analysis. The object of the analysis is a 7000 ton chemical tanker, for which four different types of the wake improvement devices have been designed: two vortex generators, a pre-swirl stator, and a boundary layer alignment device. These produced five different cases of the ship wake structure: the original hull and hull equipped alternatively with four wake improvement devices. Two different propellers were analysed in these five wake fields, one being the original reference propeller P0 and the other - a specially designed, optimised propeller P3. The analysed parameters were the pictures of unsteady cavitation on propeller blades, harmonics of pressure pulses generated by the cavitating propellers in the selected points and the fluctuating bearing forces on the propeller shaft. Some of the calculated cavitation phenomena were confronted with the experimental. The objective of the calculations was to demonstrate the differences in the calculated unsteady propeller performance resulting from the application of
different wake improvement devices. The analysis and discussion of the results, together with the appropriate conclusions, are included in the paper.

Numerical analysis
Propeller efficiency
Wakes

2015010136

Comparison of three simple models of Kelvin’s ship wake.
He, J., Zhang, C., Et al
English

A theoretical explanation of observations of high-Froude-number ship wakes that are narrower than the classical Kelvin 39° angle was recently offered by Rabaud and Moisy. The explanation relies on the assumption that a ship hull does not create waves longer than its length. A validation of this theoretical model has also been given. The validation is based on the approximation of the flow created by a ship hull by means of a Gaussian distribution of pressure at the free surface. These two flow models predict a wake angle $\psi_{\text{max}}$ that decreases like $1/F$ as the Froude number $F$ increases beyond $F=0.5$. A third theoretical explanation was recently proposed by the authors. This theoretical explanation assumes that the wave pattern of a ship mostly consists of dominant waves that are created by the ship bow and stern, and is mostly determined by interference effects between these dominant waves. The analysis of interference effects on the Kelvin wake of a ship predicts a wake angle $\psi_{\text{max}}=0.14/F^2$ for a monohull ship, or $\psi_{\text{max}}=0.2\sqrt{b/F}$ for a catamaran with beam/length ratio $b$. The ‘flow models’ underlying these three alternative theoretical explanations of narrow ship wakes are examined, and the corresponding theoretical predictions are compared to the 37 observations of ship wakes reported by Rabaud and Moisy for Froude numbers $F$ within the wide range $0.1 < F < 1.7$. The computed waves are largest along a ray angle that agrees with the prediction of the bow and stern wave interference model, but is noticeably smaller than predicted by the Gaussian pressure distribution model.

Catamarans
Interference
Kelvin waves
Monohulls
Wakes

2015010137

A new method to predict body-force distribution for modelling the propeller in viscous CFD code without potential flow code.
Journal of the Japan Society of Naval Architects and Ocean Engineers, v 19, 2014, pp 1-7
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_1/_article
Tokgoz, E., Kuroda, K., Et al
Japanese

This paper reports the development of a new body-force model for the rotating propeller within viscous flow code and its application to uniform flow and propeller advancing with the angle of attack. A simplified quasi-steady blade element theory with the infinite-bladed propeller model (time averaged propeller induced velocity field) is coupled with the Reynolds averaged Navier-Stokes (RANS) code to determine the thrust and the torque distributions. The present effort aims to reduce the computational effort while keeping the effect of ship with motion in quasi-steady manner for propeller. The solid-surface effect on the propeller loading and power is also studied. Open-water validation simulations are done for the range of Froude numbers includes the range $F<0.6$, where interference between transverse bow and stern waves is important, and corresponds to the vast majority of ships. The predictions given by the Rabaud-Moisy ‘cut off-wavelength model’ and the ‘Gaussian pressure distribution model’ are in close agreement with two wake observations for $1.6<F<1.71$. and may also be consistent with several wake observations for $0.6<F<1.4$, but are not consistent with most observations. This finding and a critical examination of the assumptions underlying the Rabaud-Moisy model and the Gaussian pressure distribution model suggest that these theoretical models may not be realistic for most ships. This conclusion is further validated by numerical computations of wave patterns for $F=1$. The computed waves are largest along a ray angle that agrees with the prediction of the bow and stern wave interference model, but is noticeably smaller than predicted by the Gaussian pressure distribution model.
Methodical-AU type fixed-pitch propeller. Reported results show fair predictive agreement between the new body-force model and the experimental data.

Computational fluid dynamics
Propeller forces
Propeller loading
Uniform flow

2015010138
Study on CFD simulation of hydrodynamic phenomena with vortex flow around the blunt bow.
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_9/_article
Ueura, T., Hino, T., Et al
Japanese

Hydrodynamic phenomena with vortex flow around the bow of a blunt ship are simulated by using various Computational Fluid Dynamics (CFD) codes. In the conventional experimental studies, some flow properties in front of the blunt bow beneath the free surface have been found and reported; for example, a necklace vortex based on the wave breaking phenomena is the typical one. In CFD simulations, however, reliable results have not yet been obtained. The authors pay attention to the free surface boundary conditions to carry out the numerical simulations by Navier-Stokes (NS) solvers in CFD codes. As NS solvers with the different free surface boundary conditions, two phase flow and double model flow solvers in OpenFOAM prepared as CFD tools box of open sources and one phase flow solvers of SURF, NEPTUNE developed by the National Maritime Research Institute are used. As the results of two phase flow solver included in OpenFOAM above mentioned some flow properties with vortex flows can be obtained. Influences of the free surface boundary conditions to the vortex flow phenomena around the blunt bow are discussed in comparison with various results based on other NS solvers and experiments.

Blunt bodies
Computational fluid dynamics
Vortices

2015010139
Michell's thin ship theory considering the gradient of ship form in depth direction.
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_19/_article
Tsubogo, T.
Japanese

This paper shows a thin ship theory of the wave making resistance considering an effect of the gradient of hull form in the depth direction based on linear approximation, which is made by modifying the original Michell's thin ship formulation and by using Havelock's Green function. Some computing applications of wave resistance by both Havelock's formula and pressure integration on the centre plane of the ship are shown to compare with other researchers' results. The effects of vertical gradient of the hull on wave resistance are the phase shift in Froude number domain and the decreasing amplitudes of humps and hollows in comparison with Michell's integral. The added depth gradient term is controlled to affect in low Froude number range by a condition. The method must be improved further to enhance quality and reliability.

Thin ship theory
Wave resistance

2015010140
Prediction of steady performance of contra-rotating propellers including wake alignment.
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_31/_article
Inukai, Y., Kanemaru, T., Ando, J.
Japanese

To reduce fuel oil costs and emission of greenhouse gases of ships in operation, application of Contra-Rotating Propellers (CRP) will be one of the solutions, which have high propulsive efficiency. Although several estimation methods of predicting open water characteristics of CRP have been developed in the past, few methods treat accurately with trailing wake geometry, which influences much on estimate accuracy. CRP makes the flow around the propellers more complicated compared with conventional single propeller because the aft and forward propeller of the CRP strongly interacts. In order to improve estimate accuracy, more rigorous
treatment of the trailing wake geometry is desirable. This paper presents a calculation method, taking deformation of trailing wake accurately into account. The method is based on a simplified surface panel method "SQCM" which satisfies the Kutta condition easily. The SQCM consists of Hess and Smith type source panels on the propeller surface and discrete vortices on the camber surface according to Lan's QCM (Quasi-Continuous vortex lattice Method). The wake vortex lines are arranged in accordance with the direction of the flow including induced velocity by both propellers. Some calculated results are shown and validated by comparing experiments. It is found that thrust and torque of the aft propeller differ considerably depending on which the deformation of trailing wake is taken into account or not. The calculated results with deformed wake agree very well with the experiment, while the calculated results without deformed wake always overestimate the thrust and torque of the aft propeller.

Contrarotating propellers
Propeller efficiency

2015010141
Research on a smallest blade area propeller 2nd report; the design, model tests and full scale measurements of a smallest blade area propeller.
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19-39/_article
Yamasaki, S., Ishihara, Y., Et al
Japanese
This paper concerns results of model tests and full scale measurements of a propeller designed for an inland ship (749 GT chemical tanker) aiming 1% increase of propulsive efficiency comparing with 1st retrofit small blade area Non Hub-Vortex (NHV) propeller. It was shown in the 1st report that the 1st retrofit propeller, of which the blade area was decreased by 20% from the original propeller, reduced 4% of the engine output without problems of ship vibration and cavitation erosion. The Smallest Blade Area (SBA)-NHV propeller, of which the diameter was increased by 3.3% and the blade area was decreased by 10% from the 1st retrofit propeller, was designed and towing tank tests (propeller open water test and self-propulsion test) and cavitation tests (cavitation observation, erosion paint test and fluctuating pressure measurement) were carried out. The model test results showed that the propulsive efficiency of the SBA-NHV propeller is about 1.5% higher than that of the 1st retrofit propeller and the risk of cavitation erosion and the fluctuating pressure of both propellers are almost equivalent. Finally, sea trial tests of the 749 GT chemical tanker was performed with the SBA-NHV propeller which was manufactured as the second retrofit propeller. The sea trial test results demonstrated about 2.5% deduction of engine output without any problem of ship vibration comparing with the 1st retrofit propeller. It was confirmed that the turning and stopping abilities of the SBA-NHV propeller were equivalent and a little worse respectively comparing with those of the original propeller.

Full scale tests
Model tests
Propeller efficiency
Propulsive efficiency

Unsteady hydrofoils: theoretical and computational analysis.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786498
Valentine, D.T.
English
In this paper the computational problem examined is the impulsive start of a two-dimensional flat-plate hydrofoil at a fixed angle of attack. The method applied is an equally-spaced lumped-vortex panel method. The results from a lumped-vortex wake model and a shed-vortex sheet wake model are reported. Comparisons with the linear theory of Wagner (1925), the theoretical results associated with the single lumped-vortex wake model and the full wake model are presented. In addition, it is shown that the computational predictions are consistent with results reported by Katz and Plotkin (2001); they applied a distribution of vortices to model the wake. In this paper the importance of resolving the chordwise pressure distribution in unsteady hydrofoil
provides new predictions of both the evolution of lift and induced drag for the instantaneously started flat plate. The computational predictions are compared with theoretical predictions also discussed in this paper.

Computation  
Hydrofoils  
Predictions  
Pressure distribution

2015010143  
**Coefficients of propeller-hull interaction in propulsion system of inland waterway vessels with stern tunnels.**  
*TransNav Journal, v 8 n 3, September 2014, p 377 [8 p, 9 ref, 7 tab, 9 fig]*  
Kulczyk, J., Tabaczek, T.  
English

Propeller-hull interaction coefficients - the wake fraction and the thrust deduction factor - play a significant role in design of ship propulsion systems. In the case of inland waterway vessels there is no reliable method of predicting these coefficients in the early design stage. Based on the outcome of model tests and from numerical computations the authors show that it is difficult to determine uniquely the trends in change of wake fraction and thrust deduction factor resulting from the changes of hull form or operating conditions. Nowadays the resistance and propulsion model tests of inland waterway vessels are carried out rarely because of relatively high costs. On the other hand, the degree of development of computational methods enables’ to estimate the reliable values of interaction coefficients. The computations referred to in this paper were carried out using the authors’ own software HPSDKS and the commercial software Ansys Fluent.

Hull propeller interaction  
Inland waterways vessels

2015010144  
**Drag and torque on locked screw propeller.**  
*TransNav Journal, v 8 n 3, September 2014, p 441 [7 p, 10 ref, 4 tab, 7 fig]*  
http://www.transnav.eu/Article_Drag_and_Torque_on_Locked_Tabaczek31,528.html  
Kulczyk, J., Tabaczek, T.  
English

Few data on drag and torque on a locked propeller towed in water are available in literature. Those data refer to propellers of specific geometry (number of blades, blade area, pitch and skew of blades). The estimation of drag and torque of an arbitrary propeller considered in analysis of ship resistance or propulsion is laborious. The authors collected and reviewed test data available in the literature. Based on collected data there were developed the empirical formulae for estimation of hydrodynamic drag and torque acting on locked screw propeller. Supplementary CFD computations were carried out in order to prove the applicability of the formulae to modern moderately skewed screw propellers.

Drag  
Propellers  
Torque

2015010145  
a fundamental study on the reduction of added resistance for KCS.  
Volume 1, p 23 [8 p, 14 ref, 4 tab, 19 fig]  
http://www.snak.or.kr/eng/sub01_01.html  
Jeong, K.-L., Lee, Y-G., Yu, J-W.  
English

Due to tight regulations on CO2 emissions, interest in the resistance on a ship in waves is increasing. This paper presents a numerical simulation method for the flow around a ship in regular head waves in order to calculate the added resistance. The continuity equation and Navier-Stokes equations are numerically calculated in a fixed rectilinear grid system. The free surface flow near the ship is simulated by the modified marker-density method. The ship studied in this research is KRISO container ship (KCS). During the numerical simulations, the heave and pitch motions are set free, but other motions are set fixed. Varying the wave length, the characteristics of the added resistance are investigated. The flare shape is
modified to reduce the added resistance. The flare modification-induced reduction of added resistance is evaluated by numerical computation.

Added resistance in waves
Containerships
Numerical analysis

2015010146
A RANS modelling approach for predicting powering performance of ships in waves.
Volume 1, p 31 [8 p, 18 ref, 4 tab, 12 fig]
http://www.snak.or.kr/eng/sub01_01.html
Winden, B., Turnock, S., Hudson, D.
English
In this paper, a modelling technique for simulating self-propelled ships in waves is presented. The flow is modelled using a RANS solver coupled with an actuator disk model for the propeller. The motion of the ship is taken into consideration in the definition of the actuator disk region as well as the advance ratio of the propeller. The RPM of the propeller is controlled using a PID-controller with constraints added on the maximum permissible RPM increase rate. Results are presented for a freely surging model in regular waves with different constraints put on the PID-controller. The described method shows promising results and allows for the studying of several factors relating to self-propulsion. However, more validation data is needed to judge the accuracy of the model.

Computational fluid dynamics
Propulsive performance
Self propulsion
Waves

2015010147
Experimental study on the effect of bow hull forms to added resistance in regular head waves.
Volume 1, p 39 [6 p, 14 ref, 4 tab, 10 fig]
http://www.snak.or.kr/eng/sub01_01.html
Hwang, S., Kim, J., Et al
English
The concepts of the bow shape for the reduction of added resistance in waves are applied to the VLCC tanker well known as KVLCC2 and the performance in waves is evaluated by model tests in regular head waves. To identify the small difference of added resistance in waves between the different bow hull forms, the measurement system which allows surge motion is newly designed and used in the study. Two different bow hull forms for the original KVLCC2 are designed with the concept of Ax-bow and LEADGE-bow, which is known as the shape for the reduction of wave diffraction. The effects of Ax-bow and LEADGE-bow on the added resistance reduction are significant in the short wavelength range of \( \lambda/Lpp < 0.7 \). From the extended analysis for irregular waves, it is known that the reduction effect is enhanced as sea state increases and the increase of calm water resistance due to the hull form variation is compensated from sea state 4. Ax-bow and LEADGE-bow have the EHP saving of both 0.2 for the sea state 4 and 2.2 and 4.2 for the sea state 5, respectively.

Added resistance in waves
Bow form
Model tests
VLCCs

2015010148
A numerical study on performance of podded propeller of tractor type.
Volume 1, p 45 [8 p, 15 ref, 2 tab, 18 fig]
http://www.snak.or.kr/eng/sub01_01.html
Choi, J-K., Park, H-G., Kim, H-T.
English
In this study, the performance of the tractor type
A podded propeller is investigated from model to full scale Reynolds number using CFD analysis. The results of the calculation for the model scale agree well with the experimental results on a large cavitation tunnel. From these results, it is confirmed that using CFD analysis for estimating performance of a podded propeller is reliable. The calculated performance of the propeller without pod housing and its comparison with that of the podded propeller blades indicates the interaction of the podded propeller is mainly influenced by advance coefficient, while relatively little by Reynolds number. On the other hand, drag ratio, which is the ratio of pod housing drag to total thrust of podded propeller, increases as the advance coefficient increases due to accelerated flow in the slipstream of the podded propeller. This tendency appears larger in model scale than in full scale. In order to investigate the drag of pod housing, the calculations for the pod housing without propeller are carried out. The results indicate the pod housing drag is affected not only by the advance coefficient but also by the Reynolds number. From this study, it is confirmed that the interaction between propeller and pod housing is quite important, thus when designing podded propeller blades and pod housing, consideration of the interaction is necessary.

**Computational fluid dynamics**  
**Electric drives**  
**Pods**  
**Propeller efficiency**  
**Propulsive performance**

**2015010149**

**Experimental investigation of the effect of waves, ventilation and cavitation on POD-propeller loads.**  
http://www.snak.or.kr/eng/sub01_01.html  
Hagesteijn, G., Brouwer, J.  
English

When ventilation occurs unpredictably and uncontrolled, the propeller starts racing due to the reducing torque in the ventilated regime. Except for rare applications such as surface piercing propellers specially designed for this purpose, traditional propellers could suffer from a noticeable breakdown of thrust and torque once a sufficient amount of air is entrapped by the rotating propeller. Experience showed that the risk of ventilating propellers was negligently underestimated in traditional towing tank experiments but better predicted in depressurised towing tanks, where the ambient pressure is scaled down according to Froude similarity. The EU-funded Streamline project was the first project for which ventilation inception measurements were carried out in MARIN’s Depressurized Wave Basin (DWB). The tests were carried out with a podded cruise liner model, sailing in waves and depressurized conditions. In order to acquire detailed load measurements, MARIN used their in house developed 6 component and 5 component transducers. The 6 component transducer was used for measuring the omnidirectional propeller loads, while the 5 component transducer was used for measuring 2 blade forces and 3 blade moments. At the same time synchronized high speed video recordings were made to acquire insight in the occurring phenomena. In this paper a description of the test set up is presented. Furthermore some recordings and observations are discussed in detail, providing more insight into the complex phenomena that takes place when cavitation and ventilation are originating and vanishing. A method to split the quasi static hydrodynamic loads from the highly dynamic cavitation-ventilation impacts is discussed.

**Cavitation**  
**Dynamic loads**  
**Model tests**  
**Propeller efficiency**  
**Ventilation**

**2015010150**

**Resistance characteristics and form factor evaluation for geosim models.**  
http://www.snak.or.kr/eng/sub01_01.html  
Van, S-H., Ahn, H., Et al  
English

Model tests in towing tanks are very important for hull form design and powering performance prediction of a full scale ship before building. Also the model-ship correlation and extrapolation method based on the model test results are significant factors for accurate powering performance predictions. For the extrapolation of resistance, it is assumed that the frictional or viscous resistance is equal or proportional to that of the flat plate with the same
Reynolds number and the residuary resistance is equal to the model and full scale ship. However, the enhancement of the extrapolation method is always explored to improve the model-ship correlation. As a part of this effort, a series of geosim test were. The KVLCC, KCS, and KLNG were selected as the typical commercial vessels. Four differently scaled model-ships for each hull form were manufactured and resistance tests were performed. CFD computations were also performed for the corresponding geosims by WAVIS 2.2. Resistance characteristics and form factor are analysed based on the ITTC 1957 model-ship correlation line and ATTC friction line to investigate the scale effect on the form factor. Considerable scale effects are found in resistance characteristics and consequently in the form factor for differently scaled geosim models. Importance of the friction line for the form factor evaluation and dependency of the form factor on Reynolds number are discussed.

Geosims
Model tests
Numerical analysis
Resistance

2015010151

On resistance performance of three manned submersibles with full ocean depth.

http://www.snak.or.kr/eng/sub01_01.html

Li, H., Li, Z., Cui, W.

English

Currently there are three full ocean depth manned submersibles being developed using different hydrodynamic principles. The purpose of this paper is to provide an in-depth analysis of the resistance characteristics of the three manned submersibles by using the computational fluid dynamics method. A comparative study of the three manned submersibles is carried out. This would be expected to lay a necessary foundation for development of the full ocean depth manned submersible.

Computational fluid dynamics
Resistance
Submersibles

2015010152

Design for service: effects of loading conditions on powering performances.

http://www.snak.or.kr/eng/sub01_01.html

Crepier, P., Veldhuis, C.H.J., Starke, A.R.

English

This paper discusses the results of a study to numerically determine the speed-power curve of a ship for several loading conditions. Therefore the RANS solver parnassos coupled to the BEM code PROCAL has been applied to a single screw container vessel. Loading conditions have been varied: two different draughts and a large range of speeds have been computed. In a first step, the resistance curves have been computed and compared to model test results. The computed results show a difference contained within 4.5 with the experimental data, noting that the model was tested with rudder but the calculation was done without. In a second step, self-propulsion was simulated by a RANS-BEM coupling and results have also been compared to model test results. A reasonable agreement with experimental data for moderate speeds is found but larger deviations, up to 10, are obtained for the higher speeds. The absence of the rudder can explain a part of this difference. However, further research should be done to understand all details.

Computational fluid dynamics
Power
Resistance

2015010153

Flat plate drag reduction by air cavities on a ship model.

AMT'13, 3rd International Conference on Advanced Model Measurement Technology for the EU Maritime Industry; 17-18 September 2013; Gdansk, Poland. Organised by Newcastle University, UK and CTO S.A., Gdansk, Poland. P 363 [5 p, 5 ref, 4 fig]
http://conferences.ncl.ac.uk/amt13/proceedings/

Zverkovskyi, O., Delfos, R., Et al

English

This paper describes the experimental study on the frictional drag reduction on a horizontal flat plate by an air cavity. The integral shear force on the plate was measured in a cavitation tunnel by a custom built...
force balance. First, the friction was measured on a conventional flat plate. Then, the measurements were done with the developed air cavity on the test plate. The results of the comparison showed a possibility to reduce the friction drag on the test plate up to 60%.

Air Cavities Drag reduction Experimentation Flat plates

2015010154

A practical method for predicting the propulsive performance of energy efficient ship with wave devouring hydrofoils at actual seas.
http://pim.sagepub.com/content/228/4/348.abstract
Feng, P., Ma, N., Gu, X.
English

The Energy Efficiency Design Index (EEDI) is made mandatory by the International Maritime Organization to reduce emissions of greenhouse gases from international shipping. In this study, wave energy recovery using a pair of hydrofoils fixed at the ship bow to realize energy efficient propulsion is proposed. This so-called wave devouring hydrofoil (WDH) functions both as an anti-motion fin and a wave energy device, which can help reduce the ship wave added resistance, heave and pitch responses. To evaluate its performance, the coupled interaction between the hydrofoils and the ship under head sea condition is first modelled in the frequency domain together with the evaluation of wave added resistance in the presence of the WDHs. A model test is then conducted using a sample containership. Both the beneficial effect of the WDHs and the validity of the numerical model are proved. The peak response is reduced by 80%, 30% and 25% for added resistance, heave and pitch, respectively. This model is then further modified to include other wave directions. Based on frequency domain results, short-term and long term predictions of speed loss, engine power increase and propeller racing are performed for a 3100TEU containership along her transportation route. The merit of this prediction model is that the hull-propeller-engine interactions is considered from a system balance point of view. It is demonstrated that the WDHs can contribute to the energy-efficient ship propulsion at actual seas, achieving a slight reduction of EEDI and ensuring less speed loss and propeller racing.

Added resistance in waves Hydrofoils Propeller efficiency Propulsive performance

2015010155

A practical RANS-based design on a tandem propeller for energy saving.
http://www.snak.or.kr/eng/sub01_01.html
Tzeng, Y-W., Chen, C-H., Chang, C-Y.
English

In this paper, a dual-blade, multi-element configuration of a propeller is firstly investigated. It is found that the propeller efficiency increases with a proper relative position between the upstream and downstream blades. The interaction between the closely set blades is observed and discussed. A propeller designed by the state of art is selected and modified according to the configuration found. This modified propeller is then further optimised by an automatic design system using RANS. With the automatic design system using RANS for computations, the wake interactions and the refined viscous force predictions are all taken into consideration during the design, for which are important for such unconventional propeller. The resulted design has the efficiency of 77.8, which is significantly improved from the original design of 74.8. This new configuration may help the energy saving for marine transportation with the ever-worsening fuel shortage.

Computational fluid dynamics Energy conservation Propeller efficiency Tandem propellers
Optimisation of energy saving device combined with a propeller using real-coded genetic algorithm.

Ryu, T., Kanemaru, T., Et al

This paper presents a numerical optimisation method to improve the performance of the propeller with a Turbo-Ring using real-coded genetic algorithm. In the presented method, UNDX (Unimodal Normal Distribution Crossover) and MGG (Minimal Generation Gap) model are used as crossover operator and generation-alternation model, respectively. Propeller characteristics are evaluated by a simple surface panel method "SQCM" in the optimisation process. Blade sections of the original Turbo-Ring and propeller are replaced by the NACA66 a=0.8 section. However, original chord, skew, rake and maximum blade thickness distributions in the radial direction are unchanged. Pitch and maximum camber distributions in the radial direction are selected as the design variables. Optimisation is conducted to maximize the efficiency of the propeller with a Turbo-Ring. The experimental result shows that the efficiency of the optimised propeller with a Turbo-Ring is higher than that of the original propeller with a Turbo-Ring.

Energy conservation
Optimisation
Propeller efficiency

Propeller performance of a containership fitted with energy-saving rudder fin in a seaway.

Lee, S-K., Yu, K., Tsen, R.K-C.

In this study, the effects of hull form on added resistance are studied by experimental and numerical methods. Particularly, two KVLCC2 hull forms are considered: the original hull form and a modified with Ax-bow. Both hulls have the same shape below still-water level, but the difference is in the shape of the bow above still-water level. Captive model tests were performed for the two hull forms. Added resistance is evaluated by subtracting the still-water resistance from the mean resistance in waves. In the numerical analysis, three different seakeeping analyses are adopted: strip method, Rankine panel method with linear and nonlinear approaches, and a Cartesian grid method. In this study, numerical difficulties for the evaluation of added resistance induced by the Ax-bow existing above the mean water and seaway conditions for a containership fitted with an energy-saving device (ESD) are performed in this Computational Fluid Dynamics (CFD) study. Simulation results of the original design without ESD and the design fitted with ESD are compared to each other for calm water and wave conditions. To investigate the energy-saving mechanism of the ESD for propulsion, propeller energy-loss analyses for with and without ESD designs in the calm water condition are performed. It is found due to the ESD action, the rotational kinetic energy loss can be reduced to benefit energy-saving propulsion. In addition to propulsion performance, the hydrodynamic load on the energy-saving rudder fins is also a design concern as the structural integrity of the rudder fins is important for effective functioning of energy-saving propulsion. For ESD safety design, as cyclic loads created by propeller excitation and ship motion effects are important, they are also calculated and reported in this paper.
water level are observed. The experimental and numerical results of motion response and added resistance are compared and the effects of hull form on added resistance are discussed.

2015010159

Hydrodynamic analysis and design investigation of a ship with wave devouring hydrofoils for energy efficient propulsion.
http://www.snak.or.kr/eng/sub01_01.html

Feng, P., Ma, N., Gu, X.
English

A wave energy recovery method using a pair of hydrofoils alongside the ship to realize energy efficient ship propulsion is proposed. The so called wave devouring hydrofoils (WDHs) function both as passive anti-motion fins and wave energy absorbers to significantly reduce the ship's added resistance, heave and pitch responses in waves. The hydrodynamic model of the coupled WDH-hull system in head waves is established in the frequency domain based on potential theory. The SI75 containership is adopted for design studies. Model experiments are carried out to show the feasibility of this idea and the validity of the numerical model. Experimental results show that the peak response of wave added resistance is reduced up to 80 together with much smaller heave and pitch responses of the ship. The influences of several design parameters are then investigated to provide some guidance for the future application of this green ship technology.

2015010160

Auxiliary kite propulsion contribution to ship thrust.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786784

Ran, H., Janson, C-E., Allenström, B.
English

Low speed transportation is more energy efficient than high speed transportation in general. At the same time of maintaining speed, ships with lower design speeds provide possibilities for further reducing fuel consumption by using auxiliary wind propulsion devices. A kite is one type of auxiliary wind propulsion device that can be used for this purpose. The aim of this study is to investigate the influence of auxiliary kite propulsion on the performance of a Panamax tanker, specifically on engine power reduction, manoeuvrability in different wind/wave directions and on course-keeping ability of the ship. The study was carried out by means of computer-based simulations. Scenario combinations are established for various ship speeds, headings and weather conditions. For the purpose of simulation, a simplified auxiliary kite propulsion model was built. Throughout the simulations, forces, moments and motions of the tanker were recorded, and so were rudder angle, ship thrust and engine power. The result shows that auxiliary kite propulsion can play a significant role in reducing engine power in following up to beam sea conditions. The study is a first step towards a fully dynamic kite model where a control mechanism will be introduced to find the most favourable flying trajectory.

Added resistance in waves
Propulsive efficiency
Wave energy

Propulsive performance
Thrust
Wind power
Analysis on onboard measurement data for the validation of the effect of the energy saving device STEP.

Kuroda, M., Tsujimoto, M., Et al

In this paper, the effect of the energy saving device STEP and the validation through onboard measurement are described. The energy saving device STEP has the function of reducing the added resistance in waves acting on a ship navigating in actual seas. STEP is the device of about 5m length which improves the bow shapes above the waterline, and induces the reduction of the added resistance in waves. In this study, STEP has been developed for the 5,000 unit pure car and truck carrier through numerical considerations and tank tests, and has been installed on the actual ship. In order to validate the effect of STEP in actual seas, the onboard measurement has been conducted for the ship with STEP and the same type ship without STEP. As a result of the analysis of the onboard measurement data, the effect of STEP has been confirmed and evaluated as 3 reduction of CO2 emission under the scantling full load condition in waves of more than 2m high within 90 deg from head waves.

The influence of a keel bulb on the hydrodynamic performance of a sailing yacht model

Sfakianaki, K.N., Liarakopis, D.E., Et al

The significance of towing tank testing in the evaluation of the performance of ships both in calm and rough waters has been recognised by many authors. For instance, on a competitive sailing yacht design the study of the free surface is of great importance. In towing tank measurements on sailing yachts, the keel is acting as lifting surface at yaw angles 3.5o - 7o which affect considerable all resistance parameters as well as the free surface. The yacht keel features a relatively large laminar region and requires special transition devices which must control both lift and drag components. Modern sailing yacht designs consist of a keel-bulb configuration. Keel-bulb configuration has beneficial results to the overall stability of the yacht. However, the bulb tends to increase the resistance components. In addition, in some cases, the lift increases, which results to better windward sailing. Especially on leeway angles 3.5o - 7o, where the keel significantly affects the hydrodynamic phenomenon, these phenomena are more intense. A ¼ scaled model of a 50-ft modern sailing yacht has been tested. The experimental results referring to the drag, the side force, the dynamic C.G. rise and the dynamic trim, are presented. Furthermore, the performance of the model in calm water was evaluated, both with and without the bulb attached to the keel for a grid of heeling and leeway angles. The procedure used for the alignment, the calibration procedure as well as issues of great importance are discussed in detail. Useful conclusions are drawn following the discussion of the experimental results.

Horizontal hydrodynamic coupling between shuttle tanker and FPSO arranged side-by-side.

Wang, H-C., Wang, L.

Side-by-side offloading operations are widely utilized in engineering practice. The hydrodynamic interactions between two vessels play a crucial role in safe operation. This study focuses on the coupled effects between two floating bodies positioned side-
by-side as a shuttle tanker-FPSO (floating production, storage and offloading) system. Several wave directions with different side-by-side distances are studied in order to obtain the variation tendency of the horizontal hydrodynamic coefficients, motion responses and mean drift forces. It is obtained that the coupled hydrodynamics between two vessels is evidently distinguished from the single body case with shielding and exaggerating effects, especially for sway and yaw directions. The resonance frequency and the peak amplitude are closely related with side-by-side separation distance. In addition, the horizontal hydrodynamics of the shuttle tanker is more susceptible to coupled effects in beam waves. It is suggested to expand the gap distance reasonably in order to reduce the coupled drift forces effectively. Attention should also be paid to the second peaks caused by hydrodynamic coupling. Since the horizontal mean drift forces are the most mainly concerned forces to be counteracted in dynamic positioning (DP) system and mooring system, prudent prediction is beneficial in saving consumed power of DP system and reducing tension of mooring lines.

Coupled motion
FPSOs
Multibody systems
Shuttle tankers

2015010164

Added resistance and parametric roll prediction as a design criteria for energy efficient ships.
Ocean Systems Engineering, v 4 n 2, June 2014, pp 117-136
http://www.koreascience.or.kr/article/ArticleFullRecord.jsp?cn=TPTPKZ_2014_v4n2_117
Somayajula, A., Guha, A., Et al
English

The increased interest in the design of energy efficient ships post IMO regulation on enforcing EEDI has encouraged researchers to reevaluate the numerical methods in predicting important hull design parameters. The prediction of added resistance and stability of ships in the rough sea environment dictates selection of ship hulls. A 3D panel method based on Green function is developed for vessel motion prediction. The effects of parametric instability are also investigated using the Volterra series approach to model the hydrostatic variation due to ship motions. The added resistance is calculated using the near field pressure integration method.

Added resistance in waves
Rolling
Ship motions

2015010165

Model testing and CFD analysis of 2D profiles towards offshore applications.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786432
Machado, L. do Vale, Fernandes, A.C., Bodstein, G.C.R.
English

This paper presents numerical and experimental work motivated by the study of a rudder profile with significant levels of lift that provides better performance for the manoeuvring and stabilization of a ship. This is the so-called Schilling profile. The analysis of the two-dimensional subsonic steady flow over four profiles was carried out using computational fluid dynamics (CFD) tools with a $\kappa-\omega$ SST turbulence model. Three Schilling profiles with different thicknesses are considered and the classical NACA 0015 profile, taken as a reference. Simulation results are compared to experimental measurements at various angles of attack and two orders of magnitude of the Reynolds number, $5.45 \times 10^4$ and $1.09 \times 10^5$. The numerical results show general good agreement with experimental data and highlight the distinct behaviour of Schilling profile.

Computational fluid dynamics
Manoeuvring
Model tests
Stability
**2015010166**

**Time varying forces on FPSO bilge keels.**  

Veer, R. van 't  
English

One of the more challenging topics in offshore hydrodynamics remains the a-priori prediction of the roll response in irregular waves of a ship-shaped floating unit. It requires insight in how roll damping is generated by the bilge keels in particular. Such can be obtained through dedicated model tests measuring the bilge keel loads, and this paper presents several findings derived from FPSO seakeeping tests at model scale 1:70. Since the most practical and perhaps only feasible sea keeping prediction tool for engineering studies remains the well-developed 3D potential flow, the global roll damping coefficients and the time varying bilge keel loads are studied based on fluid velocities calculated by the potential flow method. The findings of this paper enhance the understanding of roll damping and bilge keel loads.

Bilge keels  
FPSOs  
Rolling

**2015010168**

**Analysis of pusher-barge system with different manoeuvring and propulsion devices.**  

Yuba, D.T.G., Tannuri, E.A.  
English

Pusher-barge system with different manoeuvring and propulsion devices were modelled and analysed. Both azimuth thrusters and conventional propulsion system (which is composed by rudder and propeller) were considered in the pusher. An additional azimuth thruster installed on the bow of the barges was also analysed, in order to increase the manoeuvrability of the convoy. Hydrodynamic derivatives for different pusher-barge configurations used in Tietê-Paraná river (B × L = 2 × 3, 1 × 2 and 1 × 1) were obtained from previously published works and complemented by captive model tests and CFD calculation executed in the context of the present project, presented in a complementary paper in this conference Grassi et al. (2013). Numerical models for each propulsion and manoeuvring devices were obtained by standard formulations. A time-domain simulator was then implemented and the standard zig-zag and turning circle tests were simulated to compare performance of the different manoeuvring and propulsion devices. It was verified that pushers equipped with azimuth thrusters can increase the manoeuvrability of the system for slow speed navigation. For higher speeds, the conventional rudder and propeller pusher presents similar or even better manoeuvring properties, since the effectiveness of the rudder increases. The additional bow azimuth thruster can also improve manoeuvrability parameters, since the force applied at the bow increases the turning moment. However, its...
efficiency depends also on the speed and the instantaneous pivot-point of pusher-barge system. A broad discussion about the advantages and physical limitations of this additional bow azimuth thruster is presented.

Manoeuvring
Propulsion systems
Pushed barges
Thrusters

2015010169

Free surface effects on hydrodynamic analysis of flapping foil thruster in waves.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786448

Filippas, E.S., Belibassakis, K.A.
English
The analysis of an oscillating wing located beneath the ship’s hull is investigated as an unsteady thruster, augmenting the overall propulsion of the ship and offering dynamic stabilization. The unsteady thruster undergoes a combined oscillatory motion in the presence of waves. For the system in horizontal arrangement the vertical heaving motion is induced by the motion of the ship in waves, essentially ship heave and pitch, while the rotational pitching motion of the flapping propulsor about its pivot axis is set by an active control mechanism. Our method is based on coupling the seakeeping operators associated with the longitudinal and transverse ship motions with the hydrodynamic forces and moments produced by the flapping lifting surfaces, using simplified unsteady lifting line theory. First numerical results presented in Belibassakis & Politis indicate that high levels of efficiency are obtained in sea conditions of moderate and higher severity, under optimal control settings. For the detailed investigation of the effects of the free surface in the paper a potential-based panel method has been developed for the hydrodynamic analysis of 2D hydrofoil operating beneath the free surface, undergoing heaving and pitching oscillations while moving with constant forward speed. The instantaneous angle of attack is influenced by the foil oscillatory motion and by the incident waves. At a first stage of development the authors consider moderate submergence and relatively low speeds permitting us to approximately neglect effects due to breaking waves and cavitation. Numerical results are presented concerning the numerical performance of the developed BEM. Also results concerning the thrust coefficient and the efficiency of the system over a range of motion parameters, including reduced frequency, Strouhal number, feathering parameter and compared against other methods. The analysis indicates that significant efficiency can be obtained under optimal operating conditions. Thus, the method can serve as a useful tool for assessment and the preliminary design and control of such systems extracting energy from sea waves for marine propulsion.

Flaps (control surfaces)
Free surfaces
Seakeeping
Thrusters

2015010170

Evaluations of a ship evacuation manoeuvre from tsunami attack.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786452

Kobayashi, E-I., Yuragi, K., Koshimura, S.
English
A tsunami generated by an earthquake in a coastal area not only raises the sea level, but also creates strong horizontal flows in bays. Any ships in the area are subject to these strong lateral flows. Since these phenomena can make a ship’s movement uncontrollable, subject piers to tremendous forces, slam ships into breakwaters, and set vessels adrift and ground them, it is very important to understand them and the resulting movement of a ship, and to consider possible countermeasures. It is particularly urgent to evaluate the effects of a tsunami on ships carrying hazardous materials, such as VLCCs (Very Large Crude Carriers), sailing near the coast or moored to a jetty, and to consider and evaluate ways of counteracting these effects. From this viewpoint, basic analyses of a VLCC’s movement resulting from a tsunami are carried out, and then countermeasures for avoiding this motion are investigated. First, this paper describes mathematical models of a tsunami flow and the manoeuvres of sailing and moored ships. Next, computer simulations of the evacuation manoeuvres of a ship at berth to avoid the effects of a tsunami are
discussed. Finally, the paper reports additional simulations of the lateral motion of a ship moored at anchor when a tsunami hits.

Manoeuvres
Tsunamis
VLCCs

2015010171

A simple and efficient method for the fat ship in waves.
Huang, M-h., Zou, Z-l., Et al
Chinese

This paper presents a simple and efficient calculation method for the ship motions in waves. The method is suitable for slender ships and fat ships to consider the three-dimensional flow field around the ship. The starting point of the method is approximating the ship section by a rectangle with the same area as that of the original ship section. Then, the flow field is divided into inner domain below the ship bottom and the outer domain beside ship hull. The velocity potential in the inner domain is given by an analytic solution, the velocity potential in the outer domain is expressed by a source-sink distribution along the contour of ship water area. The two potential solutions are matched at the interface of two domains. This method is validated using the results for the three-dimensional source-sink distribution method.

Full form ships
Ship motions

2015010172

Estimation of short term probability distributions of wave induced loads acting on a cruise vessel in extreme seas.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786206
Rajendran, S., Fonseca, N., Guedes Soares, C.
English

A time domain code based on strip theory is applied to calculate the probability distributions of relative motions and bending moments of a cruise ship in a set of extreme seas. The code includes two levels of complexity. The simpler one combines linear radiation and diffraction forces with nonlinear Froude-Krylov forces, hydrostatic forces and shipping of green water on the bow. Cummins formulation is used to represent the radiation forces. The second approach is a generalization of the first one and, although the formulation is based on the linear assumption (of the radiation forces), the effects of body nonlinearity are considered by a simplified method: the memory functions, infinite frequency added masses and the radiation restoring coefficients are assessed at each time instant as function of the instantaneous wetted surface. A similar procedure is used to calculate the diffraction forces. The code is used to analyse the responses of a cruise ship in a set of extreme sea conditions. The nonlinear radiation and diffraction effects on the responses are analysed by comparing the “fully nonlinear” results with the numerical predictions assuming linear radiation and diffraction forces. The short term nonlinear responses are represented by empirical probability distributions, obtained from time domain simulations, and the quality of the predictions is assessed by comparing with model tests experimental data.

Bending moments
Cruise ships
Probability distribution functions
Seakeeping
Ship motions

2015010173

Dynamic positioning system for a ship on harbour manoeuvring with different observers. Experimental results.
Polish Maritime Research, v 21 n 3, 2014, p 13 [12 p, 44 ref, 6 tab, 11 fig]
http://www.bg.pg.gda.pl/pmr/pmr.php
Tomera, M.
English

In cases when the navigational space of the manoeuvre performed by the ship is severely limited, the procedures making use of the rudder blade, propeller screw, and thrusters are very complicated. Such situations take place when the ship manoeuvres inside the harbour area and in those cases the structure of the control system is very complex. The article describes the algorithm of multivariable control of ship motion over the water surface, which makes use of the state vector consisting of 6 variables. Three of them, which are the position coordinates (x, y) measured by the DGPS system and
the ship heading $\psi$ measured by gyro-compass, were obtained experimentally. The three remaining variables, which are the velocities in surge $u$, sway $v$, and yaw $r$ directions, were estimated by Kalman filter, Kalman-Bucy filter and extended Kalman filter, respectively. The control algorithms making use of these observers were examined using the training ship Blue Lady which was navigated on the lake Silm in Ilawa/Kamionka. The experimental results obtained using control systems with three observers were finally compared between each other.

**Dynamic positioning**

**Manoeuvring**

**Restricted waters**

### 2015010174

**Computational simulation of motion of a rescue module during its launching from ship at rough sea.**

*Polish Maritime Research, v 21 n 3, 2014, p 54 [7 p, 11 fig]*  

**Dymarski, C., Dymarski, P.**

**English**

This paper is a continuation of the authors' previous work titled: “A computational model for simulation of motion of rescue module during its launching from stern ramp of a ship at rough sea”. It presents results of computer simulations of motion of a rescue module with embarked persons during its launching on rollers along stern ramp of a ship at rough sea. The simulations were conducted for a selected ship fitted with a launching ramp, for a few selected scenarios of sea conditions. It was assumed that during this operation the ship drifts across direction of wave propagation.

**Computer simulation**

**Launching**

**Motion**

**Rescue vessels**

### 2015010175

**Using reduced hydrodynamic models to accelerate the predictor-corrector convergence of implicit 6-DOF URANS submarine manoeuvring simulations.**

*Computers & Fluids, v 102, 10 October 2014, pp 215-236*  

**Bettle, M.C., Gerber, A.G., Watt, G.D.**

**English**

An implicit predictor-corrector method is presented for the simultaneous integration of the six degrees-of-freedom (DOF) equations of motion for a manoeuvring submarine and the unsteady Reynolds-Averaged Navier Stokes (URANS) equations describing the vehicle hydrodynamics. The novel method uses coefficient-based hydrodynamic models for estimating the Jacobian matrix for Newton iteration. The method is applied to emergency rising and horizontal plane zig-zag manoeuvres. It is shown to converge faster at each time step than under-relaxed fixed-point iteration with an optimum relaxation parameter. A simple model containing only primary linear hydrodynamic coefficients that are relatively easy to estimate or measure was found to be adequate for modelling the Jacobian matrix in these simulations.

**Manoeuvring**

**Simulation**

**Submarines**

### 2015010176

**Manoeuvrability of a semi-displacement type high speed monohull.**

*Journal of the Japan Society of Naval Architects and Ocean Engineers, v 19, 2014, pp 47-59*  
[https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_47/ article](https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_47/ article)

**Yasukawa, H., Hirata, N., Nakayama, Y.**

**Japanese**

In this paper, the effects of hull attitude change, ship speed, metacentric height $GM$ and stern appendages such as rudder, shaft bracket, bossing and propeller shaft on manoeuvrability of a high speed vessel are investigated. The range of Froude number of the studied ship is from 0.6 to 1.0. The hydrodynamic force characteristics are captured by a Circular Motion Test. Using the hydrodynamic derivatives, manoeuvrability indices are calculated. As a result, the following knowledge is obtained through the study: by inclusion of ship attitude change, $Y'\psi$...
increases, \( N'\gamma \) slightly decreases, \( Y'\gamma \, -m'\chi \) and \( N'\nu \) significantly increase. The effect of the attitude change is not negligible. Inclusion of the attitude change improves the course stability due to contribution of \( Y'\gamma \) and \( -m'\chi \) and \( N'\nu \). When ship speed increases and GM decreases, the course stability becomes worse in general although the turning performance is improved. This tendency is the same for displacement typed ships. The bare hull ship becomes unstable for course keeping in any Froude numbers, although the ship with stern appendages is stable. Thus, the effect of stern appendages on the course stability is considerably large. This is mainly due to the increase of absolute values of \( Y'\nu \) and \( N'\gamma \) by the stern appendages.

High speed vessels
Manoeuvrability
Monohulls

2015010177

A fast numerical method for internal flood water dynamics to simulate water on deck and flooding scenarios of ships.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786477
Janßen, C.F., Bengel, S., Et al

English

The paper reports the extension of a Lattice Boltzmann model for the nonlinear viscous shallow water equations (NSW) and its application to the simulation of internal flood water dynamics. The solver is accelerated with the help of NVIDIA’s CUDA framework to access the computational power of graphics processing units (GPUs). The model is validated with typical tank sloshing and cross flooding scenarios and the results are compared to analytical solutions and the results of a state-of-the-art shallow water solver on the basis of Glimm’s method.

Deck wetness
Flooding
Numerical analysis

2015010178

Ship-bank interaction of a large tanker and related control problems.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786467
Mucha, P., El Moctar, O.

English

The objective of this work is to establish a synthesis between modern methodology in the field of ship manoeuvring and control theory using the example of hydrodynamic ship-bank interactions for a large tanker. Evolving technologies have paved the way for developing increasingly sophisticated modelling techniques to study ship flows. These technologies have made it possible to resemble Planar Motion Mechanism (PMM) tests in numerical simulations using Reynolds-averaged Navier-Stokes (RANS) equations. These advances give way for the numerical determination of hydrodynamic derivatives as present in the manoeuvring equations. This methodology is adopted in the present investigation to obtain these coefficients for various separation distances to a vertical wall. Likewise, control theory has experienced vital progress enabling engineers to apply elaborate control policies in their systems. Special attention has been paid to the distinct discipline of optimal control theory and the family of Linear Quadratic (LQ) regulators. Among the popular class of conventional Proportional-Integral-Derivative (PID) controllers rather heuristic design procedures are applied; appealing to the practitioners but might not be suitable for special applications. The work presented investigates the suitability of deriving hydrodynamic properties by means of Virtual Planar Motion Mechanism (VPMM) tests for the KVLCC2 tanker travelling at various distances to a vertical wall of infinite depth. In subsequent manoeuvring simulations the performance of the introduced controllers is discussed.

Control
Interactions
Manoeuvring
Tankers
Wall effects
Experimental results on collision avoidance of autonomous ship manoeuvres.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786484
Perera, L.P., Ferrari, F.P., Et al
English
In this paper, experimental results on collision avoidance of autonomous ship manoeuvres are discussed. The collision avoidance experiments are conducted on a navigation and control platform that has been presented in a mathematical formulation as well as in an experimental setup. The mathematical formulation of collision avoidance consists of three systems: vessel traffic monitoring and information system (VTMIS), collision avoidance system (CAS), and vessel control system (VCS). The experimental platform of collision avoidance consists of a physical system that has been used to generate experimental results. The experimental platform is further divided into two sections: vessel model and navigation and control platform. The vessel model consists of a scale ship, where the CAS is implemented. The navigation and control platform consists of hardware structure and software architecture that supported for vessel model navigation. Two ship collision situations are considered in this study, where one ship is implemented under the vessel model and another ship is simulated. Finally, the successful collision avoidance results with respect various collision situations are presented.

Collision avoidance manoeuvres
Mathematical models

A method of immersed surface capture for broaching application.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786497
Horel, B., Guillerm, P-E., Et al
English
The modelling of ship behaviour in astern seas requires a large range of manoeuvrability and seakeeping knowledge since the understanding of the ship motions returns to solve a fluid structure interactions problem between waves and the ship hull. The broaching phenomenon is known as an abrupt change in motion in the horizontal plane, resulting in a loss of ship’s heading. It is characterized by a sudden divergence of yaw. Thus, there is a transfer of the kinetic energy on the roll axis that increases the risk of ship capsize. In the aim of modelling this phenomenon, the developed model uses the capture of the intersection between the ship hull and the free surface. Thus, overcoming the hydrostatic stiffness matrix and integrating directly the hydrostatic pressure on the immersed surface. This method has the advantage of taking into account nonlinearities of the wave profile into the calculation of the immersed surface, directly by performing a remodelling of the facets near the free surface. In the literature, three main factors are likely to affect the stability: the loading of the vessel, the presence of external disturbance torques and inadequate conditions of navigation, as is the case when a ship is caught in a storm. The first two factors are taken into account in the study of static stability, while the third factor is considered in the study of the instantaneous stability. Hydrostatic behaviour of a ship is interesting when one wants to know her intact stability limits in calm seas. However, in the study of the ship behaviour in following seas, the ship is no longer in usual conditions of navigation, but in unsuitable conditions requiring the study of the instantaneous stability. In the model formulation, the dynamic torsor comes from the general non-linear manoeuvrability equations and the time advance is solved by a 4th order Runge Kutta scheme with a constant time step. The torsor of the total applied
mechanical action on the ship hull is expressed as the superposition of six torsors (gravity, hydrostatic, Froude Krylov, radiation, hydrodynamics and manoeuvrability) expressed in the centre of gravity of the ship. Thus, a strong coupling between the manoeuvrability and seakeeping equations is obtained. Validation cases will be conducted and presented. The improvement of the model will require the implementation of test campaigns that will be specific for the study of ship behaviour in astern seas. Validation of the model will help to define new stability criteria for ships in wave.

Broaching  
Hydrostatics  
Kinetic energy  
Stability  

2015010181

Parametric roll of high speed ships in regular waves.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786500

Moideen, H., Somayajula, A., Falzarano, J.M.
English

Analysis of ship parametric roll has generally been restricted to simple analytical models and sophisticated time domain simulations. Simple analytical models do not capture all the critical dynamics while time-domain simulations are often time consuming to implement. The model presented in this paper captures the essential dynamics of the system without over simplification. This work incorporates various important aspects of the system and assesses the significance of including or ignoring these aspects. Special consideration is given to the fact that a hull form asymmetric about the design waterline would not lead to a perfectly harmonic variation in metacentric height. Many of the previous works on parametric roll make the assumption of linearized and harmonic behaviour of the time-varying restoring arm or metacentric height. This assumption enables modelling the roll motion as a Mathieu equation. This paper provides a critical assessment of this assumption and suggests modelling the roll motion as a Hills equation. Also the effects of non-linear damping are included to evaluate its effect on the bounded parametric roll amplitude in a simplified manner.

High speed vessels  
Regular waves  
Rolling  

2015010182

Stopping of ships equipped with Azipods.
TransNav Journal, v 8 n 3, September 2014, p 373
[4 p, 4 ref, 2 tab, 6 fig]
http://www.transnav.eu/Article_Stopping_of_Ships_Equipped_Nowicki,31,519.html

Nowicki, J.
English

The paper discusses different possibilities of stopping a large ship equipped with azipods. Model tests were carried out to compare the effectiveness of stopping the ship using the different methods. The ship model used in stopping tests reproduces a large LNG carrier of 150 000 m³ capacity.

Electric propulsion  
Manoeuvring devices  
Stopping  

2015010183

Trim optimisation – theory and practice.
TransNav Journal, v 8 n 3, September 2014, p 387
[6 p, 4 ref, 1 tab, 6 fig]

Reichel, M., Minchev, A., Larsen, N.L.
English

This paper describes the trim optimisation process for a large cargo vessel. The physics behind changed propulsive power is described and the analyses in order to elaborate the optimum trimmed conditions are presented. Different methods for prediction of required power in trimmed conditions are presented and results are compared against each other. The
methods with their advantages and disadvantages are discussed. On the basis of power prediction, a trim guidance with dedicated SeaTrim® software for ship master is made and presented.

Computational fluid dynamics
Optimisation
Stability
Trim

2015010184

The need of the revision of passenger ships’ stability criterion on account of turning.
TransNav Journal, v 8 n 3, September 2014, p 393
[7 p, 13 ref, 2 tab, 4 fig]
http://www.transnav.eu/Article_The_Need_of_the_Re vision_Szoda_31_522.html

Szoda, Z.
English

The angle of heel on account of turning is one of the mandatory stability criteria for passenger ships. Formula used for calculations of this criterion contained in the International Code on Intact Stability is criticized at present. Agendas of the Sub-committee on Ship Design and Construction (SDC) for the first (2014) and the second (2015) sessions contain the item on revision of this criterion and corresponding regulation. The paper presents some shortcomings of the criterion. Turning tests of a freely manoeuvring model of a passenger ship have been executed aiming at gathering data for the future discussion and its facilitation. The paper presents results of the tests together with preliminary conclusions that confirm the need of the revision of the regulation and put forward concerns on application of such values as initial metacentric height (GMo) and righting lever curve (GZ (?) calculated for a ship laying still for calculation of a ship’s heel caused by turn.

Passenger ships
Stability
Standards
Turning manoeuvres

2015010185

Steady-state manoeuvring of a generic ASD tug in escort pull and bow-rope aided push operation.
TransNav Journal, v 8 n 3, September 2014, p 449
[9 p, 6 ref, 7 fig]
http://www.transnav.eu/Article_Steady-state_Manoeuvring_Artyszuk_31_529.html

Artyszuk, J.
English

This paper is devoted to expand the research undertaken in the author’s previous work, basically done on simplified modelling the escort push operation. Now, the other two modes of a tug's employment, as stated in the title, are covered. The special focus is again set on the indirect towing in that the towline force is much higher than the thruster force. The ratio of these two forces, referred to as the relative towing force (or amplification ratio) is evaluated together with the hull drift angle and the thruster(-s) angle for a given escort speed. This mutual relationship is known as the tug performance diagram. Although rather generic (container-type) formulas are derived, they are supplied for exemplification purposes with simple, analytically given hull hydrodynamic forces. The aim is also here to provide a basis for further sensitivity analysis of the model and possible improvement/optimisation to the tug design. The obtained charts also could serve as rough and clear guidance for tow masters while escorting.

Manoeuvring
Tugs

2015010186

Comparative analysis of the results of measurements and calculations of period's oscillation motion of the training ship model.

Mironiuk, W.
English

Results of tests of a training-ship model’s free rolling are presented. The paper presents the description of the laboratory and results of rolling. The first stage of research presents the immersion testing the ship model and the results recorded during the study are
presented in the paper. Next, the determined values were used to calculate periods of the model rolling and compared with results of the tests.

Model tests
Rolling

2015010187

Experimental and numerical extreme motions and vertical bending moments induced by abnormal waves on a bulk carrier.
Vasquez, G., Fonseca, N., Guedes Soares, C.
English

This investigation focuses on the motions and global structural loads induced by abnormal waves on a bulk carrier. A nonlinear time domain method based on strip theory is used to predict the ship responses. The results are compared with experimental data obtained at the model scale. The time domain hydrodynamic forces are calculated by convolution of linear memory functions, while nonlinear contributions arise from Froude-Krylov forces, hydrostatic forces and shipping of green water. The time domain simulations are compared directly with experimental records from bulk carrier model tests with in head waves for two Froude numbers. Extreme wave conditions (such as the New Year Wave) previously measured at sea during real storms were replicated both at the seakeeping tank and by the numerical code. The comparison analyses show a good agreement between numerical and experimental with good accuracy.

Bending moments
Bulk carriers
Irregular waves
Ship motions
Ship response

2015010188

Time-domain analysis of passenger comfort on cruise ships under motion responses in waves.
http://pim.sagepub.com/content/228/4/331.abstract
Kim, J-H., Kim, Y.
English

The assessment of passenger comfort in modern cruise ships is considered from a hydrodynamic point of view, in addition to improvement using stabilizing fins. Passenger comfort is evaluated in this study based on the symptoms of motion sickness on ships provoked by low-frequency whole-body vibration. Motion sickness dose value is an index used to quantify seasickness and is chosen as a primary index to evaluate passenger comfort. To calculate motion sickness dose value in the time domain, a time series of vertical accelerations should be processed using frequency filters, which are defined in the international standards and guidelines provided by classification societies as forms of transfer functions in the frequency domain. Digital frequency band-limiting and weighting filters are formulated as a form of infinite impulse response filter and then applied to the present case. Two pairs of stabilizing fins are equipped to reduce the roll and pitch motions and to improve the passenger comfort on a model cruise ship. A linear optimal control algorithm, linear quadratic Gaussian, is considered to actuate each stabilizing fin. Numerical computations are carried out based on practical operating conditions for the cruise ship model using a time-domain ship motion program, which integrates the motion control algorithm and the passenger comfort analysis. The results of computations show that passenger comfort on a cruise ship can be evaluated appropriately by computing the index motion sickness dose value in the time domain. The motion stabilization by the stabilizing fins can be considered as a good method to reduce the motion of the present cruise ship model and eventually contribute to improve passenger comfort.

Comfort
Cruise ships
Fin stabilizers
Motion sickness
Time domain
A study on a fixed type fin stabilizer exploiting the Coanda effect.
Seo, D-W., Lee, S-J., Et al English

A ship operating in rough sea may suffer from an undesirable motion which may severely affect the performance of the equipment onboard and make a person feel uncomfortable. Hence, considerable attention turned to roll stabilization, and various devices such as bilge keels, stabilizing fins, gyroscopic devices, tanks, rudders and flaps have been conceived and utilized for that purpose. The Coanda effect is evident when a jet of a fluid is applied tangentially to a curved surface of a hydrofoil since the jet then increases the circulation around the foil, and accordingly the lift. In this study, model tests and numerical simulations have been conducted to examine the practicality of a fixed type fin stabilizer augmented by the Coanda jet. The results show that the lift coefficient of the modified Coanda fin at the angle of attack $\alpha=0^\circ$ matches with that of the reference stabilizer fin at the maximum operating angle of attack $\alpha = 260$ if the Coanda jet is supplied at the rate of the jet momentum coefficient $C_j = 0.1$. It is also concluded that fixed type fin stabilizers can be put to practical use for active motion control of ships and other mobile units by exploiting the Coanda effect.

Coanda effect
Control surfaces
Fin stabilizers

Full scale CFD validation on thruster-hull interaction on a semi-submersible crane vessel in transit condition.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786624
Ottens, H., Bulten, N., Dijk, R. van English

Heerema Marine Contractors of the Netherlands operates three semi-submersible crane vessels; the Thialf, Balder and Hermod. The first two vessels are equipped with a DP system. The ability of each crane vessel to keep its position depends highly on the performance of the DP system of that crane vessel. The thrust efficiency of the DP system depends on the efficiency of the individual thruster, but also on the interaction of the thruster wake and the hull of the vessel. Thruster-hull interaction is important during operations, but also during transits from one location to another. During the transits of the Balder and Thialf, the DP thrusters are used as propulsion. Understanding the thruster-hull interaction effects in this transit condition can result in an optimum thrust setting. In previous validation studies CFD was used to assess the current loads and the thruster-hull interaction on a semi-submersible vessel. In these studies the CFD results were validated with a series of dedicated model tests. The comparison between the CFD and model test data shows that CFD is able to predict the relevant force components within a sufficient accuracy for engineering purposes. However, Heerema Marine Contractors is mainly interested in full scale data. Unfortunately, not much full scale data is available to validate the extrapolation of model test and CFD results to full scale thruster efficiency. Therefore a first validation study is performed based on acquired full scale data during a transit of the Thialf in Q4 2011. Comparing the full scale test data with the CFD results shows that the CFD can be used to predict which settings is the most efficient. Optimisation of thruster settings on semi-submersible vessels is not trivial due to number and location of the azimuth thrusters. Using CFD simulations the power settings and azimuth angles of the thrusters were changed to obtain the optimal thrust setting during transit. In Q2 2012 the Thialf made her first transit after a dry-dock period in which the hull was cleaned and painted. Repeating similar tests conditions as in Q4 2011 demonstrates
the effect of a clean hull. Additional tests demonstrated the effect of a more efficient thrust setting originated by the CFD results. The implications of the optimised azimuth setting in transit on the life time of the thruster is verified using CFD and FEM. The paper addresses lessons learnt to improve the CFD simulations as well as practical aspects and limitations of thrust efficiency modelling using CFD. It demonstrates that CFD can be used to understand the associated flow physics and that CFD can be used to predict improvements in thrust efficiencies. In addition, some lessons learnt on full scale monitoring will be addressed.

Computational fluid dynamics
Floating cranes
Interactions
Semisubmersibles
Thrusters

2015010191
Modelling thruster-hull interaction with CFD.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786626
Maciel, P., Koop, A., Vaz, G.

The application of CFD for the analysis of thruster interactions effects (or degradation effects) is still a largely unexplored area. Quantifying these effects is essential to the design of dynamic positioning (DP) vessels. Presently, thruster interactions can be quantified using data available from literature, which unfortunately is often scarce, too general or not applicable to specific designs. Dedicated model tests, on the other hand, do provide detailed results but are relatively expensive and tend to become available relatively late in the design process. Alternatively, with CFD different vessel designs and thruster layouts can be investigated for thruster interaction effects in a cost-efficient manner early in the design process. This paper presents a practical method for modelling thrusters, describing the propeller blades as an actuator disk. Numerical choices for the calculations are discussed and steady state calculations are performed. This approach is evaluated on thruster-hull interaction cases in both bollard pull and under current conditions, for a series of configurations with increasing complexity: a thruster in open water, a thruster positioned under a flat plate and a thruster under a barge. A comparison to experimental results is presented for the flow field (against PIV experimental data) and forces on the thrusters and hull of the vessel. A modern Verification and Validation procedure is used to quantify uncertainties. The results are encouraging, both in a qualitative and quantitative sense. In this context, the modelling approach employed proves to be a robust and accurate solution, with low computational effort, and therefore appropriate to be used for much more complex real applications.

Computational fluid dynamics
Hulls
Interactions
Thrusters

3.4 FLUID STRUCTURE INTERACTION

2015010192
Wake-induced vibration of tandem cylinders of different diameters.
Assi, G.R.S.

The wake-induced vibration (WIV) of the downstream cylinder of a tandem pair is investigated for different diameter ratios of D1/D2=1/1, 1/2 and 1/3, where D 1 and D 2 refer to the upstream and downstream cylinders, respectively. The streamwise separation between the cylinders was L/D1=3.5, 7.0 and 6.5, respectively, measured from the centre of the upstream cylinder to the forward stagnation point of the downstream cylinder. Experiments with low mass-damping cylinders have been conducted in a water channel at around Re=25 000. The dynamic response showed that the downstream cylinder experienced WIV for all diameter ratios investigated, with displacement amplitudes reaching more than 1.5 diameters for higher reduced velocities beyond the vortex resonance range. The frequency response showed a similar behaviour for all three configurations, giving hints that a type of wake-stiffness mechanism might be governing the frequency of oscillation for all diameter ratios. The response was found to be dependent on both D1/D2D1/D2 and L/D1L/D1. In all cases, the static upstream cylinder was found to shed vortices as an
isolated cylinder, not influenced by the presence or movement of the downstream body. Lift and drag coefficients as well as measurements of velocity fluctuations in both wakes are presented for all cases.

Cylindrical bodies
Tandem arrangement
Vibration
Vortex shedding
Wakes

2015010193
Wake-induced vibration of tandem and staggered cylinders with two degrees of freedom.
Journal of Fluids and Structures, v 50, October 2014, pp 340-357
Assi, G.R.S.
English

The wake-induced vibration (WIV) of two staggered cylinders with two degrees of freedom (2-dof) has been investigated by experiments in a water channel for Reynolds number between 2000 and 25 000. The streamwise separation was fixed to 4 diameters and the lateral separation varied between 0 and 3 diameters for tandem and staggered configurations. Results are presented in the form of trajectories of motion and dynamic response curves of displacements, frequencies and force coefficients. Excitation caused by the WIV mechanism is found to get weaker as the initial position of the downstream cylinder is increased from the centreline of the wake (tandem arrangement) towards the sides. For a lateral separation of 3 diameters wake interference was already found to be negligible. Evidence of a type of wake-stiffness concept is also observed to occur for 2-dof WIV in tandem arrangement, especially for higher reduced velocities. A similar mechanism may also be occurring for staggered arrangements around the centreline.

Cylindrical bodies
Vibration
Wakes

2015010194
Wake-induced vibrations of an elastically mounted cylinder located downstream of a stationary larger cylinder at low Reynolds numbers.
Journal of Fluids and Structures, v 50, October 2014, pp 479-496
Wang, H., Yang, W., Et al
English

Two-dimensional numerical simulations of flow past two unequal-sized circular cylinders in tandem arrangement are performed at low Reynolds numbers (Re). The upstream larger cylinder is stationary, while the downstream cylinder has both one (transverse-only) and two (transverse and in-line) degrees of freedom (1-dof and 2-dof, respectively). The Re, based on the free stream velocity $U_\infty$ and the downstream cylinder diameter $d$, varies between 50 and 200 with a wide range of reduced velocities $U_r$. The diameter of the upstream cylinder is twice that of the downstream cylinder and the centre-to-centre spacing is 5.5d. In general, for the 1-dof case, the calculations show that the wake-induced vibrations (WIV) of the downstream cylinder are greatly amplified when compared to the case of a single cylinder or two equal-sized cylinders. The transverse amplitudes build up to a significantly higher level within and beyond the lock-in region, and the $U_r$ associated with the peak amplitude shifts toward a higher value. The dominant wake pattern is 2S mode for Re=50 and 100, while with the increase of Re to 150 and 200, the $P+S$ mode can be clearly observed at some lower $U_r$. For the 2-dof vibrations, the transverse response characteristics are similar to those presented in the corresponding 1-dof case. The in-line responses are generally much smaller, except for several significant vibrations resulting from in-line resonance. The obvious in-line vibration may induce a C (chaotic) vortex shedding mode for higher Re (Re=200). With regard to the 2-dof motion trajectories, besides the typical figure-eight pattern, several odd patterns such as figure-double eight and single-looped trajectories are also obtained due to the wake interference effect.

Tandem arrangement
Vibration
Wakes
2015010195

On the intrinsic mechanism of wakes interference past two cylinders towed beneath a free surface.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786438

Rajaona, D.R., Ramanakoto, T.
English

An experimental study of the flow past a set of two horizontal cylinders is presented. The cylinders are towed in a uniformly accelerated and decelerated motion in a visualization tank in order to enhance the vortex effects. The main cylinder (D = 0.04 m; L/D = 16) is placed in the flow past a front one (d = 0.002m; L/D = 16). They are towed beneath the free surface and the drag and lift forces are measured. The main cylinder wake pattern is visualized by an embarked CCD camera. The Reynolds number based on the maximum velocity is from 0 to 14000 and the Froude number based on the main cylinder immersion from 0.2 to 1.2 for an acceleration value of 0.15m.s⁻². It is shown that the near wake is made of a combination of the main cylinder Von Karman vortices and those of the front cylinder. The interference phenomenon and the free surface effects are studied by varying the depth parameter and the two cylinders arrangements.

Cylindrical bodies
Wakes

2015010196

Hydrodynamic interactions in multiple body array: a simple and fast approach coupling boundary element method and plane wave approximation.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786444

Singh, J., Babarit, A.
English

The hydrodynamic forces acting on an isolated body could be considerably different than those when it is considered in an array of multiple bodies, due to wave interactions among them. In this context, this paper presents a numerical approach based on the linear potential flow theory to solve full hydrodynamic interaction problem in a multiple body array. In contrast to the previous approaches that considered all bodies in an array as a single unit, the present approach relies on solving for an isolated body. The interactions among the bodies are then taken into account via plane wave approximation in an iterative manner. The boundary value problem corresponding to an isolated body is solved by the Boundary Element Method (BEM). The approach is useful when the bodies are sufficiently distant from each other, at-least greater than five times the characteristic dimensions of the body. This is a valid assumption for wave energy converter devices array of point absorber type, which is our target application at a later stage. The main advantage of the proposed approach is that the computational time requirement is significantly less than the commonly used direct BEM. The time savings can be realized for even small arrays consisting of four bodies. Another advantage is that the computer memory requirements are also significantly smaller compared to the direct BEM, allowing us to consider large arrays. The numerical results for hydrodynamic interaction problem in two arrays consisting of 25 cylinders and same number of rectangular flaps are presented to validate the proposed approach.

Approximation
Boundary element method
Interactions
Multibody systems

2015010197

Experimental investigation of dynamic response of tension leg platform with perforated members.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786451

Srinath, V., Chandrasekaran, S.
English

Perforated cylindrical structures are extensively used in near-shore breakwaters to reduce wave-structure interaction and scouring; however use of perforated members on floating offshore structures is not widespread. This study investigates the influence of perforated members on the dynamic response of
Tension Leg Platforms (TLP) through model testing. Detailed experimental investigations are carried out on the scale model of TLP with and without porous outer cover, under unidirectional regular waves. Based on studies conducted, it is shown that fluid-structure interaction is reduced in the presence of outer perforated covers; as a result, surge and pitch responses decrease.

Dynamic response
Model tests
Tension leg platforms

2015010198

Vortex-induced motion evaluation on semi-submersible platforms using a time domain methodology.
Volume 5: Ocean Engineering, Paper OMAE2013-10725 [8 p]
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786458
Lacerda, T.A.A.G. de, Ellwanger, G.B., Senra, S.F.
English

As exploitation activities moves into fields located in deep water, the industry has been addressing studies aiming at concepts of platforms that reduce the influence of environmental loads on risers. The deep draft semi-submersible platform is one of these concepts. The semi-submersible deep draft platform is described in a simplified way as a deck supported by columns connected by pontoons. This particular geometry can make this structure susceptible to a significant low frequency vibration movement caused by vortex shedding. This phenomenon is usually known as VIM (Vortex Induced Motions). The amplitude of these motions depends on some parameters such as current velocity, hydrodynamic diameter of the column, natural frequency of the platform due to the mooring system and structural damping (hull, mooring lines and risers). One of the consequences of these motions is the increase of the fatigue damage on the risers connected to the platform. In a previous work presented by the authors in 2009, a time domain methodology based on a Van der Pol equation was described. This methodology was developed in order to represent the vortex shedding phenomenon. In this paper the Van der Pol methodology is improved by considering the VIM phenomenon acting on a multicolumn structure.

Motion
Offshore structures
Semisubmersibles
Vortices

2015010199

Long-term extreme response of marine structures considering the combination of first and second order wave effects.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786173
Sagriolo, L.V.S., Sousa, F.J.M. de, Et al
English

In this paper, the long-term extreme response of a floating marine structure subjected to first and second order (slow-drift) wave effects is addressed. The proposed formulation is based on the long-term up-crossing rate, which is obtained by integrating the contribution of all short-term sea states. In order to speed up the evaluation of the long-term integral, an analytical expression for the short-term responses up-crossing rates was adopted. This expression is based on Hermite polynomials, and considers the response as a second order Volterra stochastic process. This formulation was applied to evaluate the 1-yr, 10-yr and 100-yr lateral motions of a circular-shaped monocolumn platform, and the non-Gaussian (nonlinear) results are compared with those obtained by assuming the response as a Gaussian process.

Dynamic response
Floating structures
Wave loads on structures
Structural response analysis of LNG CCS experiencing the sloshing impact determined by both convolution of fluid structure interaction methods.

http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786183

Hwang, S.Y., Lee, J.H., Et al
English

Sloshing assessment of LNG cargo tanks is expected to satisfy the required structural strength of insulation components. It is difficult to estimate the sloshing pressure and structural response of cargo containment in real size because of the uncertainty of intensive computation time as well as the complexity of sloshing motion. In this study, several procedural components are suggested to meet the endurable strength of LNG CCS during the design of LNG cargo containment. The measured sloshing impacts from small scale model test are treated by individual impacts. Thereafter, static and transient structural response of LNG CCS is sequentially performed in order to evaluate the structural strength. The structural response is also calculated in time series through convolution method considering the history of pressure. It is used to investigate the structural response induced by the history of impacts. Finally, an idealized fluid structure interaction on the localized insulation panel is investigated in order to evaluate the structural strength in actual scale.

Fluid structure interaction
LNG tanks
Sloshing
Structural response

A small scale field experiment for hydrodynamic coefficients of Morison’s forces in random waves.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786200

Arena, F., Fiamma, V.
English

The paper deals with wave forces on vertical and horizontal cylinders through the Morison’s equation. In particular, the hydrodynamics coefficients on cylinders are investigated by means of two small scale field experiments, by analysing two stationary random processes of time: the measured wave force $F_a(t)$, and the wave force calculated with the Morison equation $F_c(t)$. The kinematics in the Morison’s equation is obtained with the theory of wind-generated waves from the directional wave spectrum obtained from measurements of surface waves. Starting from the measurements a new approach is proposed for the evaluation of the hydrodynamic coefficients of Morison’s forces for random sea waves. Finally, the distributions of the peaks of the random wave forces, $F_a(t)$, and $F_c(t)$, is achieved.

Cylindrical bodies
Hydrodynamic coefficients
Morison equation
Wave forces on structures

Forcing of a bottom-mounted circular cylinder by steep regular water waves at finite depth.
Journal of Fluid Mechanics, v 755, September 2014, pp 1-34
http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9318659&fulltextType=RA&fileId=S0022112014003863

Paulsen, B.T., Bredmose, H., Et al
English

Forcing by steep regular water waves on a vertical circular cylinder at finite depth was investigated numerically by solving the two-phase incompressible Navier–Stokes equations. Consistently with potential flow theory, boundary layer effects were neglected at the sea bed and at the cylinder surface, but the strong nonlinear motion of the free surface was included. The numerical model was verified and validated by
grid convergence and by comparison to relevant experimental measurements. First-order convergence towards an analytical solution was demonstrated and an excellent agreement with the experimental data was found. Time-domain computations of the normalized inline force history on the cylinder were analysed as a function of dimensionless wave height, water depth and wavelength. Here the dependence on depth was weak, while an increase in wavelength or wave height both lead to the formation of secondary load cycles. Special attention was paid to this secondary load cycle and the flow features that cause it. By visual observation and a simplified analytical model it was shown that the secondary load cycle was caused by the strong nonlinear motion of the free surface which drives a return flow at the back of the cylinder following the passage of the wave crest. The numerical computations were further analysed in the frequency domain. For a representative example, the secondary load cycle was found to be associated with frequencies above the fifth- and sixth-harmonic force component. For the third-harmonic force, a good agreement with the perturbation theories of Faltinsen, Newman & Vinje (1995) and Malenica & Molin (1995) was found. It was shown that the third-harmonic forces were estimated well by a Morison force formulation in deep water but start to deviate at decreasing depth.

Breaking waves
Cylindrical bodies
Gravity waves
Fluid structure interaction
Numerical analysis

2015010203
Scaling of the hydroelastic response of flexible lifting bodies in transitional and turbulent flows.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786478
Ducoin, A., Young, Y.L.
English

The objective of this research is to derive and validate scaling relationships for flexible lifting bodies in transitional and turbulent flows. The motivation is to help the design and interpretation of reduced-scale experimental studies of flexible hydrofoils, with focus on the influence of viscous effects on the hydroelastic response. The numerical method is based on a previous validated viscous FSI solver. It is based on the coupling between a commercial Computational Fluid Dynamics (CFD) solver, CFX, and a simple two-degrees-of-freedom (2-DOF) system that simulates the free tip section displacement of a cantilevered, rectangular hydrofoil. To validate the scaling relations, sample numerical results are shown for three geometrically similar models: full scale, 1/2 scale and 1/10 scale. On the fluid side, although the effects of gravity and compressibility are assumed to be negligible, three different methods of scaling the velocity are considered: Reynolds scaling, Froude scaling, and Mach scaling. The three scaling methods produce different velocity scales when the fluid properties and gravitational constant are the same between the model and prototype, which will lead to different scaling for the material properties. The results suggest that by applying Mach scaling (which does not mean the flow is compressible, but simply requires the relative inflow velocity and fluid properties to be the same between the model and the prototype) and Re ≥ 2 × 10^6, the same material as the full scale could be used, which will lead to similar stress distributions, in addition to similar strains, and hence similar hydroelastic response and failure mechanisms. However, if Re ≤ 2 × 10^6 and Mach scale is used, a viscous correction is required to properly extrapolate the experimental results to full-scale.

Hydroelasticity
Lifting surfaces
Turbulent flow

2015010204
Simulation of the gap resonance between two rectangular barges in regular waves by a free surface viscous flow solver.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786488
Elie, B., Reliquet, G., Et al
English

This paper compares numerical and experimental results in the study of the resonance phenomenon which appears between two side-by-side fixed barges for different sea-states. Simulations were performed using SWENSE (Spectral Wave Explicit Navier-
Stokes Equations) approach and results are compared with experimental data on two fixed barges with different headings and bilges. Numerical results, obtained using the SWENSE approach, are able to predict both the frequency and the magnitude of the RAO functions.

Barges
Multibody systems
Resonance
Viscous flow

2015010205
Development of a computer program for three dimensional analysis of zero speed first order wave body interaction in frequency domain.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786499
Guha, A., Falzarano, J.
English
Evaluation of motion characteristics of ships and offshore structures at the early stage of design as well as during operation at the site is very important. Strip theory based programs and 3D panel method based programs are the most popular tools used in industry for vessel motion analysis. These programs use different variations of the Green’s function or Rankine sources to formulate the boundary element problem which solves the water wave radiation and diffraction problem in the frequency domain or the time domain. This study presents the development of a 3D frequency domain Green’s function method in infinite water depth for predicting hydrodynamic coefficients, wave induced forces and motions. The complete theory and its numerical implementation are discussed in detail. An in house application has been developed to verify the numerical implementation and facilitate further development of the program towards higher order methods, inclusion of forward speed effects, finite depth Green function, hydro elasticity, etc. The results were successfully compared and validated with analytical results where available and the industry standard computer program for simple structures such as floating hemisphere, cylinder and box barge as well as complex structures such as ship, spar and a tension leg platform.

Green function
Fluid structure interaction

2015010206
A classification of shallow water resonant sloshing in a rectangular tank.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786842
Bouscasse, B., Colagrossi, A., Et al
English
A numerical and experimental analysis of sloshing phenomena (i.e. violent fluid motions inside a tank) has been conducted in shallow water regimes. A large range of experimental data from moderate to large amplitude sway motions has been considered for different filling heights. The numerical simulations, performed through a δ-SPH model, aim to cover the configurations where no experiments were available and provide an exhaustive description of the shallow-water sloshing motion.

Resonance
Sloshing
Tanks

2015010207
Impact of elastic body on the deep and shallow water.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786845
Korobkin, A.A., Khabakhpasheva, T.I.
English
Two-dimensional unsteady problem of elastic body impact on liquid free surface is considered. The water is either of infinite depth or shallow. This paper is
concerned with the effect of the water depth on the bending stresses in the structure caused by the fluid-structure interaction. The Wagner model is used for infinite water depth. In the case of shallow water impact, the hydrodynamic problem is one-dimensional but nonlinear. Both problems for deep and shallow waters are solved numerically by the normal mode method. Two shapes of the body, cylindrical shell and elastic wedge, are considered. The impact conditions and the structural characteristic are identical. The bending stresses in the structure are investigated. It is shown that the bending stresses for impact on shallow water are greater than those for the infinite water depth. The developed methods and approaches can be combined with FFM to include complex structures.

Bending stress  
Elastic bodies  
Fluid structure interaction  
Water depth  

2015010208  
**A model scale experimental investigation on vortex-self induced vibrations (VSIV) of catenary risers.**  
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786631  
**Pereira, F.P., Gonçalves, R.T., Et al**  
English  
Vortex Self-Induced Vibrations (VSIV) of a reduced scale model of a catenary riser were experimentally investigated. The riser model dynamics were assessed with a submerged optical motion capture system and significant VSIV were revealed as result of oscillatory vertical motion imposed to the top. Such behaviour recovers similar ones reported in the technical literature by other authors and resembles previous fundamental studies, by Sumer and Fredsoe, with rigid cylinders forced to oscillate in a plane and elastically mounted in the transversal direction. The present experiments are preliminary and pertain to a much more comprehensive experimental set, within a research project aimed at studying the nonlinear dynamic behaviour of risers, through experimentally validated analytical and numerical, nonlinear reduced-order models.

Model tests  
Risers  
Vortex induced vibration

2015010209  
**Experimental study on flow around circular cylinders with low aspect ratio.**  
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786632  
**Gonçalves, R.T., Rosetti, G.F., Et al**  
English  
Experiments were carried out in a recirculating water channel regarding the flow around stationary circular cylinders with low aspect ratio piercing the water free surface. Eight different aspect ratios were tested, namely L/D = 0.1, 0.2, 0.3, 0.5, 0.75, 1.0, 1.5 and 2.0; this range corresponds to aspect ratio related to circular offshore systems, such as spar and monocolumn platforms. Force was measured using a six degree-of-freedom load cell and Strouhal number is inferred through the transverse force fluctuation frequency. The range of Reynolds number covers 10,000 < Re < 50,000. PIV measurements were performed in some aspect ratio cases, namely 0.3, 0.5, 1.0 and 2.0 for Reynolds number equal to 43,000. The results showed a decrease in drag force coefficients with decreasing aspect ratio, as well as a decrease in Strouhal number with decreasing aspect ratio. The PIV showed the existence of an arch-type vortex originated in the cylinder free end.

Cylindrical bodies  
Experimentation  
Fluid flow
Vortex induced vibration of circular cylinder with two degrees of freedom: computational fluid dynamics vs. reduced-order models.


http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786633

Wang, E., Xiao, Q., Et al

Computational fluid dynamics (CFD) studies capturing vortex-induced vibration (VIV) phenomena in a wide range of both the hydrodynamics and the structural parameters are important, because the analysis outcomes can be applied to numerical prediction codes, complement experimental measurement results and suggest a modification of some practical design guidelines. Nevertheless, in spite of many published studies on VIV, CFD studies for two dimensional coupled cross-flow/in-line VIV even with two degrees of freedom (2-DoF), are still quite limited. More CFD studies which can control the equivalence of system fluid-structure parameters in different directions with reduced uncertainty are needed to improve the numerical model empirical coefficients and capability to effectively match numerical predictions and experimental outcomes. This paper presents a CFD study on the 2-DoF VIV of elastically mounted circular cylinder with a low mass ratio ($m^* = 2.55$). The Reynolds number is fixed to be 150 and the reduced flow velocity parameter is varied by changing the cross-flow natural frequency. To model the problem, two-dimensional Navier-Stokes equations coupled with linear structural equations in the in-line and cross-flow directions are solved. Particular attention is paid to the determination of maximum attainable amplitudes and the associated instantaneous lift and drag forces and hydrodynamic coefficients. These results are compared with the obtained results from alternative numerical prediction outcomes using new reduced-order models with four nonlinearly coupled wake-structure oscillators (Srinil and Zanganeh, 2012). Some qualitative and quantitative aspects are discussed. Overall, the important VIV characteristics are captured including the dual-resonance and figure-of-eight trajectories. Through the flow visualization study, it is found that as the dual-resonance is excited, a P+S wake pattern appears.

Vortex induced vibration experiment research of two cylinders in tandem arrangement.


http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786634

Kang, Z., Liu, W., Qin, W.

The vortex-induced vibration of tandem arrangement of two cylinders compared with the single cylinder is more complicated. The double cylinder arranged in tandem, which is free to move in two degrees of freedom respectively, and which has low mass and damping. This study shows that a critical centre-to-centre spacing can be used to distinguish the far and near wake interference. The streams in this test were uniform flow, ranging from 0.2m/s to 0.8m/s with the interval of 0.1m/s. The Re numbers are ranging from 22000 to 88000. The mass ratio of cylinder is low. For far wake interference, the downstream cylinder shows large amplitudes of response, therefore the wake induced vibration (WIV) is found. For near wake interference, both the upstream cylinder and downstream cylinder are exposed to an evident phenomenon of VIV, but the amplitude of upstream and downstream are less than that of single cylinders in cross-flow direction and in-line direction. The critical spacing was found to be 3.4 to 4.9.
A power equation model for vortex-induced vibration of circular cylinder.

Qin, W., Kang, Z., Et al

Based on a semi-empirical model of vortex-induced vibration of an elastically mounted circular cylinder, the general equation of dynamics is put forward to establish the power equation for free vortex-induced vibration in this paper. The derivation of the governing equation is the general method to analyse fluid-structure interaction without priori assumptions about the form of the governing equations, which is of good/strong applicability and expansibility. To estimate the reliability of power equation in free vibrations, the power equation acquiring flow field provided by CFD is solved and compared with the experimental results. Results show that the power equation is effective to predict the response of structure in vortex induced vibration.

Cylindrical bodies
Vortex induced vibration

4.1 STRUCTURAL RESPONSE

Effective shear area in one dimensional ship hull finite element models to predict natural frequencies of vibration.

Souza e Silva, O.P., Silva Neto, S.F. da, Et al

This work discusses procedures used to determine effective shear area of ship sections. Five types of ships have been studied. Initially, the vertical natural frequencies of an acrylic scale model 3m in length in a laboratory at university are obtained from experimental tests and from a three dimensional numerical model, and are compared to those calculated from a one dimensional model which the effective shear area was calculated by a practical computational method based on thin-walled section Shear Flow Theory. The second studied ship was a ship employed in midshipmen training. Two models were made to complement some studies and vibration measurements made for those ships in the end of 1980 decade when some vibration problems in them were solved as a result of that effort. Comparisons were made between natural frequencies obtained experimentally, numerically from a three dimensional finite element model and from a one dimensional model in which effective shear area is considered. The third and fourth were, respectively, a tanker ship and an anchor handling tug supply boat, both with comparison between three and one dimensional models results out of water. Experimental tests had been performed in these two ships and their results were used in other comparison made after the inclusion of another important effect that acts simultaneously: the added mass. Finally, natural frequencies experimental and numerical results of a barge are presented. The natural frequencies numerical results of vertical hull vibration obtained from these approximations of effective shear areas for the five ships are finally discussed.

Finite element method
Hull vibration
Resonant frequency
Shear strain

Assessment of fatigue reliability for jacket-type offshore platforms considering dynamic behaviour.

Khedmati, M.R., Rigo, P., Et al

In order to traditionally investigate the strength of marine structures, the structure is subjected to a maximum static load. However, the marine structures are usually suffering environmental forces varying with time. Wave forces are the most important time
dependent loading that causes fatigue in structural elements and joints. In this paper different methods base on S-N curve and linear elastic failure mechanics are presented. The governing equations and theories that are used in each method are expressed and the application of each method is discussed. The two main methods of deterministic analyses are: stress-based approach (S-N curve approach) and linear elastic fracture mechanics (LEFM) approaches. These approaches are applicable to different analyzing strategies, i.e. the first approach is used for cases in which general form of fatigue is dominant, but the latter involves the calculations of reliability as functions of crack geometry and its boundary conditions. The SPD12C jacket platform in South Pars Oil Field is also modelled as a case study and the results of fatigue reliability analysis are presented. In this paper a comprehensive method is presented to accurately predict the reliability of offshore platforms. This method is based on S-N curve and the results are compared with the fatigue life of joints. Due to nonlinear interaction of soil and piles and the other affecting parameters such as flexibility of joints, non-Gaussian procedure of loading, and nonlinearity of reaction force, the precise analysing of stress levels will be impossible and a complex numerical analysis could only give limited information about the statistical properties of stress. In order to perform the fatigue analysis and predicting the cycles of stress SACS was used, a powerful software for designing and analysing offshore structures. In this paper the whole structure was modelled subjected to different forces such as wave and sea currents. The effects of parameters such as marine growth and interaction of soil and piles are also included. The latter is shown to have a significant effect on determination of fatigue life of the platform.

Fatigue life
Jacket structures
Offshore platforms
Structural reliability

2015010215
Predicting method of natural frequency for ship’s overall vertical vibration.
Brodogradnja, v 65 n 3, September 2014, p 49 [10 p, 18 ref, 4 tab, 1 fig]
http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=188445
Yin, Y., Zhao, D., Et al
English
At the ship design stage, empirical formulas are generally used to predict the overall vertical vibration natural frequency of ship to avoid the harmful resonance against main excitation. Nowadays, with the development of modern large-scale ships, the existing empirical formulas are becoming unpractical, some corrections should be applied on these classical formulas or a new formula derived for the prediction of vertical vibration frequencies of ship. In this paper, a new empirical formula is given for predicting the natural frequency of a ship’s overall vertical vibration. Based on the Timoshenko beam theory, the formula is derived by introducing by shear coefficient to correction shear uniform distribution hypothesis for a thin-walled box beam with free-free boundary condition. This new formula is obtained by statistical analysis for large amounts of measured natural frequency results of the ship overall vertical vibration. The proposed prediction method in this paper was used to predict the natural frequencies of six ships. The predicted natural frequencies are consistent with that by measurements. The comparison with measurements show that the formula proposed in this article is more feasible to use, and also provide a new method to the prediction of natural frequency of the ship overall vertical vibration.

Beam theory
Resonant frequency
Vibration

2015010216
Buckling analysis of plate with an initial imperfection using RKPM based on convected coordinate system.
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_169/article
Sadamoto, S., Tanaka, S., Okazawa, S.
Japanese
A geometrical nonlinear formulation is presented to simulate buckling/post-buckling behaviours of panels in ship structure employing a mesh free approach. Reproducing kernel is adopted in the mesh free approximation. In a previous study, a mesh free flat shell formulation was developed based on Mindlin-Reissener theory. However, there were difficulties in introducing initial imperfection to the flat panel. In this study, convected coordinate system is applied to the mesh free shell formulation to reproduce complicated initial imperfection, e.g., thin-horse
mode. To verify the proposed approach, buckling/post-buckling behaviours of panels are simulated using total and updated Lagrangian formulations and the results are examined.

Buckling
Defects
Plates
Postbuckling

2015010217

Brittle crack propagation/arrest behaviour in full penetration T-joint.
Journal of the Japan Society of Naval Architects and Ocean Engineers, v 19, 2014, pp 179-185
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_179/_article

Handa, T., Nishimura, K., Et al
Japanese

Arrestability of brittle cracks is extremely important for the structural integrity of welded joints of heavy gauge steel plates used in large container ships. Recently, great attention has been focused on potential crack propagation along welds made with large heat input. In this study, a T-joint is applied to the strength deck structure of container ships to enhance crack arrestability. Material crack arrest toughness, Kca, of some steel plates are varied. The ESSO tests of T-joint components showed that a brittle crack is arrested at the T-joint if the steel plate used in the flange has a high Kca value in the range from 4900 to 7300 N/mm3/2. FE-analyses of the stress intensity factor K indicated that brittle crack propagation is arrested under the condition that the K-value at the running crack tip is less than the Kca of the material. It is noted in the T-joint that the K-value at the deepest point of the crack decreases and is finally below the Kca of the flange plate when a brittle crack rapidly penetrates the flange plate to a depth of 30-40mm. These phenomena show the advantage of the T-joint in brittle crack arrestability in the flange plate of the strength deck structure.

Crack arrest
Crack propagation
Tubular joints

2015010218

Stochastic formulation of structural response of steel plates with random initial distortions.
https://www.jstage.jst.go.jp/article/jjasnaoe/19/0/19_187/_article

Mandal, R., Kawamura, Y.
Japanese

In this study the stochastic properties of the response of a square steel plate under in-plane compressive load subject to random initial distortions have been characterized using Polynomial Chaos Expansions (PCE). First the random characteristics of maximum initial distortions of a steel plate have been approximated using PCE. Subsequently an analytical procedure has been developed based on elastic large deflection analysis which can be used to predict the stochastic characteristics of the plate response. A significant feature of the proposed method is the avoidance of the generally time-consuming Monte Carlo Simulation for evaluation of response statistics. Moreover, this methodology requires knowledge about the governing equations of the physical system. It is also theoretically reasonable as it has a strong mathematical basis. It has been found that the proposed formulation can predict the statistical characteristics of the plate response with sufficient accuracy, when compared to those obtained from Monte Carlo Simulation.

Distortion
Steel plates
Steel structures
Structural response

2015010219

Effect of repeated impacts on the response of polar class ship structures.
http://www.snak.or.kr/eng/sub01_01.html

Cho, S-R., Truong, D.D., Song, H-C.
English

Experimental and numerical investigations were performed of the effect of repeated impacts on the response of polar class vessel structures at room and low temperatures. Repeated dynamic impact tests were conducted on four single frame models. The
both ends of the single frame models were fixed onto a strong bed. Repeated impacts were applied by releasing a knife edge striker using a drop testing machine. After each impact test the permanent deflections were measured. For repeated impact tests at low temperature the models were kept in cold chambers filled with dry ice and ethanol. The temperature histories were measured with thermocouples attached to the models. Numerical analyses were also performed to predict the damage of the single frame under repeated impacts. In the calculations the strain hardening was considered using the properties of material obtained from the tensile tests. The comparison of the test results with those of numerical prediction shows quite reasonable agreements.

Ice transiting vessels
Impact loads
Numerical analysis
Structural response

2015010220


Hodapp, D.P., Collette, M.D., Troesch, A.W.
English

Recent work by the authors investigated an extension of the finite element analysis of plasticity-induced crack closure to non-stationary, ship structural loading sequences by taking advantage of their inherent time-dependent nature in which the larger loading cycles tend to be clustered together. In doing so, first-order load interactions are presumed to arise from the random occurrence and severity of physical storms encountered by ships and offshore structures throughout their service lives. This material hysteresis is captured through a time-dependent crack “opening” level (KopKop) which is based on the evolution of a rate-independent, incremental plasticity model simulating combined nonlinear kinematic and isotropic hardening. The result is a mechanistic rather than phenomenological numerical model requiring only experimentally measured fatigue crack growth rates under constant amplitude, cyclic loading (e.g., ASTM E647-13) and a full material constitutive model defined through experimental push–pull tests for the same material. This approach permits a consideration of material behaviours which are physically relevant to structural steels, yet necessarily omitted in the similar application of a strip-yield model. The paper generalizes the model originally proposed by the authors to now consider arbitrary storm model loading sequences taken from high-fidelity, time-domain seakeeping codes. To predict the fatigue fracture induced by variable amplitude stress records with upwards of $5 \times 10^6$ cycles, a consistent modelling reduction is applied based on the Ordered Overall Range (OOR) or racetrack counting method. The resultant crack growth behaviour is demonstrated to converge remarkably well for sufficiently small refined mesh sizes. Using this model, and by considering different arrangements of the same stress record, the importance of nonlinearities (i.e., those associated with ship response as well as material hysteresis) are emphasized.

Crack propagation
Fatigue cracks
Finite element method
Loads (forces)
Ship structures

2015010221

http://www.snak.or.kr/eng/sub01_01.html

Brinchmann, K., Califano, A., Steen, E.
English

This paper describes a developed methodology for assessing the structural capacity of a free fall lifeboat. The approach is based on coupling advanced engineering tools, such as computational fluid mechanics and finite element analysis. This gives the possibility of assessing the structure in every phase of a lifeboat drop identifying weaknesses and eliminating uncertainties, which previously may have been missed.

Computational fluid dynamics
Finite element method
Fluid structure interaction
Lifeboats
Structural strength
Assessment of whipping and springing on a large container vessel.


Barhoumi, M., Storhaug, G.

Wave induced vibrations increase the fatigue and extreme loading, but this is normally neglected in design. The industry view on this is changing. Wave induced vibrations are often divided into springing and whipping, and their relative contribution to fatigue and extreme loading varies depending on ship design. When it comes to displacement vessels, the contribution from whipping on fatigue and extreme loading is particularly high for certain container vessels. A large modern design container vessel with high bow flare angle and high service speed has been considered. The container vessel was equipped with a hull monitoring system. The vessel has been operating between Asia and Europe for a few years and valuable data has been collected. Also model tests have been carried out of this vessel to investigate fatigue and extreme loading, but model tests are often limited to head seas. For the full scale measurements, the correlation between stress data and wind data has been investigated. The wave and vibration damage are shown versus heading and Beaufort strength to indicate general trends. The wind data has also been compared to North Atlantic design environment. Even though it has been shown that the encountered wind data has been much less severe than in North Atlantic, the extreme loading defined by IACS URSII is significantly exceeded when whipping is included. If whipping may contribute to collapse, then proper seamanship may be useful in order to limit the extreme loading. The vibration damage is also observed to be high from head to beam seas, and even present in stern seas, but fatigue damage in general is low on this East Asia to Europe trade.

Containerships
Extreme loads
Springing
Vibration
Whipping

Residual stress and deformation of T-joint welds under transverse shrinkage restraint conditions.


Fu, G., Lourenço, M.I., Et al

English

The finite element model of ABAQUS combined with FORTRAN subroutines was developed to predict the residual stress and deformation of T-joint welds under two different boundary conditions, free shrinkage condition and transverse shrinkage restraint condition. The sequentially coupled thermal and mechanical FE model was employed. The convection and radiation conditions and temperature-dependent material properties were considered. The element birth and death technique were employed to simulate the weld metal deposition in T-joint. The moving heat source model was assumed to be Goldak's double ellipsoidal model and implemented into the numerical model through a dedicated subroutine. The numerical results of the deformations under the free shrinkage condition were calibrated by the experimental measurement. The welding induced imperfections of this T-joint welds under transverse shrinkage restraint condition were calculated. The comparisons of the results of the residual stress and deformation under the free and restraint shrinkage condition are discussed.

Deformation
Residual stress
Shrinkage
Tubular joints
Welded joints
2015010224

A review of strains to internal loads conversion methods in full scale measurements.
http://www.snak.or.kr/eng/sub01_01.html

Bigot, F., Derbane, Q., Baudin, E.
English

In full scale measurements as in model tests it is impossible to directly measure the hull girder loads. A conversion matrix usually combines the different strain or motion measurements and yields the different internal load values, at one or several locations. This paper shows that all the different possible procedures to obtain the internal loads from strain measurements can be seen as variations of a single general procedure. First, a base of distortion modes is built using the structural model. Then a conversion matrix is used to project the measured values on the distortion modes base, and the internal loads are obtained by recombination of their modal values. These last two steps are often merged in a single conversion matrix, thus hiding the underlying analysis base. So the apparently different methods to convert strains into internal loads actually only differ in the choice of the deformation base that is used. The case of a real container ship instrumented with strain gauges is considered. Several types of distortion bases are considered and compared.

Bending moments
Strain measurement
Torsion

2015010225

Development of the integrated system for DLA of the hull structure.
http://www.snak.or.kr/eng/sub01_01.html

Won, S-i., Choi, B-k., Kim, D-s.
English

In general, the direct load analysis for assessment of yielding and fatigue strength of hull structures is adopted for large ships in order to strengthen the initial design based on the rule or to satisfy the requirement for a specific notation. However, this analysis is too complicated for a designer to carry out the whole procedure without any numerical errors because this includes quite a number of FE analyses and corresponding parameters to be considered during the calculation. To satisfy the requirement of the various Classification Societies and to reflect the designer's needs, the process of the structural assessment using direct load analysis is standardized to consider various rules and the calculation procedure is automated to reduce the calculation effort. The system is mainly composed of four parts according to the general procedure of the dynamic load analysis such as the interface to ship motion, load transfer module to the FE model, global to local mapping module in F. analysis and fatigue life estimation module.

Fatigue life
Hull strength
Loads (forces)

2015010226

Hull-superstructure interaction induced secondary effects in passenger ships.
http://www.snak.or.kr/eng/sub01_01.html

Parmasto, O., Romanoff, J., Remes, H.
English

This paper investigates the hull-superstructure interaction in a modern passenger ship structure. A typical modern cruise ship structure, which has a superstructure with internal longitudinal bulkheads and a side shell with low shear stiffness is examined using the Finite Element Method. The results show that the normal stress response in the various sections of the investigated passenger ship structure differs considerably due to hull-superstructure interaction induced secondary effects. It is also shown that shear lag and vertical stiffness of the deck under the longitudinal bulkheads are important factors determining the response of the investigated passenger ship structure. The influence of these
Ultimate strength based stiffened panel design using multi-objective optimisation methods and its application to ship structures.

Ma, M., Hughes, W., Paik, J.K.

An efficient method of predicting the ultimate strength of stiffened panels under combined loads has been implemented in ALPS/ULSAP. The validity of the method was confirmed by various structural collapse tests and nonlinear FEA. The method is parametric formulated, mesh free, computational efficient, and is able to predict six different failure modes for a stiffened panel; therefore the solution process is suitable for design space exploration. In this paper, multi-objective optimisation methods are used to determine the Pareto optimal solutions of a stiffened panel based on the ALPS/ULSAP algorithm. The objective is to solve a design problem aiming at simultaneously minimizing the weight and cost of a stiffened panel, and maximizing its buckling and yielding stress. Two multi-objective methods, Pareto Simulated Annealing and Ulungu Multi-Objective Simulated Annealing are presented for a single panel optimisation, where the loads applied to the panel are assumed to be constant. To optimise a system of stiffened panels, e.g., ship structures, where the loads applied to an individual panel are functions of the system structural scantlings, an iterative procedure is presented. The numerical results show that the proposed method is very useful to perform ultimate strength based ship structural optimisation with multi-objectives, namely minimization of the structural weight and cost and maximization of structural safety.

Numerical simulation of fatigue crack propagation under simulated whipping loading arising in hull structures.

Matsuda, K., Gotoh, K.

Fatigue crack propagation behaviour under simulated whipping loadings which contain two different frequency components is highlighted. Numerical simulation of fatigue crack propagation based on an advanced fracture mechanics approach using the RPG (Re-tensile Plastic zone Generating) stress criterion for fatigue crack propagation is improved to enable the extraction of the effective loading history. The critical value of the plastic hysteresis for the stress versus strain relationship occurring in the vicinity of a crack tip is defined as the control parameter for extracting the effective loading history. Comparison of fatigue crack propagation curves obtained from the improved numerical simulations with the measurements which were conducted by Sumi (2010) is performed. These comparisons show the validity of the proposed procedure for extracting the effective loading history from the superposed loading history containing different frequencies. In addition, imperfection of the S-N curves approach, which corresponds to the combination of the linear cumulative damage law and the loading cycle count by the rain flow method, is conducted.
Thermal analysis and strength evaluation of cargo tanks in offshore FLNGs and LNG carriers.

The objective of this study is to develop a procedure for thermal analysis and strength evaluation of cargo tank structures in offshore FLNGs and LNG carriers. In this paper, a heat transfer analysis methodology has been employed, and a computational tool has been developed for its application on hull and tank structures in both membrane-type and independent Self-supporting Prismatic type B (SPB) LNG vessels. Using this method, the temperature distribution and corresponding heat transfer coefficients (HTCs) in both the hull structure and void spaces can be estimated so the appropriate steel grade can be selected for the inner hull and the boil-off rate (BOR) can be calculated for LNG vessels. Based on these estimated temperature environmental profiles and HTCs in void spaces, the detailed temperature distribution of an independent SPB tank including the tank boundary and internal structures can be calculated using steady-state thermal FE analysis. Then, the temperature distribution obtained from thermal FE modelling is applied to the FE model as loading conditions for thermal stress FE analysis on cargo tanks. In stress FE analysis, design loads usually include temperature distribution, design vapour pressure, and internal pressure caused by cargo during vessel acceleration. For temperature distribution among design loads, there are three loading conditions which are: cooling down, partial filling level, and full filling level loading conditions in an independent tank. Finally, FE results are to be used for assessing the yielding and buckling strength of a tank structure in terms of acceptance criteria. A case study for an LNG SPB tank demonstrates strength assessment considering thermal effects. The complete procedure has been developed for thermal analysis and strength evaluation of cargo tank structures in offshore FLNGs and LNG carriers.

LNG tanks
Strength
Thermal analysis

Design of offshore installations against ship collision based on interaction analysis.

The damage to offshore platforms subjected to ship collisions is investigated. The considered scenarios are bow and stem impacts against the column of a floating platform and against jacket legs and braces. The effect of ship-platform interaction on the distribution of damage is studied by means of nonlinear shell finite element modelling of both structures. A supply vessel of 7500 tons displacement is modelled including the bulbous part. The collision forces from the vessel are compared with those of the design vessel in the NORSOK code. For bow collisions the crushing behaviour and potential penetration of the bulbous section into cargo tanks or void spaces of floating platform is especially focused. For jackets braces it is investigated if the braces can penetrate into the ship bow without being subjected to significant plastic bending or local denting. The adequacy of the NORSOK design guidance for broadside collisions against jacket legs is evaluated.

Collision resistance
Finite element method
Offshore structures
Offshore service vessels
Platform rammings

Plastic mechanism analysis of structural performances for stiffeners on a typical double bottom structure during shoal grounding accident.

This paper mainly deals with the structural responses of stiffeners on a typical tanker double bottom
structure, which consists of three major stiffened components: the bottom plating, transverse floors and longitudinal girders, when grounding over the "shoal" type sea bed obstacles. A prevailing method is to smear the stiffeners into the plating thickness and thus includes the role of stiffeners during an accidental action. However, this method may not provide convincing predictive accuracy of the stiffener performances, and the collapse pattern cannot be tracked. Therefore, theoretical models are built for 3 major types of stiffeners, providing deep insight of the deformation patterns with reasonable predictive accuracy. The established theoretical models are based on a careful study of the progressive deformation process of numerical simulations using the code LS_DYNA. Using the plastic analytical method, major plastic analysis strategy for each stiffener type is introduced and discussed. This set of theoretical models will contribute substantially to the establishment of efficient tools for fast and reliable assessment of the performances of ship double bottom structures during sliding grounding.

Double bottoms
Groundings
Stiffeners
Structural response
Tankers

2015010232

A practical method for the fatigue strength assessment of container carriers.
http://www.snak.or.kr/eng/sub01_01.html
Brindley, S.M., Matsumoto, T., Sasaki, S.
English

Two approaches for the practical fatigue strength assessment of container carriers are presented in this paper, a design approach and an assessment approach. The design approach is a simplified method used at the initial design stage and the assessment approach is a more thorough method used for confirmation of the design. For the fatigue strength assessment, this paper identifies the critical primary strength members required to be assessed and the governing equivalent design wave loads to evaluate the characteristic stress range. Material strength, material thickness and mean stress effects are included in the methodology. The linear cumulative damage is calculated based on the Palmgren A (1924) and Miner, M (1945) methods. For the simplified design approach, suitable stress concentration factors and allowable stress range curves are derived and presented.

Containerships
Fatigue strength
Stress concentration
Torsion

2015010233

Fatigue and weather on ultra large containerships.
http://www.snak.or.kr/eng/sub01_01.html
Renaud, M., De Lorgeril, E., Et al
English

The increase in global container shipping has seen the emergence of larger and larger vessels that are currently able to load 16000 TEUs and measure almost 400 meters long. The structure of this ship has low natural frequencies that are close to wave frequencies of particular sea state. Thus, the dynamic response cannot anymore be ignored in the calculation of the hull's fatigue. The CMA CGM Rigoletto, containership of 9400 EVP, has been instrumented with accelerometers, strain gauges and sea state sensor in order to know better the dynamic behaviour of large containerships. Thanks to this measurement campaign, the cumulated fatigue since the ship came out of the shipyard has been calculated and the sea state met during his exploitation has been estimated. The goal of this study is to establish the link between the fatigue of the ship and the weather met during operational conditions. An experimental method has been developed to calculate the fatigue of the ship based on the historic of sea states met. The fatigue damage is mainly caused by some special events. Linking Asia to Europe, the cumulated fatigue damage of the CMA CGM Rigoletto seems to not be a structural problem contrary to a ship on a transpacific line.

Containerships
Damage
Fatigue (materials)
Monitoring
Stresses
Strength of ships’ grillages under lateral load and in-plane compression.


Lokshin, A.Z., Mishkevich, V.G., Ivanov, L.D.

English

The paper deals with the strength of a grillage loaded by lateral load and in-plane compression load (in one direction). It consists of a system of prismatic girders crossing under 90°. The compression load is taken by the longitudinal girders that are elastically fixed on rigid supports. The system of aggregated differential equations is derived for solution of the problem using the Lagrange method. It allows for replacement of the system of aggregated differential equations by a system of independent differential equations. These equations for the case of simultaneous action of lateral and longitudinal compression load have the form of differential equations for bending of prismatic girders laying on elastic foundation and loaded with lateral and longitudinal compression forces. When only lateral load exists, the form of these equations coincides with the form of differential equations for bending of girders laying on elastic foundation and loaded with lateral load alone. When only longitudinal compression load exists, the form of these equations coincides with the form of differential equations for buckling of girders laying on elastic foundation. Solutions are given for bending of a grillage (the first two problems). Formulas are derived for calculation of the parameters of longitudinal girders’ bending when girders’ end sections are elastically fixed. Also, formulas are derived for calculation of the reaction forces at cross-points of transverse and longitudinal girders. When only longitudinal compression load exists (third problem), a solution is given for the connection between the coefficient of elastic foundation’s rigidity and the Euler force. Results obtained by using the proposed method are compared with FEA simulations.

Evaluation of side structures for mooring fenders at selected terminals for large LNG carriers.


Wang, G., Shi, Q-q., Et al

English

Side structures may sustain damages due to local contact loads of marine fenders. At present, there are no rules or standards for the design of side structures for fender loads. It has been up to the shipyard to design side structures considering fender loads. This paper presents a practical approach for evaluating side structures against contact loads from fenders. This involves collecting marine fender data from LNGC terminals, selecting fender loads for evaluating side structures, deciding ranges of side structures for fender loads evaluation, analysing structural responses, evaluating acceptance, and considering reinforcement if necessary. This practical approach was illustrated through an application to a design of a 172K m³ LNG carrier that is being built in Hudong-Zhonghua.

Fatigue analysis of deepwater hybrid mooring line under corrosion effect.

Polish Maritime Research, v 21 n 3, 2014, p 68 [9 p, 24 ref, 3 tab, 20 fig]

Qiao, D., Yan, J., Ou, J.

English

In the deepwater exploitation of oil and gas, replacing the polyester rope by a wire in the chain-wire-chain mooring line is proved to be fairly economic, but this may provoke some corresponding problems. The aim of this paper is to compare the fatigue damage of two mooring system types, taking into account corrosion effects. Using a semisubmersible platform as the
research object, two types of mooring systems of the similar static restoring stiffness were employed. The mooring lines had the chain-wire-chain and chain-polyester-chain structure, respectively. Firstly, the numerical simulation model between the semi-submersible platform and its mooring system was built. The time series of mooring line tension generated by each short-term sea state of South China Sea S4 area were calculated. Secondly, the rain flow counting method was employed to obtain the fatigue load spectrum. Thirdly, the Miner linear cumulative law model was used to compare the fatigue damage of the two mooring system types in long-term sea state. Finally, the corrosion effects from zero to twenty years were considered, and the comparison between the fatigue damage of the two mooring system types was recalculated.

Corrosion
Damage
Fatigue life
Mooring lines

2015010237

Comments on linear summation hypothesis of fatigue failures.
Polish Maritime Research, v 21 n 3, 2014, p 77 [9 p, 8 ref, 6 tab, 5 fig]
http://www.bg.pg.gda.pl/pmr/pmr.php
Szala, G.

This paper presents a comparative analysis of the results of fatigue life calculations with the use of the linear summation hypothesis of fatigue failures (LHSUZ), confronted with experimental test results. The calculations and fatigue tests were performed for variable amplitude, two-step and ten-step loading conditions, both in the low-cycle fatigue and high-cycle fatigue range, for the case of C45 steel as an example. Experimental verification of the hypothesis LHSUZ did not reveal any significant influence of load level and form of load spectrum on conformity of results of the calculation by using the LHSUZ, to results of fatigue tests on C45 steel. However, it enabled to assess magnitude of a correction factor which appears in the considered linear hypothesis.

Failure
Fatigue life
Fatigue tests
Steel structures

2015010238

Material properties and crashworthiness of ASTM A131 steel plated structures at low temperature: an experimental and numerical study.
http://www.snak.or.kr/eng/sub01_01.html
Park, D.K., Lee, B.J., Et al

English

To investigate the low temperature effect on mechanical properties and crashworthiness of steel plated structures, a series of tensile tests and axial crushing tests were undertaken on grades of ASTM A131-type carbon steel. LS-DYNA nonlinear finite element method analyses were also carried out to develop nonlinear finite element method modelling techniques for structural crashworthiness analyses at low temperatures.

Finite element method
Low temperature
Mechanical properties
Steel structures

2015010239

Study on high-speed tensile tests for SUS304L in cryogenic environment considering initial plastic strain.
http://www.snak.or.kr/eng/sub01_01.html
Park, T., Jeon, S., Et al

English

There are some considerations to assess structural safety of 1st barrier in membrane type LONG CGS under sloshing loads such as high speed behaviour, cryogenic environment and effect of initial plastic strain. For this assessment, high-speed tensile tests in cryogenic environment for SUS304L are performed considering initial plastic strains. From the results,
initial plastic strains which are generated in room temperature almost do not affect fracture in cryogenic environments.

Cryogenics
LNG tanks
Membrane tanks
Plastic deformation
Tensile tests

2015010240
Steel plates with excellent HAZ toughness for offshore structures.
http://proceedings.asmedigitalcollection.asme.org/proceeding.aspx?articleID=1786229
Ichimaya, K., Hase, K., Et al
English
In the field of offshore structures, the strength and the toughness required for steel plates used for oil resource development become higher as the installation areas of the structures move into Arctic and deep water areas. High strength steel plates for offshore structures, which meet the low temperature specification, have been developed. Excellent properties of the steel plates have been achieved by micro-alloying, the latest controlled rolling and accelerated cooling technology. Excellent properties of weld joints have been also achieved by advanced metallurgical techniques, which are grain-refinement of the coarse grain heat affected zone (CGHAZ), reduction of Martensite-Austenite (M-A) constituent in inter-critically CGHAZ (ICCGHAZ), and improvement of the matrix toughness. These steels are designed for excellent weldability due to low weld cracking parameter (PCM) value up to 550 MPa class in yield stress, and also up to 101.6 mm in thickness with 420 MPa class in yield stress, and satisfying −40°C of crack tip opening displacement (CTOD) temperature specification for offshore structure.

Offshore structures
Plates
Steel
Toughness

4.3 CORROSION AND FOULING

2015010241
Influence of localized pit distribution and bench-shaped pits on the ultimate compressive strength of steel plating for shipping.
Corrosion, v 70 n 9, September 2014, pp 915-927
http://corrosionjournal.org/doi/abs/10.5006/1223
Wang, Y., Wharton, J.A., Shenoi, R.A.
English
This work has developed numerical models simulating steel plate corrosion degradation and presents a series of novel finite element modelling to assess the influence of localized pit distribution and bench-shaped pits, which are often observed in long-term exposures. Four location patterns of one-sided corroded shipping steel plates have been considered, which include both geometric and material nonlinearities. Validation of the modelling method is achieved by a thermoelastic stress analysis, which provides the principal stress distribution over the plate surface. The modelling results demonstrate that the frequently detected localized corrosion may reduce the ultimate strength by up to 20% compared to uniformly corroded plate. In addition, bench-shaped pits may further decrease the ultimate strength by up to 14% compared to the no-bench condition with the same degree of pitting.

Finite element method
Pitting corrosion
Plates
Steel
Ultimate strength

2015010242
Hull protection for ice-going vessels.
The Hydrex Group, White Paper No. 14, 2014 [28 p, 30 fig]
No author given
English
Icy waters are a particularly hazardous environment for ships’ hulls. Choosing the right hull coating for icebreakers and ice-going vessels can make a huge difference to the safety and longevity, the fuel consumption and the environmental impact of the
ship. This White Paper is a guide to choosing the best hull coating for ice-going ships' hulls and their rudders and running gear.

Coatings
Corrosion control
Frictional resistance
Ice transiting vessels

2015010243

Cathodic protection design for offshore wind turbine foundations.
Materials Performance, v 53 n 9, September 2014, p 26 [4 p, 10 ref, 3 fig]
http://www.nace.org/Publications/Materials-Performance/
Ayyar, S., Jansson, J., Sørensen, R.
English
This article presents design considerations and some of the challenges a corrosion engineer encounters while designing a cathodic protection (CP) system for an offshore wind turbine foundation. Offshore wind turbine foundations in this article refer to monopole and jacket-type foundations comprising steel.

Cathodic protection
Foundations
Offshore structures
Wind turbines

2015010244

Efficiency of the cathode protection in the sports crafts, fishing and cabotage boats.
Girón, M.A., Madariaga, E., Et al
English
In sacrificial anode design, quality manufacturing processes and proper installation are critical for maximum protection of equipment and vessels. The damage which causes corrosion can be reduced and even avoided by protection methods which are economically profitable. The predictable future savings will come by the correct use of the current state of knowledge. This acquired knowledge is not always used rationally despite the great progress and current knowledge about the physical-chemical corrosion phenomena. Aspects relating to the assembly, distribution and support must be optimised for optimum performance and facilities are properly protected. Determine guidelines to consider in the design of the equipment (compatibility and incompatibility of the materials), the manufacturing quality of the elements to prevent galvanic corrosion, as in the embodiment of different patterns of maintenance in the case of pleasure craft, fishing boats and coastal represent very substantial costs and losses of the life of the vessels and their vital components.

Cathodic protection
Galvanic corrosion
Sacrificial anodes

5 NAVAL VESSELS AND DEFENCE TECHNOLOGY

2015010245

Step change required in landing craft performance.
Warship Technology, October 2014, p 38 [3 p, 2 tab, 3 fig]
http://www.rina.org.uk/wt.html
Middleton, T.
English
The author argues that there is an urgent need for new types of landing craft to be developed and looks at some recent designs.

Landing craft

2015010246

Wave piercing monohull has a host of potential applications.
Warship Technology, October 2014, p42 [4 p, 5 fig]
http://www.rina.org.uk/wt.html
No author given
English
Reducing hull motions in waves at speed has long been recognised as an important goal in commercial and military vessel design. Numerous attempts were – and are being – made to achieve that goal. Methods range from introducing very long and narrow bows, to an array of articulated trim, roll and pitch controlling devices, many of them computer controlled. All add capital and operating costs, and have a varying degree of success in reducing motions. This article describes the SHARC Wave Piercing
Monohull (SWPM) which eliminates much of this added cost. It has no moving parts, and allows the hull to stay within standard proportions without resorting to long narrow hulls. Many current methods either ‘avoid’ interaction with waves (long narrow and tall bows) or attempt to counteract it (articulated fins or transom tabs), whereas the SWPM concept relies on interaction with waves.

**2015010247**

**The use of fuzzy logic design tools for habitability consideration.**


http://www.snak.or.kr/eng/sub01_01.html

Strickland, J.D., Kileny, P.R., Singer, D.J.

English

The reduction of weight of modern naval vessels and the transition from steel to aluminium has increased the rate of problems associated with noise and vibration. Due to this trend there has become a need to address the issue of noise within the earliest stages of design. This system will be used to characterize traditionally neglected human factors considerations and develop a methodology for the introduction of these concerns in the early stage ship design process. The use of the proposed fuzzy logic method provides the opportunity for the inclusion of different data sources, namely vibration. Additionally a fuzzy logic system can easily be incorporated into early stage design activities.

Fuzzy sets
Habitability
Naval vessels
Noise
Vibration

**2015010248**

Modularity, flexibility, tailoring, design to cost, fitness for purpose, value for money, etc...

**Several concepts, one goal: the affordable warship.**


http://www.snak.or.kr/eng/sub01_01.html

Ferraris, S.

English

The spending reviews deriving from the world economic crisis reduce the sums allocated for defence, including the budgets for new warships. Navies have to review their approach to the purchasing of new vessels, while shipbuilders must try to minimize costs. Affordability is the real goal. Navies should clearly define the operational profile of vessels, and the scope of supply, without leaving room for major later modifications. Shipbuilders should use civilian well-proven solutions and commercial equipment, redefine standards, approach vessels configuration in terms of flexibility and modularity, use rational design techniques, apply concepts like design to cost and design for production, etc. Suppliers could help both customers and builders to find out the "best for purpose" solutions. Classification Societies could ensure a better technology transfer between naval and commercial communities. Examples of practical applications will better explain all concepts and highlight the crucial benefits, which can be provided by a suitably balanced integrated approach.

Modular construction
Naval vessels
Ship design
Shipbuilding costs
Optimum lifetime maintenance schedule for naval vessels subjected to fatigue and corrosion.


Temple, D.W., Collette, M.

English

As current naval fleets age and budgetary issues force governments to extend the service life of their ships long past the point they were originally designed for, maintenance costs over the lifetime of vessels are becoming an increasingly large burden. Maintenance schedules for most naval vessels are largely based on their availability, usually calling for repairs on fixed intervals that are not chosen with the specifics of the ship's structure in mind. Because of this it is desirable to optimise the scheduling of a vessel's maintenance cycles for the design of the physical structure of the ship. A framework is presented to schedule maintenance cycles for naval vessels in order to minimize the lifetime costs for the ship. Using this model and the structure of a notational DTMB-5145 hull form the maintenance schedule for the vessel is optimised in order to minimize the lifetime costs.

Fatigue life
Corrosion
Naval vessels
Optimisation
Ship maintenance

6 MISCELLANEOUS

The effect of the economic crisis of 2007 to the container shipping in Spain, Turkey and Greece.


Şenbursa, N., Martinez, J.E., Madariaga, E.

English

The paper brings into sharp relief how the economic crisis of 2007 affected the maritime sector particularly in container shipping in Spain, Greece and Turkey and how the butterfly effect of the economic crisis is spreading to container shipping nowadays. It further argues that it is possible to theorize and analyse resilience within real data. The paper presents data from different investigation organizations regarding the development of the maritime sector as of 2000 until 2007 and the stagnation period of container shipping in each of the countries Spain, Turkey and Greece during the crisis period. This paper discusses particularly Spain, Greece and Turkey due to the similar economic structures in these countries. The realization of the analysis will be done through publications, online publications, authorities' statistics and statistics of the sector's database. It is estimated that the normalization process of the shipping market could take two or perhaps even four years as of today 2014. The related companies in three countries were dropping out of the market in 2009 therefore it was the worst economic and financial recession over the decades in the sector; it is important to state that there had been a dramatic drop over 4.5% in 2009 in the container business most affected by the crisis. The overall conclusion is that the growth period which will be the increase of import and export trade volumes, unemployment rate, increasing production and the GDP of each country. In this so called revival period, the economy and trade volumes are expected to grow both within the EU and in world trade. Economic indicators (unemployment rate, GDP/capita) will move in a positive direction along with consumer confidence. The policymakers should be aware of a possible overheating.

Containerised shipping
Economic conditions
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