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TABLE OF CONTENTS

THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
PAGES 5 - 12, 2012

NUMERICAL SIMULATION OF THE 3D FLOW AROUND AN INCLINED CIRCULAR CYLINDER MOUNTED ON A CURVED PLATE

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ABSTRACT

The dynamic characteristics of the pressure and velocity field of the flow around a circular cylinder mounted on a plate are investigated numerically and analyzed physically. This research is focused on establishing an appropriate method to further uncover the effect of the flow on the scouring around the pile driven the riverbed or seabed. Herein, the scouring can be controlled or limited. To do that, a numerical simulation aimed at describing the flow field around a circular cylinder mounted on a plate is presented. Several geometric configurations are taken into account, e.g. flat or curved plate, straight or inclined cylinder. The turbulent flow for Re=3900 and Re=10^6 are simulated using the Spalart-Allmaras one-equation model and the results are compared and evaluated.

Keywords: juncture flow, RANS, Finite Volume, recirculation zone, boundary layer

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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PAGES 13-18, 2012

NUMERICAL SEAKEEPING ANALYSIS IN IRREGULAR OBLIQUE WAVES FOR AN 1100 TEU CONTAINER SHIP

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ABSTRACT

The topic of this paper is the numerical seakeeping analysis of an 1100 TEU container ship, with 173.42m length, considered with initial design and optimized structure. The numerical seakeeping analysis includes three main degrees of freedom, heave, pitch and roll. There are considered two loading cases, full cargo (F) and no containers on deck (NDC), with several speed values, under irregular oblique waves, ITTC wave power density spectrum, full range heading angle. Based on short-term statistical values and seakeeping criteria, the statistical polar diagrams of the dynamic response for seakeeping assessment are obtained. The seakeeping analysis is carried on with eigen DYN_OSC program code.

Keywords: seakeeping, numerical, dynamic response, short-term analysis, 1100 TEU container ship.

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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HYDRODYNAMIC PERFORMANCE OF THE KVLCC2 TANKER HULL

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ABSTRACT

The introduction by International Maritime Organization (IMO hereafter) of the Energy Efficiency Design Index (EEDI hereafter) for new ships and of the Ship Energy Efficiency Management Plan (SEEMP hereafter) for all ships-the new ones and the already built ones, emphasizes the necessity of determining the resistance and propulsion performance of a given ship. Thus, both resistance and propulsion performance of the KRISO Verry Large Crude Carrier 2 (KVLCC2 hereafter) are determined by means of a viscous Computational Fluid Dynamics (CFD hereafter) solver, a propeller beeing fitted to the model in the second considered case.

Keywords: KVLCC2, CFD, RANS, EEDI, ship resistance, self-propulsion, propeller open water

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
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ANALYSIS OF 1500 T BARGE FOR PERFORMANCE ENHANCING

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ABSTRACT

In order to improve the efficiency of Danube fleet, one possibility is to modify, with minimum costs, the existing ships. The modification – in particular the lengthening of 1500 t barge – have two main objectives: increasing the capacity of cargo and the reducing of the operational draught. For this purpose, some analyses were made:- design review according actual Rules in order to find the design margins (freeboard, scantling, etc.); - the analysis of waterway conditions (seasonal depth, locks, etc.); - the determination of optimal length of the ship by systematic approach. The results consist in a new barge with 20% more payload and 4% increase of navigation period in shallow draught season at same payload..

Keywords: barge, scantling, FEM analysis, performance enhancing, shallow draught

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
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LINEAR AND NON-LINEAR HYDROELASTICITY ANALYSIS OF A STRUCTURAL OPTIMIZED CONTAINER SHIP WITHOUT CARGO ON DECK

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ABSTRACT

In this study is presented the linear and non-linear hydroelastic structural response analysis of a 1100 TEU container ship, induced by irregular head waves, model Longuet-Higgins. The numerical analysis are carried on two structures: one with initial designed scantlings and the second one with optimized structure. On both cases the loading condition is without containers on deck. The optimisation process has defined the objective function as the minimum weight, with several structural restrains. The numerical analyses are carried on with the own program codes package DYN, based on the hydroelasticity theory. The ship hull dynamic response includes the linear and non-linear oscillations, taking into account the bottom and side slamming phenomena, and the vibrations on the first and higher natural modes, taking into account the springing and whipping phenomena. The results are indicating the extreme loads induced in hull structure by the waves and that on the optimized structure the non-linear flexural dynamic vibration response is higher in compare to the initial design structure case.

Keywords: 1100 TEU container ship, initial and optimized structure, linear and non-linear hydroelasticity

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
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A SIMPLIFIED FEM PROCEDURE FOR COMPUTING THE OVERALL SHIP NATURAL VIBRATION MODES

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ABSTRACT

A detailed FEM procedure used for computing the overall natural ship vibration is highly time consuming, both by the pre and by the post processing work quantity. So that, in order to shorten the way, the author elaborated a procedure based on the equivalent density method, by which a series of minor structural elements (profiles) are melted into theirs supporting panels. By this way the working time is significantly reduced. The overall ship vibration natural modes remain valid, while the local ones do not.

Keywords: ship vibration, FEM analysis

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
PAGES 53-62, 2012

ANALYSIS OF THE NACA HYDRODYNAMIC COEFFICIENTS IN FREE STREAM

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ABSTRACT

Shipping safety is strongly dependent on the ship maneuvering performance. The rudder is one of the most used steering systems which must generate the lateral hydrodynamic force and the torque reqiured to control vessel movements in the horizontal plane. The literature provides various methods that can be used in order to estimate the specific hydrodynamic coefficients for the NACA profiles at an angle of attack different from zero. Presented in this paper, the comparative analysis of these methods shows that there are significant differences between results. In addition, these approaches are not systematic and do not take into account a number of important parameters. In this context, the paper proposes the use of the hydrodynamic coefficients which were obtained based on the experimental data given in the literature for a number of symmetrical NACA profiles with different relative thicknesses, placed in free stream. These results take into consideration the same variables: the flow direction, the apect ratio and the angle of attack of the rudder. A computer program useful for engineering applications was developed in order to determine, for the mentioned variables, the specific hydrodynamic coefficients of the symmetrical NACA profiles.

Keywords: hydrodynamic profile, hydrodynamic coefficients, lift, drag, *NACA*

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
PAGES 63-70, 2012

STUDY ON THE INFLUENCE OF THE FLOW CONTROL DEVICE GEOMETRY ON BEARING FORCES FLUCTUATIONS

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ABSTRACT

The paper presents the second part of a hydrodynamic study of propeller-induced shaft forces for a ship hull fitted with wake improvement devices. The focus of the study was on the influence of the flow control device geometry and arrangement on bearing forces fluctuations. Inflow velocities distribution in the propeller plane has been numerical investigated using commercial CFD software. The results have been used as input data for bearing forces calculations. For this purpose, an in house code based on quasi-steady approach has been used. Influence of various parameters such as the flow control device geometry, inclination and position in respect to the ship stern has been investigated.

Keywords: flow control device, wake-equalizing duct, propeller induced bearing forc

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
PAGES 71-76, 2012

THE APPARITION AND EXTENSION OF CRACKS IN "T" SHAPED COMPOSITE STRUCTURES

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ABSTRACT

Fiberglass-reinforced polyester (GRP) is the most widely used composite material in the ship building industry and requires careful study in point of mechanical characteristics and their resistance to crack and fatigue. The article presents a numerical study that targets the apparition and extension of cracks in "T" shaped composite structures. The results of the study conclude that the tensile intensity factor K and the energy at the tip of the crack increases with the extension of the crack.

Keywords: cracks, intensity factor K, energy at the tip of the crack, composite materials, FEM

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
PAGES 77-82, 2012

STUDY TO IMPROVE PASSENGERS COMFORT ON THE OPEN DECKS

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ABSTRACT

This paper presents a study of the air currents that appear on the cruise ships's open decks. The results can be used in designing open spaces on the upper deck so they match to passengers comfort requirements.

Keywords: comfort, passengers, open decks, cruise ship

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XI – SHIPBUILDING. ISSN 1221-4620
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FREE SURFACE FLOW SIMULATION AROUND COMBATANT SHIP

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ABSTRACT

The paper proposes a numerical investigation based on RANS computation for solving the free-surface viscous flow around a combatant ship hull. A RANS-RSM hybrid techniques have been employed not only to evaluate the free surface flow field around the naval combatant ship hull, but also to determine the ship resistance of hull. The numerical solutions provided have been compared with available experimental data.

Keywords: free surface flow, combatant ship, Rankine source method, RANS

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INFLUENCES OF MOORING PARAMETERS ON SURGE MOTIONS OF A SEMISUBMERSIBLE ON LONGITUDINAL WAVES

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ABSTRACT

For large moored offshore structures, due to their large inertial forces, it is commonly considered that the structure is imposing the motions on the mooring system. However, a systematic evaluation of the inter-influence between the floating structure and the mooring lines could be of interest as far as horizontal motions are taken into account. Systematic experiments have proven that in certain conditions large motions can be observed, inducing significant mooring line forces. The present paper is focused on above mentioned aspects. Based on systematic experimental tests relevant diagrams are presented. Five model chains of a prototype and a range of pretensions have been used for the mooring influence evaluation.

Keywords:moored offshore structures, hydrodynamic tests, seakeeping

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NATURAL GAS AS FUEL FOR RIVER GOING SHIP

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ABSTRACT

In relation with the actual quest for solutions more environmental friendly and for cost saving in case of river going ships, the replacement of Diesel Fuel with Natural Gas as fuel could be a potential alternative. In cooperation with Ship Design Group (design and consultancy company) the analysis and investigation concerning the possibility to use natural gas as fuel was made. The goal consisted in the clarification of five main aspects:

1. *gas solution: liquefied natural gas or compressed natural gas?*
2. *engine type: gas-only engine, gas-Diesel engine or dual-fuel engine?*
3. *legal aspects: there are regulation for ships fueled by natural gas?*
4. *technical aspects: which are the implication on technical solution and performances?*
5. *economical aspects: the solution of natural gas fueled ship is efficient?*

The conclusions of this study could be a good starting point for future attempts in this field.

Keywords: river going ship, fuel, propulsion, natural gas

THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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MODEL SCALE RESISTANCE COMPUTATION FOR THE KRISO CONTAINER SHIP

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ABSTRACT

The present study considers, for the KRISO Container Ship (KCS hereafter), the model scale resistance computation, two Computational Fluid Dynamics (CFD hereafter) solvers beeing used in this regard. Both wave and viscous components of the total model scale resistance are computed by the use of a potential flow solver, respectively by the use of a viscous flow solver. Of most importance in getting accurate results for the complex flow problems that are defining the free-surface viscous flow, the computational grid is properly generated. In order to validate the numerical techniques the experimental results of the model scale resistance tests conducted in the towing tank of the Faculty of Naval Architecture from the "Dunarea de jos" University of Galati were considered.

Keywords: KCS, RANS, CFD, potential flow, viscous flow, resistance test

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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THE SPEED INFLUENCE ON THE HYDROELASTIC DYNAMIC RESPONSE IN IRREGULAR WAVES FOR A CONTAINER SHIP

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ABSTRACT

This paper focuses on the speed influence on linear and non-linear hydroelastic structural response of a container ship, induced by irregular head waves model Longuet-Higgins. The numerical analysis is applied for an optimized container ship structure, with minimum weight objective function, under several structural constrains, with overall length of 173.42 m. The numerical analysis are carried on with the own program codes package DYN, based on the hydroelasticity theory. The study is taking into account six different ship speeds, from 0 knots to 20 knots, in the loading case without containers on deck. The ship heading angle remains constant. The dynamic response includes the linear and non-linear oscillations, the bottom and side slamming hydrodynamic phenomena occurrence, the global steady state springing and transitory whipping hydroelastic phenomena occurrence. The numerical results are pointing out that the non-linear model has better sensitivity to stress out the ship speed influence on the hydroelastic symmetric response in head waves, mainly on the global vibration response components.

Keywords: speed influence, hydroelasticity, irregular waves, structural response, container ship

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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SIMPLE SUPPORTED BEAM COMPUTING PROGRAM FOR MOBILE DEVICES

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ABSTRACT

Given the continuously increasing spreading of the mobile devices (i.e. tablets and smartphones) a new and valuable computing power becomes available into the pocket. Whishing to try this new resource, the author achieved a program for computing the stresses, deformations and 1st natural vibration mode for a simple supported beam composed by cylindrical spans. The program was written using Java language on the Android platform.

Keywords: beam, bending, vibration, computer programming.

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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NUMERICAL AND EXPERIMENTAL STUDY OF THE BEHAVIOR OF OFFSHORE PLATFORMS LEGS DURING IMPACT

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ABSTRACT

During the exploitation period of an offshore structure, it may suffer an impact with different objects. One of the impact cases is the mooring of ships. The type of offshore platform used for this study is the Jack-Up Drilling Platform "Gloria". With the aid of the Solid Works-COSMOS/M software analysis were made for different types of impact. The numerical results were compared with experimental results.

Keywords: structure offshore, impact, Solid Works-COSMOS/M, Stress von Mises

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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EXPERIMENTAL UNCERTAINTY FOR THE GALATI UNIVERSITY TOWING TANK TESTS WITH EXAMPLE FOR NACA 0012 SURFACE PIERCING HYDROFOIL

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ABSTRACT

Experimental uncertainty assessment methodology and procedures with example for the NACA0012 surface piercing hydrofoil, including resistance and wave profile tests, with discussion of bias and precision limits and total uncertainties are presented. The procedures follow the International Towing Tank Conference procedures and recommendations.

Keywords: uncertainty assessment**,** experimental uncertainty, bias, bias limit, precision limit

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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INITIAL SEAKEEPING NUMERICAL ANALYSIS IN IRREGULAR WAVES OF A 800 TEU CONTAINER SHIP

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ABSTRACT

The objective of the present work is to perform an initial seakeeping analysis of an 800 TEU containership, with a total of 139,96m length. The study includes a seakeeping linear analysis, for the heave, pitch and roll motion degrees of freedom. Ship-wave heading angle covers 360 degrees with 15 deg. step. The statistical short term prediction response is carried out for an ISSC wave spectrum. The initial dynamic response short term statistical polar diagrams are obtained according to the limits of seakeeping criteria.

Keywords: initial seakeeping analysis, short term dynamic response

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THE INFLUENCE OF FATIGUE PHENOMENON ON INTEGRITY OF OFFSHORE STRUCTURES

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ABSTRACT

During their life, structures suffer static and dynamic load actions. The most dangerous tensions that apear in these situations are those that repeat in time after a certain variation law. This structures will be subjected to fatigue. Fatigue phenomenon is dangerous especially for the structures which on their distruction can affect human lives and the environment. Offshore structures used in drilling for oil on land or on the sea bottom are a good example of this. Numerical and experimental modeling of this article constitutes a methodology to study the occurrence and propagation of cracks in structural elements of the offshore drilling platform legs.

Keywords: cracks, intensity factor of tension, FEM, optical measuring system ARAMIS HS, deformations

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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STUDY OF THE SHAPE IN SHIP STRUCTURE DESIGN

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ABSTRACT

The aim of this paper is to study the influence of shape design on flow simulation. A preliminary CFD analysis is done for choosing the environment conditions. Both in water and in air calculus are made. The second part of this research is focused on behavior in air environment for models with different geometry. The numerical analysis and conclusions are presented at the end of the paper.

Keywords: CAD system, structure ship design, shape, flow, numerical simulation

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OPTIMIZED SPRINGBACK REDUCTION CONTROL APPROCH IN SHEET METAL FORMING

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ABSTRACT

In this paper a novel approach for springback reduction is proposed for applied in sheet multipoint forming with interpolators. A set of definitions for blank-process-tooling system variables and parameters are proposed. The new method namely optimized springback reduction approach includes the application of a new algorithm, composed from simulation, reduced-order modeling and optimization. The reduced order model of the system at whole is build on the base of FE simulation results. For optimization, the reduced order model and the exhaustive search is applied. The part accuracy and precision could be evaluated by considering the system parameters values as belonging to their tolerated domains of variation. The application of this method in the case of multipoint forming could allow a more complete exploitation of the reconfigurable property of such type of tooling.

Keywords: multipoint forming, sheet metal forming, precison, accuracy, optimization

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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PREDICTION OF SHIP RESPONSE IN IRREGULAR WAVES

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ABSTRACT

Ship response based on computed wave-induced loads using Frank formulation of source method for a bulk carrier vessel, is predicted. The methodology uses the theory of Salvesen, Tuck and Faltinsen and predicts ship motions and wave - induced loads for a ship in six-degrees-of freedom advancing at constant speed with arbitrary heading in regular waves. The ITTC wave spectrum is used in order to obtain the ship response in irregular waves.

Keywords: Frank method, irregular waves, ship structural response

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SOLVING BY FEM SOME CLASSIC ISSUES RELATED TO CUT-OUT PLATES

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ABSTRACT

The purpose of this paper is to highlight plates with circular cut-outs, spread evenly, as well as plates with elliptical cutouts, spread evenly. The analysis of plates with cutouts is advantageous to be made using the appropriate transformations, which simplifies the constraint of boundary conditions on the borders with curvilinear configurations.

Keywords: circular plates, elliptical plates, normal stress

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PERCENTAGE OPERABILITY OF A SHIP IN A SPECIFIC AREA USING SEAKEEPING PERFORMANCE CALCULATIONS

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ABSTRACT

In the present work, the calculation of seakeeping performance given as an operability index is carried out for two containerships with different characteristics. The operability index depends on the wave climate of the ocean area where the ships operate, the dynamic response of the ship to the waves, and the ship mission. The relation between the ship operability and the mission characteristics is established through the seakeeping criteria, which represent the acceptable limits of operation. The wave conditions considered were those usually encountered in the Black Sea, near to the Gloria drilling platform. The transfer functions of the absolute ship motions and of some derived responses such as accelerations and relative motions are obtained using a method based on the strip theory. In order to assess the effects of the seasonality on the seakeeping index computations were performed using both annual and winter wave statistics.

Keywords: numerical analysis, ship dynamics, seakeeping, irregular oblique waves

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VERIFICATION AND VALIDATION EXERCISE FOR THE FLOW OVER A FLAT PLATE

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ABSTRACT

Numerical Verification and Validation methodology is presented with example for a benchmark flat plate case. The Verification and Validation procedures follow the ASME V&V 20 (2009) complete guide. Detailed example with discussion of all error and uncertainties sources is provided. All turbulence model implemented in Ansys Fluent were studied and results compared.

Keywords: verification and validation, error, uncertainty, flat plate, drag coefficient, boundary layer

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THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
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NUMERICAL SIMULATON OF THE WAKE FIELD PRODUCED BY A 37000TDW TANKER

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ABSTRACT

The paper presents the numerical simulation of the wake field produced by a chemical tanker using a commercial software. The ship hull has blunt lines and a complex stern shape, resulting in an uneven distribution of the wake field at the propeller plane. The result were a high vibrations that originated form the propeller and propagated through the ship steel structure to the upper decks. The solution was the use of a flow control device aimed to equalize the wake field at the propeller plane. The device's position and shape was selected following towing tank measurements for the wake field. Both cases, bare and appended hull, were numerically simulated and the results were compared with the experimental data. The comparissons shows good agreements, especially in the case of the appended hull. The differences for local wake values are attributed to the rapid change in grid cell size that takes place near the center plane due to the grid structure.

Keywords: flow control device, wake-equalizing duct, wake field

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THE STUDY OF EFFICIENCY DESIGN FOR SHIPPING AND TRANSFER FUEL OIL SYSTEM

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ABSTRACT

The efficient design of shipping and transfer fuel oil system suppose the finding of pipeline dimensions for a imposed diagram by arrangement of fuel oil tanks with limited in size weight and small head loss. The solution of pipeline network with Pipe Expert program offers possibility of many variants analyse. We have calculated flow parameters weight and head loss. We have chosen the solution considering an compromise of these factors.

Keywords: design system, flow, fuel oil system, numeric, network analyse

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HYBRID LASER ARC WELDING AND ITS APPLICATIONS IN SHIPBUILDING

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ABSTRACT

Hybrid laser-arc welding is a combination of laser beam and conventional arc welding process (MIG) and gives the combined effect of moderate hardness and small deflections for most structural steels for shipbuilding. The increasing acceptance of hybrid laser-arc welding conduct to the more permitting of use of this low heat input welding method in building ships and offshore structures. Hybrid laser-arc welding shows due to very attractive properties as e.g. low distortion, high welding speed and easy automation a great potential in the welding of structural steels. The shipbuilding industry is leading in the introduction of high power laser and laser-hybrid welding for structural applications and the major motivation for this is the reduced distortion. Today laser based welding is used quite extensively in European yards and the development here is reviewed.

Keywords: hybrid laser welding, mechanical properties, panels laser processing, shipyard applications

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IMPLEMENTATION OF OPTIMIZED SPRINGBACK REDUCTION CONTROL IN MULTIPOINT FORMING

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ABSTRACT

In this paper a novel approach for springback reduction is applied in sheet multipoint forming with interpolators. The new method namely optimized springback reduction approach includes the application of a new algorithm, composed from simulation, reduced-order modeling and optimization. A reduced order model of the system at whole is build on the base of FE simulation results. The part accuracy and precision are evaluated by considering the system parameters values as belonging to their tolerated domains of variation. For optimization, the reduced order model and the exhaustive search was applied. Application of this method in the case of multipoint forming gives rezonable values of the dimensional precision and could be used for offline control of process using such type of tooling.

Keywords: multipoint forming, sheet metal forming, precison, accuracy, optimization

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