Present situation of the Croatian shipbuilding

Summary
The importance of shipbuilding industry for the Republic of Croatia with some characteristics of big shipyards and their position in the process of privatization is discussed. The commitments on the shipbuilding market, the shipyard’s organization model, efficient work-preparation functions, inevitable modernization of shipbuilding technology, the control of process and expenses as well as the vital scientific and professional assistance in the shipbuilding are considered. There is given the chronology of the attempts of the academical and professional groups to help the recovering of the Croatian shipbuilding. In the conclusion some conditions and hazards of the privatization are indicated as well as the suggestions for further actions.

Key words: shipbuilding, privatization.

SCHOONER TYPE SAIL TRAINING SHIP DESIGN

Summary
Aim of this paper is to present training ship design process which is performed to develop vessel that will comprehend all requirements necessary for modern practical education of Croatian nautical school students and traditional characteristics of Adriatic type schooner. Special attention was dedicated to rig and sail plan design and stability analysis because building of that type of vessel are very rare today and design and stability assessment approaches are very different and insufficiently described.

Key words: training ship, ship design, stability assessment, sail plan, rig design
MEASURES OF MERIT AS CRITERIA IN SHIP DESIGN

Summary

With the standard rules for designing ships which are accepted by most classification society harmonizing criteria for the construction of ships took part. Applying the new rules will significantly extend the effective life of the ship to 35-40 years compared to today's average of 25 years leading to shortening the time of depreciation. The cost of fuel is becoming a major optimization factor, and compared with a box forms with maximized block coefficient and ratio of B/T thoughts go to the more slender and "normal" forms. To achieve success in new projects with the analysis of already acquired knowledge we need to do step back and put more effort into the conceptual design phase with caution not to rely solely on one criterion of the economic measure but on multi-criteria analysis and sensitivity analysis of more economic measures with full knowledge of the market and all its mechanisms.

Key words: measures of merit, uniform rules, ship design

APPLICATION OF ECONOMIC CRITERIA OF MERIT IN SHIP DESIGN

Summary

For the given values of capacity, speed, ratio of the main dimensions and the deadweight/displacement ratio initial ship is designed. Varying the initial values length and the ratios of the principal dimensions the fleet of ships is developed. For all ships in the fleet the economic characteristics are calculated for the different combinations of speed, interest and life cycle. Treating these features as an economic criteria of merit the best ships are selected according to following: the minimum cost price, the lowest cost price per ton deadweight, maximum of deadweight/displacement ratio, lowest life cost per ton deadweight, the minimum required freight rate, the largest profit per ton deadweight, the fastest capital return and the maximum present value of the project. The paper concludes that in the selection of the best ship the economic criteria prevails compared the technical ones.

Key words: ship design, ships’s fleet, economic measures of merit
The wooden ship (small and big size) construction usually can be realized by one of the following methods: touching paneling (Carvel- method), overlapping paneling (Clinker- method), diagonal overlapping paneling, unwrapping and „patching” paneling, laminating or combined touching and diagonal method.

In this paper the classic touched paneling (Carvel) method, usually used in the Korčula wooden shipbuilding „school“, during the centuries, is explained in ten building phases.

**Key words:** Korčula, wooden boats, building, technology, methods

The management of the interactive network companies is principal different then in case of the classic companies. The elementary reason is in that what is interactive network companies to rest on group of contracts between independent companies, while the management of the classic companies to rest on hierarchy way of the management.

The strategic intention of management in the interactive network companies is create new organisation alliance to rest on close co-operation between individually companies with aim to realized common strategy market and market's recognitions. As is the case of all complex business – production system, so in the case of the interactive network shipyard, placing the multiple levels management system. This article shows the whole management system of the interactive network shipyard who has characteristics of the combination management system, consist of the management network, as the basis part and project management as the auxiliary parth.

**Key words:** shipbuilding industry, organization, network menagement

Boris Šestanović,
EARNED VALUE MANAGEMENT IN SHIP BUILDING PROJECT

Summary

Earned Value Management (EVM) is the method for measuring the project progress or performance efficiency. It is a project management technique that requires the formation of a baseline that integrates project scope, cost and schedule. EVM method gives the answers on five basic questions raised through the whole project lifecycle: "How much work should be done?", "How much work was completed?", "How much did the work cost?", "How much is the job supposed to cost?" and "What is the job estimated cost at the moment?". The shipyard Brodosplit-Brodogradilište d.o.o., for the purpose of measuring the ship building progress, launched the project of EVM method application. In this paper there are basics of EVM method and overview of work on above mentioned project.

Key words: EVM, ship building, project, performance measuring

Filip Bosančić, Marija Rovan, Joško Palaversić,

COMPUTER ADED MANAGING OF SHIP BUILDING PROCESS

Summary

The usual method of computer application in designing (CAD) and manufacturing (CAM) process has also been implemented in ship building process. With the introduction of the IHOP ship building method there is an effect of moving specific activities into earlier stages of building process, as well as the planning smaller activities. Production of documentation, providing raw materials, production of components, and installation of components, planning, supervision and reports are becoming too complex to be represented in the form of Gantt chart. In this paper the authors wishes to present the way this issue has been addressed in the Brodosplit shipyard.

Key words: ship, IHOP, object for outfitting, technological phase, planning, reporting
TECHNOLOGY OF CUTTER FABRICATION, MOUNTING AND CONTROLLED LOWERING INTO SHIP HULL – THEORY AND PRACTICE

Summary

During the initial stage of project realization of our Self propelled cutter suction dredger, we have separated 1200 ton cutter ladder as a unique technological unit for which we have devised fabrication and mounting technology, together with detailed procedure for controlled lowering into the ship hull and assembling process. The above mentioned technology was presented in theory on our last Symposium "Sorta 2008" and this work will give proof of theory and enrich it by actual experiences and achievements from actual events.

Key words: self propelled cutter suction dredger, cutter ladder, cutter "launching”

LAUNCHING OF THE SHIP WITH INSUFFICIENT DISPLACEMENT

Summary

The most common property of the ice breaking supplier vessels is high lightship weight and ship length ratio which results in relatively high draught at the launching and high load on the cradle. At the typical launching on Uljanik shipyard slipways, the sea level on the slipway end is considerably lower than the draught of the ship. The result of such launching calculation shows negative tipping moment at the slipway end, downfall of the ship over the slipway end as well as very high load on the cradle. To avoid those scenarios, the following solutions are possible: prolongation of the slipway in order to obtain the appropriate water depth on the slipway end, which requires expensive construction works; considerable reduction of the ship weight at the launching, which requires the assembly of a large part of the ship structure after the launching, on the outfitting quay; displacement increment with auxiliary pontoons in order to lower the ship draught.

Key words: launching, load
Venesa Stanić,

BUILDING TECHNOLOGY OF THE SHIP FOR SPECIAL CARGO TRANSPORTATION

Summary

Building technology of the ship for special cargo transportation, which will be considered in this article, especially the production and installation of cargo tanks and other specialized equipment on board, represents a major challenge for the shipyard. The particularity of this project is the development of specialized equipment within the shipyard, on the shipyard outfitting area and partly in the workshops. In addition to the development of building technologies of the hull, will be explained designing technology and installation of specialized equipment integrated on the ship. Chronologically presents an analysis of problems and alternatives for the task, which were thoroughly discussed.

Key words: ship, special cargo, outfitting

Danijel Linić, Igor Lalović,

MODERN SCANNING METHOD OF AN EXISTING SHIP HULL FORM WITH THE EXAMPLE OF «MARKO POLO» FERRY REPARATION

Summary

By using a modern numerical method, e.g. scanning with total station (3D measurement), almost all the difficulties and insufficiencies of classic method are avoided. When using the classic method, many conditions have to be met and preliminary operations done, which prolongs the measurement process and makes the results inaccurate, especially when working with larger vessels in floating docks. The paper gives a short description of the classic hull form scanning method and compares it to the modern method. It gives a detailed description of the modern scanning method by means of total station and computer data processing. An example of such scanning is described. The undamaged bow area of the stranded ferry "Marko Polo" was scanned. The scanning results served as a basis to make the repair documentation of the damaged area. A brief description of other applications of this measurement method in shipbuilding is given.

Key words: ship hull form, hull form scanning, measurement in shipbuilding, total station
SIMULATION METHOD FOR SHIPBUILDING PRODUCTION PROCESS DESIGN

Summary

In this paper a simulation modeling based methodology for shipbuilding production process design is suggested. It is expected from suggested methodology to give faster, better and more efficient tool for designers of complex production processes, with special focus on shipbuilding production processes design. Within the first part of paper, various methods used in production process design practice, are investigated. In continuing, simulation modeling method is described due to its characteristics, and reasons for application. Furthermore, appliance of suggested methodology within specific shipyard production process is demonstrated. Acquired solution is finally tested and evaluated through comparison with installed robotized profile cutting line in specific shipyard production process. On grounds of conclusion droved from this comparison directions for further research are suggested.

Key words: shipbuilding, production process, design methodology, simulation

SHIPYARD PRODUCTION AREAS OPTIMAL LAYOUT DESIGN

Summary

A methodology for creating a preliminary optimal layout design of shipyard production areas is presented in this article. The proposed methodology is based on the implementation of a specifically defined procedure in four phases and using specific methods and tools. The first phase established the closeness relationships of the main production areas from the shipbuilding technological point of view, based upon a survey of relevant experts. Thereupon, the second phase proposed the generation and valuation of all possible production layout variants within the shipyard using SLP method. Furthermore, after establishing a representative number of most competitive variants, the third phase considers choosing the variant which most optimally satisfies all criteria by using the AHP method. In the fourth and final phase, a sensitivity analysis is made in order to check the stability of the chosen layout of production areas. The proposed methodology was applied to the production layout design of an existing shipyard.

Key words: layout design, AHP method, SLP method, sensitivity analysis, shipyard
MODERN THIN PANEL PRODUCTION LINE
(LASER-HYBRID TECHNOLOGY)

Summary

Modernization of the ship production process in the stage of hull sections assembly is based on the flexible production lines. They are entirely mechanized or partly automatized or robotized production lines and they are making possible, in the technological stage of a steel assembly process, the accomplishment of the concept of "moving the product through the process" instead of "moving the process through the product". The accomplishment of this principle makes possible the increasing of the production process flow and the reduction of costs on this stage of the ship hull production. Beside this, the logistics of the process can be increased and consequently the controllability of the process too.

This material displays the structure and the configuration of automatized thin panel production line (4-15 mm) as well as plates and profiles edge treatment required for laser-hybrid welding technology application in order to reduce heat transfer in basic material and costs of production process in building of passengers and Ro-pax ships.

Key words: production process modernization, thin panel production line, laser-hybrid welding

CONCEPTUAL DESIGN OF SHIPYARD ON THE RIVER DANUBE

Summary

This paper presents a conceptual design of a shipyard on river Danube. The introductory notes considered the inland navigation routes in Europe and in Croatia as well as the assessments of developments in inland navigation. Furthermore, the characteristic types of ships that could be included in the production plan of the shipyard. The industrial capacities of regional companies of potential for cooperation in shipbuilding are analyzed in order to define the basic concept of a prevailing assembly yard. The location of the shipyard has been investigated with respect to social an industrial characteristics in the region. The conceptual design proposal in the paper brings forward the shipyard layout, arrangement of working areas, material flows and launching procedures.

Key words: inland navigation, assembly yard, Danube
VISUAL SYSTEM FOR HULL STRUCTURE PAINT QUANTITY ESTIMATION

Summary

The correct estimation of painting area is very important for Shipyard Paint Department, since it is a basis for material specification, working time and price estimation. Therefore, a new application has been designed, that allows quick and reliable estimation of painting areas, as well as paint quantity. One of the application's main goals was to allow easy creation of complex spaces, along with paint area calculation. This article gives the application design overview, together with the paint area estimation workflow. The experiences gained during the initial design and application development is also presented.

Key words: visualization, space definition, paint area

MECHANICAL CHARACTERISTICS OF THE STAINLESS STEEL AT SUB-ZERO TEMPERATURES

Summary

The transport of the liquefied gas by ships becomes more important in the maritime transport. The liquefied gas is transferred in the cargo tanks at -165°C. Mechanical characteristics of the materials for ship building are faced with high-level demands. The paper, in introduction, presents types of ships for liquefied gas transport and materials for building a structure of the cargo tanks. Furthermore, requirements of the Croatian Register of Shipping for mechanical testing of the material are presented. The equipment, specimens and testing procedure are described. Specimens are tested on 4 different temperatures from 0° to -165°C. Values of the tensile strength, deformation, total uniform elongation, breaking elongation and modulus of elasticity are measured during each test. The conclusion contains remarks about mechanical characteristics of the stainless steel at sub-zero temperatures.

Key words: liquefied gas transport, mechanical characteristics, stainless steel and sub zero temperatures
ANALYSIS OF MEASUREMENT PRINCIPLES OF FMCW AND GUIDED MICROWAVE RADAR INSTRUMENTS FOR LEVEL MEASUREMENT

Summary

In this paper basic measurement principles of FMCW (Frequency modulated continues wave) and guided radars are described. Correct choosing and correct usage of instruments can considerably decrease investment cost, installation costs and maintenance costs. Knowledge about physical principles on which is based measurement is necessary for estimation of possibilities of measurement electronic circuitry and possibilities of modern technologies.

Key words: FMCW (Frequency modulated continuous wave) radar, guided radar

HYDROELASTIC RESPONSE OF A LARGE CONTAINER SHIP

Summary

Very large container ships (VLCS) are rather flexible and fast vessels and their natural frequencies are close to encounter frequencies. Hydroelastic calculation models, which enable more realistic modeling of load distribution and taking into account ship displacements and strains at the same time, have to be used for reliable design of those kind of ships. In this paper theoretical background of structural, hydrodynamic and hydrostatic models, as constitutive parts of hydroelastic model, is given. The developed procedure is based on combining structural 1D sophisticated beam FEM model with 3D BEM hydrodynamic model, which makes it especially appropriate for preliminary design stage. Computer programs which are derived for hydroelastic analysis purposes are briefly described, and hydroelastic analysis of 7800 TEU container ship has been done. Validation of 1D FEM model is checked by correlation analysis with the vibration response of the fine 3D FEM model. The results are compared to those obtained by treating ship as a rigid body.

Key words: hydroelasticity, container ship, wave load, response, FEM
LEGAL ASPECT OF RECYCLING OF SHIPS WITH A SPECIAL REFERENCE TO THE HONG KONG INTERNATIONAL CONVENTION, 2009

Summary

The maximum allowed age of ships is between 20 and 25 years. After that period a ship has to be converted for some other purpose or is to be recycled in a recycling facility. As regards that conversion only postpones recycling which is inevitable, it was extremely important to legally regulate this problem area. Ship recycling industry needs to operate in a way that fulfills certain conditions, especially those concerning protection of the environment and health and safety of people involved. Nowadays, however, recycling of ships takes place mostly in developing countries with a cheap labor force, so it is to be presumed that earlier mentioned conditions usually aren't met. The goal of the adopted International Convention for the Safe and Environmentally Sound Recycling of Ships is to prevent those problems, as well all the others that may appear during recycling operation. It stipulates various requirements for shipowners and ship recycling facilities so that entire recycling process goes by without threatening people and environment. Above mentioned Conventions has not yet entered into force nor is expected until 2015.

Key words: recycling of ships, recycling facilities, international regulations

QUALITY IMPROVEMENT IN THE PRODUCTION OF MARINE LOW-SPEED ENGINES

Summary

In the paper are presented the results of research conducted to assess the possibility of practical implementation of continuous quality improvement tools in the production of marine low-speed engines. The paper demonstrates the use of quality assurance tools in the casting and production of engine cylinder sleeve within the factory "3 Maj" Engines & Cranes. The aim of the research was to demonstrate the necessity of application of the available quality assurance tools in low volume industrial production. The results obtained are used in the observed process as well as in other processes in the production of marine low-speed engines.

Key words: quality assurance, quality improvement, marine engine, casting
SCIENTIFIC AND PROFESSIONAL PUBLISHING IN CROATIAN SHIPBUILDING

Summary

This paper at the beginning provides the overview of relevant technical journals in engineering of interest for publications of researchers in the field of shipbuilding and related topics. Next it clarifies the term "impact factor" and brings the ranges of these factors for considered engineering journals. Furthermore the study provides statistics of scientific publications of Croatian researchers in the field of shipbuilding. The statistics are accomplished by searching in the most relevant bibliographic data bases in engineering. Firstly, a general overview of scientific and professional publishing of Croatian shipbuilding researchers is summarized from the Croatian Bibliographic Data Base (CROSBI). Secondly, the international activity in publishing of Croatian shipbuilding researchers are analyzed through their publications in two bibliographic (citation) data bases Web of Science (WoS) and Scopus. The conclusion discusses the criteria for evaluation of scientific and professional publishing in the engineering fields of shipbuilding.

Key words: shipbuilding, bibliometrics, bibliographic databases, scientific communication

Mario Buršić, Krešimir Vlašić, Dani Dundara,

ADVANTAGES OF IN-HOUSE NAVAL CALCULATION PROGRAM PACKAGE

Summary

If the naval calculations in the shipyard are carried out with the same program package as used by Classification society approval procedure, effective detection of possible errors inside approved documents will not be achieved. The comparison of results obtained by two independent program packages will show if the calculations are carried out correctly. This paper shows actual events on a series of seven multipurpose RO-RO/container/car-carrier vessels recently built and still under construction. Savings of 56 pcs of remote controlled, hydraulically operated sliding doors dimension 2000×1400 mm is an advantage for shipyard but also for ship-owner as the doors were arranged inside cargo area and might be damaged during cargo operations.

Key words: In-house naval calculations program package