# International Conference on Computer Applications in Shipbuilding (ICCAS 2017)

Singapore 26 - 28 September 2017

Volume 1 of 3

ISBN: 978-1-5108-8303-1

## Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2017) by The Royal Institution of Naval Architects All rights reserved.

Printed by Curran Associates, Inc. (2019)

For permission requests, please contact The Royal Institution of Naval Architects at the address below.

The Royal Institution of Naval Architects 8-9 Northumberland Street London, WC2N 5DA United Kingdom

Phone: 44 207 235 4622 Fax: 44 207 259 5912

publications@rina.org.uk

# Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA

Phone: 845-758-0400 Fax: 845-758-2633

Email: curran@proceedings.com Web: www.proceedings.com

# **CONTENTS**

Cyber Physical System in Shipbuilding Toward Realize Smart Shipyard: Integration of Monitoring System and Shipyard Simulation System	149
Kazuhiro Aoyama, Mayuna Hoshi, Yusei Hiro, Ryo Kitamura and Kazuya Oizumi, The University of Tokyo, Japan	
A Framework for Assessing the Effects of Bias in Early-Stage Ship Design	1
M J Sypniewski and D J Singer, University of Michigan, USA	
Optimal Arrangement Method for Naval Surface Ship Considering the Stability, Operability, and Survivability	9
S K Jung, M I Roh, S M Lee, K S Kim, Seoul National University, Republic of Korea	
A Case Study in Optimizing 3D Early Design for Shipbuilding	13
JS Cheong, Samsung Heavy Industries, Korea	
J Baumer, Intergraph, USA	
HW Lee, Intergraph, Korea	
SH Ha, JM Hong, Samsung Heavy Industries, Korea	
Intent-Driven CAD vs Mechanical CAD in Shipbuilding – A Review and Solution Outline	23
T Dusch, B Franke, M Grau and C Zerbst, PROSTEP AG, Germany	
Power With Simplicity To Visualize Your Digital Asset – A Revolution For Decision Making	161
Gauthier Stonestreet, AVEVA Solutions Ltd, Norway	
An Integrated Optimization System for Reduction of Calm Water Resistance and Added Resistance in Waves of a Cruise Ship	<b>N</b> /A
Jiayi He, Marine Design and Research Institute of China	
Bow Shape Optimization af a Cruise Ship for Minimum Added Resistance Based on Actual Operational Profile	33
P Y Feng, J Y He, S M Fan, J B Wang, Marine Design & Research Institute of China (MARIC), China	
A Study on the Improvement and Application of System Dynamics Model for Demand Forecasting of Ships	39
Y Wada, Knowledge and Data System Department, National Maritime Research Institute, Japan	
K Hamada and N Hirata, Graduate School of Engineering, Hiroshima University, Japan	
A Study on the Support System of Ship Basic Planning by Using Marine Logistics Big Data	49
Mohammad Danil Arifin, Kunihiro Hamada, Noritaka Hirata, and Kai Ihara, Hiroshima University, Japan	
Yuki Koide, Churyo Engineering Co., Ltd.	

Investigating the Impact of Distributed System Routing Densities on Vessel Operability	57
C. J. Goodrum, C. P. F. Shields, and D. J. Singer, University of Michigan – Ann Arbor, USA	
Effective Utilization Of Digital Design Assets During The Post-Design Phases In Modern Shipbuilding	67
M. Yllikäinen, Cadmatic Ltd, Finland	
Performance Verification Of The Air-Conditioning System In A Submarine	73
Jan D. Wilgenhof, MSc. , MecDes, The Netherlands,	
Jesús Molina Toledo, MSc. , Navantia, Spain	
Naval Ship Design Rules Embodiment In A Cad Tool	83
J.A. Muñoz, SENER Ingeniería y Sistemas, S.A., Spain	
R. Pérez, SENER Ingeniería y Sistemas, S.A. – Universidad Politécnica de Madrid, Spain	
S. Santana, SENER Ingeniería y Sistemas, S.A., Spain	
Tools For Predicting Parametric Rolling And Its Application For Second Generation Intact Stability Criteria	91
J A Muñoz, SENER Ingeniería y Sistemas, S.A.,-Universidad Politécnica de Madrid, SPAIN	
Development of an Efficient Method for Equipment Installation of Vertical Pressure Vessels on Offshore Plants with 3D Scanning Technologies	99
M G Kim, S H Kim, S I Choi, J W Pyo and J T Lee, Central Research Institute, Samsung Heavy Industries, KOREA	
Android - Based Application Design for Welding Inspection of the New Shipbuilding	N/A
Sufian Imam Wahidi, Sepuluh Nopember Institute of Technology, Indonesia	
High Performance Virtual Reality for Massively Complex 3D Models	N/A
Ken Goh, Knud E Hansen, Australia	
Minimising The Designer / End User Knowledge Gap Using Virtual Reality	105
W Pynn, Marine Institute of Memorial University, Canada	
The Virtual Ship: From Design To Training	117
M. Peverero, D. Tozzi, A. Zini, CETENA S.p.A., Italy	
The Implications Of Uninhabited Vehicle Technology On Naval Fleet Structures And Naval Ship Design	127
N. Kouriampalis, R. J. Pawling, D. J. Andrews, Design Research Centre, Marine Research Group, Department of Mechanical Engineering, University College London, UK	
Integrated Development Environment Of Autonomic Software For USV (Unmanned Surface	145

# Vehicle) Based On ROS (Robot Operating System)

H W Lee, M I Roh, L Zhao, S H Ham and N Kim, Seoul National University, Republic of Korea C W Yu, Agency for Defense Development, Republic of Korea

International Conference on Computer Applications in Shipbuilding 2017, 26-28 September 2017, Singapore

# **CONTENTS**

Variation of Asymmetric Side Hull of Pentamaran Hull Resistance by Computational Fluid Dynamics (CFD)	167
Z Zikrina, Yanuar, and F A Nugroho, Universitas Indonesia, Indonesia	
Efficient Hull Form Design Optimisation Using Hybrid Evolutionary Algorithm And Morphing Approach	175
J H Ang, Sembcorp Marine Ltd., Singapore, and University of Glasgow, UK, C Goh, University of Glasgow, UK, V P Jirafe, Sembcorp Marine Ltd., Singapore, Y Li, University of Glasgow, UK	
A Numerical And Experimental Study Of Resistance, Trim And Sinkage Of An Inland Ship Model In Extremely Shallow Water	185
Q Zeng, R Hekkenberg, C Thill and E Rotteveel, Delft University of Technology, the Netherlands	
Enabling A Paradigm Shift In Ship Structural Design With A 3d Approach	192
T Hulkkonen, NAPA Ltd, Finland	
H C Shin, Hyundai Heavy Industries, Korea	
N H Yi, Hyundai Heavy Industries, Korea	
D H Jang, NAPA Ltd, Korea	
T G Jang, NAPA Ltd, Korea	
Auto-Fine Mesh Generation For Local Analysis Based On The Consistent Finite Element Model	199
MJ Son, JJ Woo, HG Park and JY Lee, Korean Register, Republic of Korea	
An Integrated Procedure For Preliminary Tanker Ship Design Considering Oil Outflow Risk From Ship-Ship Collision	209
X Tan and J Tao, Maritime Institute at Nanyang Technological University, Singapore	
D Konovessis, Singapore Institute of Technology, Singapore	
H E Ang, School of Mechanical and Aerospace Engineering at Nanyang Technological University, Singapore	
Development For Evaluation Sw Regarding To Container Securing Strength	219
Jin-young Park, Dong-min Kuem, Jae-hun Jung, Korean Register of Shipping, Republic of Korea	
Marine Propulsion Shafting Simulation Interfaces	225
M. Zeid, Caterpillar Propulsion, Sweden	

Research On Large-Scale Marine Propulsion Shafting Load Test And Adjustment Technology	233
Ji Wang, Collaborative Innovation Center for Advanced Ship and Deep-sea Exploration, School of Ocean Engineering, State Key Laboratory of Structural Analysis for Industrial Equipment, Dalian University of Technology, Dalian, China	
Zhongchi Liu and Dongxin Xue, School of Power and Energy, Dalian University of Technology, Dalian, China	
Shengjun Zhang and Feixiang Wang, School of Ocean Engineering, Dalian University of Technology, Dalian, China	
Technological Advancements Made In Nakilat's Fleet	245
H.R. Suwaid, Nakilat, Qatar	
Synchronised Monitoring Of Sustainability And Life Cycle Costs With A Modular Maritime IT- Platform	255
R Ahlers, BALance Technology Consulting GmbH, DE	
A Fontana, SUPSI - Scuola Universitaria Professionale della Svizzera Italiana, CH	
M Petrucciani, Dassault Systèmes Italia Srl, IT	
J Cassina, Holonix S.r.L, IT	
D Corti, SUPSI - Scuola Universitaria Professionale della Svizzera Italiana, CH	
C Norden, BALance Technology Consulting GmbH, DE	
The Concept Of Speeds (Smart Platform Of Enhanced Engineering Data For Shipping And Shipbuilding) And Innovative Use Of Ship 3d Data	267
K Hamada, Hiroshima University, JP, T Hiraki, Mitsubishi Heavy Industries, Ltd., JP, M Nagano, Japan Marine United Corporation, JP and M Ozaki, NTT DATA ENGINEERING SYSTEMS Corporation, JP	
Smarter Production, Panel Line Optimization	277
K C Salmi, Hexagon PPM, Singapore	
Leveraging Engineering 3d Design Models For Production Planning Through The Shipbuilding Project Lifecycle	280
Stalin P. Ybiernas, Keppel Singmarine, Singapore	
Najaf Bashir, Hexagon PPM (Previously known as Intergraph PPM), Singapore	
Davide Guzzi, Hexagon PPM (Previously known as Intergraph PPM), U.S.A	
Big Data Analytics to Predict System's Behavior: The RAAS (Radar As A Service) Concept	N/A
Alessandro Garibbo, Leonardo S.p.A., Italy	
The Next Generation Of Asset Integrity Management Systems	291
J Esteve, Bureau Veritas, France	
A Tew-Kaï, Dassault-Systèmes, France	

Advanced Reporting As A Tool In Complex Multidisciplinary Analysis – Case Generic Survivability Assessment	301
R Kotiranta and K Partiala, Surma Ltd, Finland	
Application Of Numerical Simulation Of Corrosion In Ship And Marine Structures	N/A
Zhu Shengqing, Yang Rui, Xiao Gang, GLB	
On A Concept Of A 3d Cad/Cam System Based On Geometric Theory For Cfrp Plates Molding Process In Shipbuilding	307
K Matsuo, M Takezawa and A Sakurai, National Maritime Research Institute, JAPAN	
Virtual Reality Empowered Design A Cebollero and L Sánchez, Sener Ingeniería y Sistemas S A, Spain	313
Using Virtual Reality Paradigm To Present Ship Structures In Cad Environment G Šikić, USCS d.o.o., Croatia	321
Wearable Application In Shipbuilding G Rogero Fernando, Optio Marine Pvt Ltd, India	329
Experience Capture In Shipbuilding Through Computer Applications And Neural Networks S. U. Sangeet, K. Sivaprasad, Yashwant R. Kamath, Department of Ship Technology, Cochin University of Science and Technology, Kerala, India	335
Holistic Ship Design – How To Utilise A Digital Twin In Concept Design Through Basic And Detailed Design T-H Stachowski and H Kjeilen, Digitread AS, Norway	341
Improvements In Learning Process And Productivity. An Analysis Of The Return Of The Investment R Perez, SENER, Spain	351
Efficient Model Data Reuse Through Advanced Copy Techniques Joseph Baumer, Intergraph PP&M, USA	N/A
Driving Transformation In The Age Of Experience A Tew Kai, Dassault Systèmes, France	361
Methodology for Efficient Application of 3D Ship Modelling Software  Damir J. Kolich, University of Rijeka  Armin Becirevic, Niksa Fafanjel, Richard Lee Storch, University of Washington	N/A
Ship Concept Design Based On A 3d-Cad-System Including A Requirement Verification H Lindner and R Bronsart, University of Rostock, Germany	365

International Conference on Computer Applications in Shipbuilding 2017, 26-28 September 2017, Singapore

# **CONTENTS**

A CAD/CAE Integrated System of Ship Structure Custom-Developed Based on NN Platform	374
Chen YouFang, Wang LiRong, Meng FanChong, China Classification Society, China	
A Study on Decision Support Methodology for Evaluating IOT Technologies Using Systems Approach	380
K Hiekata, T Mitsuyuki, R Ueno and R Wada, The University of Tokyo, Japan	
B Moser, The University of Tokyo, Japan / Massachusetts Institute of Technology, US	
An Enterprise Modelling Approach for the Early Ship Design	390
W Jabary Tischreen University, Syria	
R Bronsart University of Rostock, Germany	
Smarter Production, Industry 4.0: Dream Or Reality?	N/A
Marcel Veldhuizen, Intergraph PP&M, Netherlands	
Acoustic Simulation for Cabin on Ship by Finite Element Method	401
Y. Wakisaka, Altair Engineering, Inc., Japan	
Y. Ohtsuki, Tsuneishi Shipbuilding Co., Ltd., Japan	
Development of Ship Structural Design and Assessment System Based on Harmonized CSR	405
Ho-Gyun Park, Korean Register, Republic of KOREA	
A Model Based Approval Process for Basic Hull Design	410
O C Astrup, DNV GL, Norway and C Cabos, DNV GL, Germany	
3D Digital Classification	420
Lionel LE GUENNIC, Cédric CHEYLAN, Thierry LE GAL, NAVAL Group®, FR	
Christophe CHAUVIERE, Olivier DEGRAND, Bureau Veritas®, FR	
Alexandre TEW KAI, Glenn DUTRIEUX, Sébastien VERET, Dassault Systèmes®, FR	
Integration of Ship Hull Form Modeling Based on Subdvision Surfaces With Other Ship Design Tools	432
SH Greshake, University of Rostock, Germany	
R Bronsart, University of Rostock, Germany	
Conceptual Design of Trimaran Unmanned Surface Vehicle (USV) for Manuverability and High Speed Testing	N/A
Zulfah Zikrina, Aqil.A Reksoprodjo, Fereizqo A. Sulaiman, Ida B. Krishna, Aldwin A. Hermanudin, Universitas Indonesia	

Intelligent PME Software for Productivity in Design Offices  P. S. Chopra, MRINA; Manager, Technical & Business Development, SeaTech Solutions International (s)  Pte. Ltd.	440
U R Gadekari, MRINA; Assistant Manager, SeaTech Solutions International (s) Pte. Ltd., Singapore	
Innovative Progress Monitoring Tool for Electrical Detail Design	458
Anish S, Cochin shipyard Ltd, Cochin, India	
Automated Generation of Detailed Cabling Documentation for Cruise Ships', Passenger and Commercial Vessels' Accommodation	464
Dr. A V Lalechos, LePlan, Greece	
D Maketas, LePlan, Switzerland	
A Pavlou, LePlan, Greece	
I Davaris, LePlan, Greece	
Incorporating Subjective Preferences in Design Sythesis Models With Limited Information	470
D C Brefort and D J Singer, University of Michigan, USA	
Automatic Piping Arrangement Design Considering Piping Supports and Curved Surfaces of Building Blocks	478
H Kimura, Kyushu University, JAPAN	
Spatial Augmented Reality for Manufacturing Information of Curved Shell Plates	486
K Hiekata, T Mitsuyuki, M Enomoto and K Okada, The University of Tokyo, Japan	
Y Furukawa, National Institute of Advanced Industrial Science and Technology, Japan	
Pre-Processing Module for the Welding Distortion Analysis According to the Different Assembly Sequences	492
M S Kang, H Chung, Korea Advanced Institute of Science and Technology, Republic of Korea	
A Framework Study on Plate Forming Caused by Flame Heating with Elastic FE Computation	N/A
Jiangchao Wang, Huazhong University of Science and Technology	
Hong Zhou, Jiangsu University of Science and Technology	
Influence of Computer Applications in Resistance Prediction Of Marine Vessels	498
Sri Harish Kalidass, Blue Bear Systems and Research, UK and University of Plymouth, UK	
Development of a Code for Power Prediction of a Ship at Preliminary Design Stage	N/A
Md Mesbah Uddin, Chittagong Dry Dock Limited, Bangladesh University of Engineering and Technology, Bangladesh	

SINGLE SOURCE DATA – HELP or HINDRANCE?	508
J L Martin, SAMOSC Ltd., UK	
CAD/CAM Integration with PLM in Naval Shipbuilding	520
D Morais, M Waldie, SSI, Canada B Benevelo, ARCOS Innovations, Canada	
Big Data Platform for PLM (Product Lifecycle Management) Systems in Shipbuilding and Offshore Industry	528
S H Kim, M I Roh, M J Oh and S W Park, Seoul National University, Republic of Korea	
N K Ku, Dong-eui University, Republic of Korea	
S H Myung, Youngsan University, Republic of Korea	
A Study on the Effective Collaboration Concept Between Different Several Design Stages	530
T Kunisada, Sanoyas Shipbuilding Corporation, Japan	
T Murakami, NAPA Japan Ltd., Japan	
S Kasai, SENER Ingeniería y Sistemas	
Towards A Marine Digital Twin,	538
Predictive Engineering Analytics For Ship Design	
S W Ferguson, Siemens PLM Software, UK	
Improving Launch and Recovery Operations Through Quiescent Period Prediction from Radar	542
M. Al-Ani, J. Christmas and M.R. Belmont, University of Exeter, UK.	
J M Duncan and J Duncan, Ministry of Defence Equipment and Support HQ, UK.	
B Ferrier, Hoffman Engineering Corp., USA.	
All Weather Ship Operational Prediction Using Simulation – Technology Developments and Results from a Dedicated Royal Navy And Related Sea Trials	548
Prof. B Ferrier, Hoffman Engineering, Dynamic Interface Laboratory, USA	
Prof. J Duncan, Defence Equipment & Support, MOD, UK	
Prof. M. R. Belmont, Exeter University, UK	
Dr. J. T. Christmas, Exeter University, UK	
Mr. J. Duncan, Defence Equipment & Support, MOD, UK	
Real-Time Ship Air-Wake And Free Stream Measurements using Doppler Lidar	564
M R Belmont and J Christmas, University of Exeter, UK.	
J M Duncan and J Duncan, Ministry of Defence Equipment and Support HQ, UK.	
B Ferrier, Hoffman Engineering Corp., USA.	
R Potts, BAE Systems, UK.	

Ensuring Software Reliability, Safety, and Security	570
David Card, DNV GL, USA	
Protecting Intellectual Property Rights in Distributed CAD Environments	576
L. Seppälä, CADMATIC, Finland	
Reserve papers	
Experience Capture in Shipbuilding Using Microsoft Sharepoint	584
Yashwant R. Kamath, K. Sivaprasad	
Modelling and Simulation of Organic Rankine Cycle for Waste Heat Recovery on an Offshore Service Vessel	
C. W. Ng, I. C. K. Tam, D. Wu	592
Additional papers	
EMD-Based Natural Excitation Technique for Modal Parameter Identification of Ship Structures	602
Hongyu Cui, Xin Xu, Zhonghua Zhou, Weiqiang Peng, Ming Hong	
Methodology for Efficient Application of 3D Ship Modelling Software	
D. Kolich, A. Becirrevic, R. L. Storch	608