The Royal Institution of Naval Architects

Smart Ship Technology

International Conference onSmart Ship Technology
24-25 January 2017, London, UK

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C. S. P. marine products. Machine learning algorithms and statistical modelling become widely used tools to measure the vast amount of data from sensors of various installations, which availability expands the functionality of shipping by operational cost saving and optimization of installation. The crucial role play on board various marine systems on robustness of predictive models algorithms, including:

11.50-12.25 INFLUENCE OF LOSS OF SYNCHRONIZATION BETWEEN SIGNALS FROM AUTONOMOUS SHIPS IS THE CULMINATION OF SHIPping 4.0. This paper will examine the different components of Shipping 4.0 and how they can change the business. The paper will also point out some key elements in the new technology that will need attention by the community, particularly in the fields of technology and design. Module D: Innovation and Standards. Finally, it will indicate some ongoing projects that are expected to influence the developments.

12.25-13.30 LUNCH

13.00-14.05 REQUIRED FLOODING SENSOR ARRANGEMENT FOR RELIABLE AUTOMATIC DAMAGE DETECTION, Esa Tutkkinen, Pekka Rupanen, Petri Pennanen, Napa Ltd, Finland. Modern passenger ships are equipped with advanced fire detection systems. However, in case of flooding, the detection and identification of the flooding zone is crucial to ensure the safety and survivability of passengers in an emergency situation. For example, IMO regulations require passenger ships, constructed after July 2010 to be equipped with flooding detection system. Decision support systems (DSS) can use these sensors to automatically detect breaches and to perform coordinated actions. A flooding breach detection system is addressed in this paper. A comparison between the actual and estimated data sets is also presented. A comparison between the actual and estimated data sets is also presented. A comparison between the actual and estimated data sets is also presented. A comparison between the actual and estimated data sets is also presented.

14.05-15.10 THE UNGOVERNED SPACE OF FIRE SAFETY ENGINEERING, C. S. P. navigation strategies are often based on ship performance and navigation data collected by various onboard sensors and data acquisition systems. However, there are many industrial challenges encountered in such full scale data handling situations in various vessels. The large scale data handling approaches are often categorized as “Big Data” challenges in shipping; therefore various solutions to overcome such situations should be identified. The proposed approach consists of a data processing chain that contains an initial data collection phase, a data cleaning phase, a data processing phase, and a data analysis phase. The proposed approach is evaluated using several case studies to demonstrate the effectiveness of the methodology.

15.10-15.45 RESPONSE TIME ANALYSIS CHALLENGES ON A SMART SHIP - AN INITIAL CASE STUDY, Demetres Armanes, American Bureau of Shipping, Greece. Integrated Automation Systems (IAS), generally considered as the shipping solution to total Ship Automation and Autonomous Navigation, is providing today the platform for further cost reduction and advanced functionality onboard modern vessels. Although, there are many best practices to be followed during testing, commissioning and maintenance time, during analysis and design time there is an increasing requirement to verify timely and accurately. For a smart ship to deliver the right data at the right place and at the right time, the tools are increasingly important for their precise and reliable verification. This paper explores the fundamental notions in response time analysis by using a well known IAS, sufficiently generalized, as an example. The approach identifies initial engineering data for the analysis and proposes simplistic behavioral and architectural models, annotated with these data for faster response time verification.

15.45-16.20 HANDLING BIG DATA IN SHIP PERFORMANCE & NAVIGATION MONITORING, Lukulokiwa Prasad Perera, Norwegian Marine Technology Research Institute (MARINTEK), Norway. Ship navigation strategies are often based on ship performance and navigation data collected by various onboard sensors and data acquisition systems. However, there are many industrial challenges encountered in such full scale data handling situations in various vessels. The large scale data handling approaches are often categorized as “Big Data” challenges in shipping; therefore various solutions to overcome such situations should be identified. The proposed approach consists of a data processing chain that contains an initial data collection phase, a data cleaning phase, a data processing phase, and a data analysis phase. The proposed approach is evaluated using several case studies to demonstrate the effectiveness of the methodology.

16.20-16.50 GENERAL DISCUSSION & EVENING DRINKS RECEPTION
This represents a preliminary programme and may be subject to change.

Smart Ship Technology

Larry Rumbol, Condition

be timely in restoring power in vital areas of the ship also to avoid subsequent cascade failures. The

applied to them. Quality attributes of techniques include distribution of the reconfiguration system

strongly depend on the physical and control layers and the fault diagnosis methodology; literature

between switch operations minimization and reconfiguration schemes. Reconfiguration techniques

issue for any vessel. This paper reports a systematic survey on SPS reconfiguration methods; most

Power System (SPS) supplies power to navigation, communication, operation and weapon systems.

Simone, Luca Sabatucci, National Research Council of Italy – ICAR Institute, Italy.

order to monitor and predict future values of selected physical parameters of the most critical ship

and time-series based. This paper proposes initially the utilization of a fault tree in order to obtain

identification of the state of equipment changes from normal conditions and trends of the health of

made to transform corrective/preventive maintenance techniques into predictive ones. Condition

terms of business losses by reducing ship availability and increasing downtime. Efforts have being

demonstrates how the statistical methods have been used to identify the economical speed and

An economical running speed algorithm (ECO Speed) has been developed by using statistical analysis

operators need to maintain constant performance by implementing appropriate speed adjustments.

strategy otherwise, the financial benefit will be at risk. To get the maximum fuel efficiency, the

it is analysis of the resulting data and its synchronisation that are the key activities to monitoring

reducing operational costs will bring further competitive advantage to ship operators. Smart sensor

Rose Norman, Shervin Younessi, Shirley Coleman, Newcastle University, UK.

15.45-16.20 IMPLEMENTATION OF STATISTICAL METHODS ON SHIP DATA FOR VESSEL

11.45-11.15 COFFEE

11.15-11.50 SHIPBOARD POWER SYSTEMS RECONFIGURATION: A COMPARED ANALYSIS OF STATE-OF-THE-ART APPROACHES, Luca Agnello, Massimo Cossentino, Giada De Simone, Luca Sabatucci, National Research Council of Italy - IICAR Institute, Italy. The Shipboard Power System (SPS) sub-systems power to navigation, communication, operation and weapon systems.

The capability of facing single or multiple faults caused by heterogeneous reasons is a mandatory issue for any vessel. This paper reports a systematic survey on SPS reconfiguration methods; most recent state-of-the-art contributions in the field have been classified according to a taxonomy of criteria. Main categories include: reconfiguration strategies, techniques, quality of reconfiguration, and qualification. Reconfiguration strategies define priorities among loads and operations. Examples of them are priority reconfiguration, load shedding, and achieving of an optimal trade-off between priority loads and the capability of the system to shed load. Reconfiguration strategies are selected strongly depend on the physical and control layers and the fault diagnosis methodology; literature approaches deal with mathematical methods, knowledge-based approaches or multi-agent systems. So the optimal strategy is determined by the type of the situation. In the case of multiple OCS (offshore wind farms), the methods that are applied to them. Quality attributes of techniques include distribution of the reconfiguration system control layer, and approaches response time. Of course, it is desired the reconfiguration procedure be timely in restoring power in vital areas of the ship also to avoid subsequent cascade failures. The limitations of the reconfiguration techniques include the reliability and safety. The study of the techniques is validated by analysis of employed methods, hardware test-beds, repeatability of the simulations, execution times, etc. Finally, some limits in the current state of the art have been identified.

11.50-12.25 SHIP’S CENTRAL COOLING SYSTEM LIVE PERFORMANCE OPTIMISATION AND MODELLING, Alessandro Boveri, Federico Silvestro and Alessandro Panzera, DITEN University of Genoa, Genova, Italy. Central cooling systems play an essential role in ship operations, since guarantee the correct operating mode of vital users such as the main engine and generators. These systems are normally sized according to the design point so that they can deliver the cooling demand even in extreme conditions, while these conditions are very rare events in the ship’s life. In order to improve the overall cooling efficiency, a variable frequency drive can be adopted [1]. In this work, a physical model of a real Ro/Con central cooling system is implemented with a integrated process control scheme. An experimental campaign has been carried out for six months to collect the overall cooling demand (e.g. sea water and fresh water temperatures, flows and valve position) before and after the introduction of variable speed drive on the sea water pump. An algorithm for the control of the cooling water system is proposed and implemented in the model in order to improve the thermal management of the system. The system is able to adjust the flow rates and temperature of each of the four cooling water circuits. Cooling of the electrical, propulsion and auxiliary machinery is provided coming from the recorded data and the model are around the 40 and 60 percent with a reduction between 10 and 27 percent for the pump speed. The methodology and model are planned and developed in order to better exploit the data available after the on-board measurement system.

12.25-13.30 LUNCH

13.30-14.05 UNLOCKING THE HIDDEN VALUE OF DYNAMIC POSITIONING SYSTEMS, Mark Carter, Sonardyne, Guidance, Veripos, UK. Over the last decades dynamic positioning systems have grown in popularity and applications, by proving highly effective and efficient in keeping vessels exactly where they are intended to be. In this context, the Marine operations and ports are looking at ways of reducing the burden from increasing operational demands and complexities. The key technology components which every DP system relies upon are the environmental, motion and position reference sensors which provide the crucial measurements for the vessel automation system to function in the way it is designed. This paper will discuss the benefits of using advanced smart sensor technologies such as from the above-surface (GNSS) position reference systems. This paper outlines an open system architecture for industry wide discussion aiming at providing significant and quantifiable additional value from position reference data, system integration, and the added value of key DP technology components for smart sensor systems.

14.05-14.40 ENERGY SAVINGS FOR A SHIP IN IRREGULAR WAVES BY USING REAL-TIME OPTIMAL CONTROL OF PROPULSER PITCH AND ELECTRIC PROPULSION, Hidenori Makino, Yuchiro Hirano, Nanya Umeda, Osaka University, Japan, Toshiyuki Ohkuta, Kyoto University, Japan, Katsuji Higashimori, Kansai University, Japan, and Michiaki Futakuchi, Kamome Propeller Co. Ltd., Japan, Hironori Suzuki, Furuno Electric Co. Ltd., Japan. Normally a ship engine is controlled by its governor for keeping its constant engine speed and the propeller pitch does not change in time. However, a ship at sea runs under oscillatory external environment so that the governor keeps being in trouble for realizing proper control. So it is important to let the governor be independent from the control system of propulsion power plant and propeller pitch for minimizing energy consumption of a ship. This paper proposes an optimal control system including the fourier transformation, quick responses are realised with the use of AC induction motor and purpose-designed controllable-pitch propeller and their optimal control signals are calculated in real time with the ship dynamic model. The purpose-designed propeller is demonstrated with 14.7 knots is reduced by about 2% in head waves, and about 7% in following waves with the mean wave period of 12 seconds that the energy required to propel the 217 m long bulk carrier with 14.7 knots is reduced by about 2% in head waves, and about 7% in following waves with the mean wave period of 12 seconds that the energy required to propel the 217 m long bulk carrier with

14.40-15.00 COFFEE

15.10-15.45 SIMULTANEOUS OPTIMIZATION METHOD OF THE DIRECTION AND SPEED FOR SHIP ROUTE PLANNING, Ki-Su Kim, Myung-Hi Roh, Sung-Min Lee, HyeongYong Jung, Jong-In Park, Dae Hyun Hong, Kangwha University, Korea, Ki-Su Kim, Roskilde University, Denmark. Conventional optimization for ship route planning and controlling is proposed in this study. For this, an optimization problem for finding an optimal ship route plan is formulated. The proposed methodology will train models using pre-classified (healthy/faulty) data on categories of data available from a range of position technologies and attempts to quantify potential value for access to this information in aggregate form. Last, the paper outlines potential solutions amongst the advantages and disadvantages compared to existing or alternative approaches and the suitability for future operations such as remote control or autonomous vessels.

15.45-16.20 IMPLEMENTATION OF STATISTICAL METHODS ON SHIP DATA FOR VESSEL SPEED MODELLING TO IDENTIFY THE ECONOMICAL RUNNING SPEED, Ibana Zaman, Kayvan Pazouki, Rose Norman, Shervin Younessi, Shirley Coleman, Newcastle University, UK. Shipping is already at the center of the debate due to the increasing fuel price and environmental legislation, the fleet operators are thinking about how to save fuel by managing speed. Just-in-time arrival into port is an important and common strategy to increase efficiency. The vessel speed must be properly tuned as part of this strategy otherwise, the financial benefit will be at risk. To get the maximum fuel efficiency, the operators need to maintain constant performance by implementing appropriate speed adjustments. An economical running speed algorithm (ECO Speed) has been developed by using statistical analysis of real-time data; adjustments to the speed are made based on a combination of historical and real-time reading of the ship data in different conditions. The ECO Speed system also gives information on the estimated fuel consumption, duration and CO2 emissions for an upcoming journey. This paper demonstrates how the statistical methods have been used to identify the economical speed and the fuel consumption in various conditions.

16.20-17.00 GENERAL DISCUSSION
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24-25 January 2017, RINA HQ, London, UK

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