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The Royal Institution of Naval Architects

ICSOT 2012: International Conference Ship & Offshore Technology 2012

DEVELOPMENTS IN FIXED & FLOATING OFFSHORE STRUCTURES

23-24 MAY 2012, BUSAN, SOUTH KOREA

day 1

09.00 – 09.30 **COFFEE AND REGISTRATION**

09.30 - 10.05 **RECENT DEVELOPMENTS OF THE DESIGN AND ANALYSIS OF FLOATING WIND TURBINES**
T.Moan, Z.Gao, M.Karimirad, E.Bachynski, M.Kvittem, C.Luan, Z.Jiang, M.Etemaddar, CeSOS, NTNU, Trondheim, Norway
Offshore wind provides an important source of renewable energy and new opportunities for marine technology. Offshore wind turbines with a monopile support structure fixed to the sea bed in shallow water, have already been industrialized, while fixed turbines in deeper water are emerging and floating wind turbines are still at the research stage. In this paper we address recent developments of concepts for floating wind turbines and design criteria. Results of comparative studies of the response in wind turbines under various environmental conditions are presented. The advantages and disadvantages of these concepts in different water depths are briefly discussed.

10.05 - 10.40 **SOME RECENT ADVANCES AND FUTURE TRENDS IN ELECTRICAL EQUIPMENT FOR OFFSHORE STRUCTURES**
C.W. Baek, Korea Marine Equipment Research Institute, Korea.
Onshore oil production is expected to drop continuously after hitting a peak in 2016 due to excessive development so far. As oil demand keeps increasing while supply decreases, oil prices are rising. Therefore, many are likely to shift their focus to maritime resources. Oil and gas wells are being actively developed now, but in order to meet the demand for oil, developers are going deeper to secure more of it. As development of maritime resources using offshore plants is going deeper in seas, floating structure is advancing into the subsea sector. This paper discusses how to improve the efficiency of offshore plants and technique for connection between onshore and offshore systems. It also provides overview and perspective of convergence between offshore plants' equipments and electrical equipment for smart and green plants.

10.40 - 11.00 **COFFEE**

11.00 - 11.35 **CONCEPTUAL STUDY OF SUBSEA LIFTING RISER SYSTEM**
Y. Sang-Woong, Samsung Heavy Industries, Korea.
This paper provides the conceptual design results of lifting riser system for subsea mining. The pilot test of subsea mining will be conducted in East sea of South Korea at water depth 1,000m before real project using Metocean Data. The riser system is divided in six parts: steel pipe, flexible hose, flex joint, pump, buffer and miner. This paper is focused on the dimensions of steel pipe, flexible hose and flex joint. Properties of most of these equipments are similar to the properties of oil market products those already verified in operating field for long time. The specifications of other parts are assumed using the data of other subsea mining projects. Based on the dynamic operability analysis result, the specification and arrangement of lifting riser system are determined, and necessity of bend stiffener and the number of buoyancy modules for flexible hose are determined.

11.35 - 12.10 **INFLUENCE OF WAVE APPROACH ANGLE ON DYNAMIC RESPONSE OF PERFORATED TENSION LEG PLATFORM**
S. Chandrasekaran, S. Sampath, Indian Institute of Technology Madras.
H. H. Lee, S. M. Seob, Changwon National University, Changwon, Korea
Drilling and exploration of oil and gas becomes a challenging issue at greater water depth due to the encountered environmental loads. Tension-Leg Platforms (TLPs) are successful offshore complaint structures that are mostly preferred for deep water oil exploration. This innovative structural design dampens the vertical motion of the platform but large horizontal movements cause inconvenience to people on board, though the platform remains stable for operational sea state. To reduce the direct wave impact, coastal and offshore structures are often constructed with one or more protective perforated layers. Influence of wave approach angle on active degrees-of-freedom under regular waves is discussed in the paper. Results show a significant reduction in the dynamic response of perforated TLPs in comparison with the normal ones.

12.10 - 12.45 **DESIGN AND TESTING OF OFFSHORE ACQUACULTURE FLOATING STRUCTURE FOR SEEWEED OCEAN FARMING**
O. O Sulaiman, University Malaysia Teremgganu, Malaysia.
Seaweed farming has become one of the natural resources which is economically important. The existing cultivation systems for seaweed is not suitable with most of deep and open water area in peninsular. Moreover, the current cultivation system are not environmental sustainable and economical unstable. This paper describes the design of the offshore floating structures scientifically based on improvement of the Long Line System for commercializes scale seaweed farming. Some key factors in the design, prototype and testing of floating offshore structures considered in the development of ocean farming technology system are discused.

12.45 - 13.45 **LUNCH**

13.45 - 14.20 **STUDY ON PRODUCTION RELIABILITY OF LNG-FPSO**
Y. Seo, D. Chang, Korea Advanced Inst. of Science and Technology, Korea
This study estimated effect of various factors on the production reliability of the LNG-FPSO in the conceptual design stage.The factors were categorized into two classes depending on their nature in the system constitution: internal and external classes. The former includes the sub-classes with the production system: process unit, utility unit, and safety system unit while the latter consists of the sub-classes of external functional failure and external accident. Instead of estimating the sensitivity of the factors through input-output analysis, the leading order of magnitude of each factor was estimated. The effectiveness of this approach was demonstrated by rigorous production analysis of a system in detailed design.

14.20 - 14.55 **DYNAMIC RESPONSE ANALYSES OF COMPLIANT OFFSHORE STRUCTURES TO EXTREME WAVES**
S. Chandrasekaran, Y. Koshti, Indian Institute of Technology Madras.
In the last few years there has been an increasing focus within the shipping and offshore industry on extreme wave events and abnormal wave conditions. Hurricanes in past few years confirmed the importance of analytical studies of deep water offshore platforms under such extreme waves; safety and integrity of compliant offshore structures shall be under threat. Present study deals with detailed dynamic response analysis of two types of offshore complaint structures namely: Tension Leg Platform; and offshore Triceratops under extreme wave forces. This paper concerns the propagation of transient wave groups, focused at a point of time to produce extreme waves. Analytical studies conducted show that triangular TLPs and triceratops are less sensitive to undesirable responses thus making it as safe alternatives for deepwater oil explorations.

14.55 - 15.15 **COFFEE**

15.15 - 15.50 **NEW GENERATION OF DEEPWATER DRILLSHIP - STRUCTURAL ANALYSIS**
X. Wang, J. H. Hwang, Y. Yan, H. Yoon, ABS, USA
New ultra deepwater drillship designs are capable of operating in water depths of up to 12,000 ft. and drilling depths of up to 40,000 ft. To address the technical challenges of the structural design of these deepwater drillships requires the application of advanced design and analysis procedures for operations in various world-wide deepwater environments. This paper describes an advanced design and analysis procedure to address the strength and fatigue requirement of deepwater drillship structures. The procedure involves seakeeping analysis in transit and operational conditions for different geographic environments, strength assessment and fatigue evaluation. In summary, the new generation of deepwater drillships require a new approach to their design and analysis. The paper provides a new structural design and analysis procedure to be applied for these advanced deepwater drillships.

15.50 - 16.25 **RISK-BASED SELECTION OF OIL AND GAS ENVIRONMENTALLY FRIENDLY DRILLING SYSTEMS**
O.K Yu, Appalachian State University, USA
This paper introduces a risk-based decision-making methodology to integrate oil and gas Environmentally Friendly Drilling (EFD) technologies into an optimal selection of a drilling system. The aim of the proposed methodology is to minimize the environmental impacts, optimize the cost-benefits, and at the same time consider the effects of the public perception on the drilling process. The main focus is the uncertainty quantification associated with the components of the well design process when treated in a causal manner. To illustrate the applicability of the proposed methodology, a case study is presented where a detailed EFD system selection process is elaborated using Bayesian Networks. A simplified model is further discussed to prove the concept and to show the theoretical and computational foundations of the risk-based approach.

16.25 - 17.00 **A USER FRIENDLY UNIVERSAL PRIMER KEEPING CONSTRUCTION AND OWNERS HAPPY -**
T Stein, International Pain, UK
As exploration moves into deeper waters, owners are increasing their design life expectations for their floating assets. Coatings suppliers are being tasked with providing solutions that will mitigate steel corrosion of steel over such extended periods. However, the needs of an owner in the coatings selection process are very different from that of the applicator. .This paper will document the balance of in-service performance, meeting needs of owners whilst offering straightforward application for the construction process.

17.00 - **EVENING DRINKS RECEPTION**

day 2

09.00 - 09.30 COFFEE AND REGISTRATION

9.30 - 10.05 EFFECT OF CORROSION ON THE ULTIMATE STRENGTH PERFORMANCE OF VLCC CONVERSED INTO FPSOS
D.K. Kim, D.K. Park, S.J. Kim, H.B. Kim, J.K. Seo, B.J. Kim and J.K. Paik, Pusan National University
Aging problem is one of important factors relating to design of ships and offshore structures, which will cause the corrosion, fatigue crack and local dent. One of possible causes of such casualties is the structural failure of aging ship hulls in rough weather. In the case of corrosion, there are survey rule data by classification society based on the state of hull corrosion and suggested repair guidelines for excessively corroded hulls. In this paper, the effect of corrosion on the ultimate strength behavior relating to hull girder and stiffened panel of FPSO refitted from VLCC will be discussed. The result of this research will be useful data to evaluate ultimate strength of corroded FPSOs operating in sea state in longtime.

10.05 - 10.40 DEVELOPMENTS IN FIXED AND FLOATING OFFSHORE CONCRETE STRUCTURES
R. Pérez Fernández, Universidad Politécnica de Madrid. M. Lamas Pardo, Universidade da Coruña, Spain.
In the offshore industry there are two possible materials for the construction of the hull of a structure: steel and concrete. The extra displacement in concrete ships have been found prohibitive in the past. But in the offshore industry, the loss of mobility of a concrete hull can be perfectly offset by the advantages in terms of maintenance and resistance to fatigue. Some of the concepts in concrete platforms that are emerging in the last years are floating and gravity base platforms for use as offshore LNG terminals and as offshore industrial plants. The challenge of these offshore facilities is to optimize their capital costs to compete precisely against shore facilities.

10.40 - 11.00 COFFEE

11.00 - 11.35 UPGRADES AND CONVERSIONS OF FLOATING OFFSHORE UNITS: AN OVERVIEW
A.M. van Wijngaarden, TU Delft, The Netherlands
Changing market conditions often require offshore vessels to extend their capabilities. In the marine engineering and construction industry five tiers of vessel capabilities increase are distinguished, with increasing complexity and re-building costs. 1. Lifetime extension of a running vessel is the easiest adaption. 2. Capacity upgrade of a mobile offshore asset is done in anticipation of market opportunities. 3. Adding a vessel function to better serve offshore installation markets is a balancing act with maintaining existing vessel capacities to match upgrading costs with extra revenue potential. 4. Changing the offshore function of a vessel is a drastic step. 5. The summit of vessel conversion is the complete transformation of a cargo vessel hull into a new offshore unit.

11.35 - 12.10 SYSTEMATIC HAZARD IDENTIFICATION OF SUBSEA PRODUCTION SYSTEM
Y. Choi, D. Chang, Advanced Institute of Science and Technology,Korea
This study proposes a systematic approach to identification of the hazards of subsea production systems and implementation of safety systems against the hazards. One simplified model of subsea production system was selected, and the hazards with potential impact on production and safety of the subsea system were identified. These hazards were categorized systematically in accordance with nature and human impacted, system, utility and infrastructure impacted and process impacted hazards. The results obtained by the hazard identification were potential consequences and safety actions of the simplified subsea production system model.

12.10 - 12.45 DEVELOPMENT OF INTERFACE PROGRAM FOR INTERACTION BETWEEN ACTIONS AND ACTION EFFECTS SUBJECT TO FIRE
J.H Kim, C.K Kim, J.K Paik, Pusan National University, Korea. G.M. Katsaounis, M.S. Samuelides, School of Naval Architecture and Marine Engineering Athens, Greece
In offshore structure and FPSO topsides, fire accidents cause a severe damage about environment, human and structure. The aim of this study is to develop an interface program for automatic thermal load mapping between fluid and solid. Temperature distributions were obtained by CFD simulations. For the consequence analysis the structures were modeled using shell finite elements with nonlinear constitutive relations. The procedure of assignment the temperature loadings directly from the CFD results to the FEM model is described and representative results are given through the application of the methodology to a sample problem. This study of interface program development will be a very useful thermal load application technique.

12.45 - 13.45 LUNCH

13.45 - 14.20 A STUDY ON THE QUANTITATIVE FIRE RISK ASSESSMENT AND MANNAGEMENT
J.H Kim, D.C Kim, C.K Kim, S. Islam, J.K Paik Pusan National University, Korea
In offshore structures, fire is one of the most important hazardous events. This has been proved by several disasters such as the Piper Alpha accident. The concern of fires has recently been reflected in rules and quantified risk assessment based design practice. The aim of the present study is to develop pertinent guidelines for the quantitative risk assessment of FPSO installations, with a focus on topsides and equipment that are subject to fires. Its more specific objective is to produce documented procedures and guidelines for use in the assessment of fire actions, their consequences for FPSO topside structures and equipment, and their associated risk levels. The acceptance risk criteria are also addressed.

14.20 - 14.55 COMPUTATIONAL MODELLING OF INTERACTION BETWEEN CFD AND FEA SIMULATIONS UNDER GAS EXPLOSION LOADS
S.J Kim, Pusan National University, Korea
After the Piper Alpha accident in 1988, the study on explosion and fire risk assessment and management of FPSOs were increased in many fields. In the fields, idealized explosion load curve with peak pressure and duration time is normally used for structural consequence analysis under gas explosion loads. But, there are many uncertainties by using idealized pulse loads. In this study, to use actual pressure loads by gas explosion interface program was developed between FLACS and LS-DYNA. FLACS is a CFD simulation program that analyzes gas dispersion and explosion. And LS-DYNA is the NLFEM program that analyzes the structural consequences. This study will be helpful for nonlinear structural consequence analysis considering actual explosion loading and explosion risk assessment of FPSOs.

14.55 - 15.30 SELECTION CRITERIA FOR EPOXY PASSIVE FIRE PROTECTION
Robin Wade International Paint, UK
Epoxy passive fire protection is widely applied in the offshore industry. Today's technology uses the most durable binder systems to retain intumescent additives. The selection of epoxy PFP can be challenging for engineers and owners who may be unfamiliar with the standards and testing requirements that demonstrate a product's suitability for use offshore. In the last year there have been several developments to simplify this task. This paper outlines where the benchmark is currently set for passive fire protection and also demonstrates that such testing and Type Approvals should be backed up by in-service case histories.

15.30 - 15.50 COFFEE

15.50 - 16.25 A STUDY ON PROCEDURE FOR QUANTITATIVE RISK ASSESSMENT OF EXPLOSION IN OFFSHORE INSTALLATIONS
J.M Sohn, S.J Kim, B.H Kim, J.K Paik, Pusan National University,Korea
The hydrocarbon explosion causes a blast or a rapid increase in pressure. This kind of accidents causes serious casualties, property losses and marine pollution. Therefore, it is needed for considerable study for assessments of explosion. This study introduces and describes a number of procedures for the quantitative assessment and management of gas explosion risks in offshore installations. This study presents developed modeling techniques for CFD explosion simulations and nonlinear structural consequence analysis. These procedures can be efficiently applied to offshore development projects, and the application includes the assessment of design explosion loads as well as the quantification of effects of risk control options (RCO).

16.25 - 17.00 REQUIREMENTS FOR EXPLOSION-PROOF EQUIPMENT USED ON OFFSHORE PLATFORMS AND SHIPS IN EUROPE AND KOREA
J.H Yu, J.Y Shon, KOMERI, Korea.
D. Markus, Physikalisch-Technische Bundesanstalt, Germany
On and offshore drilling of gas or oil is a high risk sector with respect to fire and explosion hazards. Therefore, the European Union has implemented the Directive (92/91/EC) to protect workers on oil platforms. Hence, often a notified body like PTB has to be involved in the conformity procedures. In South-Korea, a similar mandatory safety certification system of explosion-proof equipment exists. If the product fulfills all the requirements of the comprehensive review it can be KC marked. This paper explains the actual and the new regulations for explosion-proof maritime or offshore equipment.

17.00 - GENERAL DISCUSSIONS

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23-24 May 2012

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The Venue for the conference is The Westin Chosun Hotel, Busan, South Korea.

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