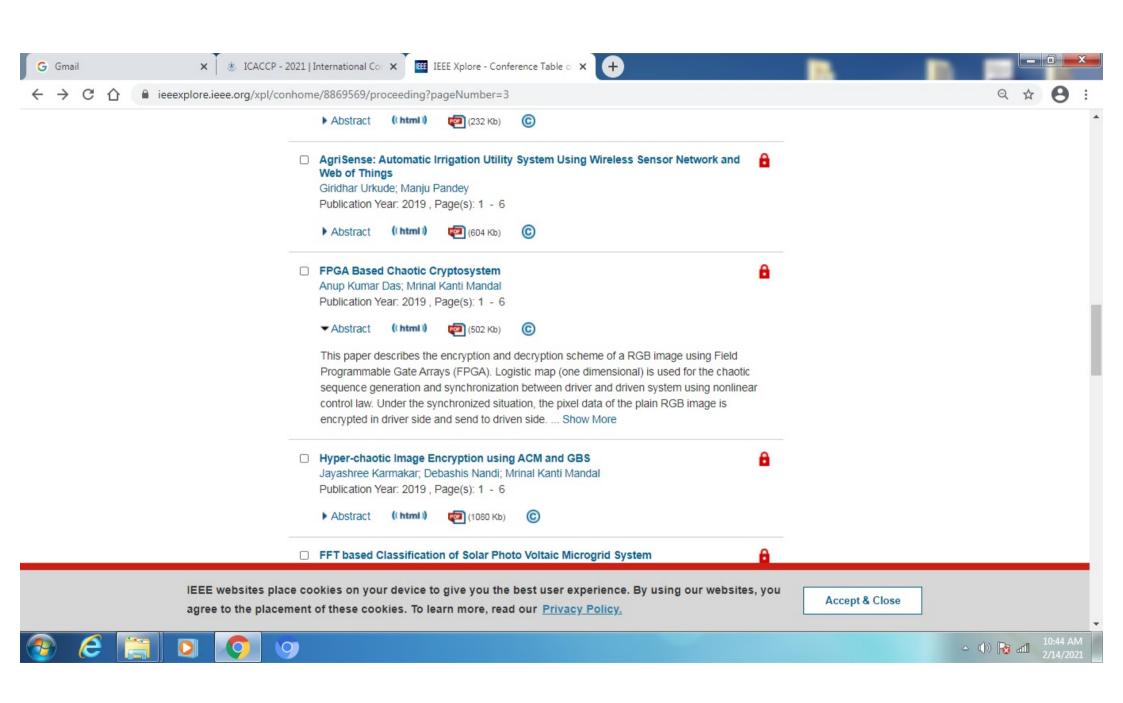


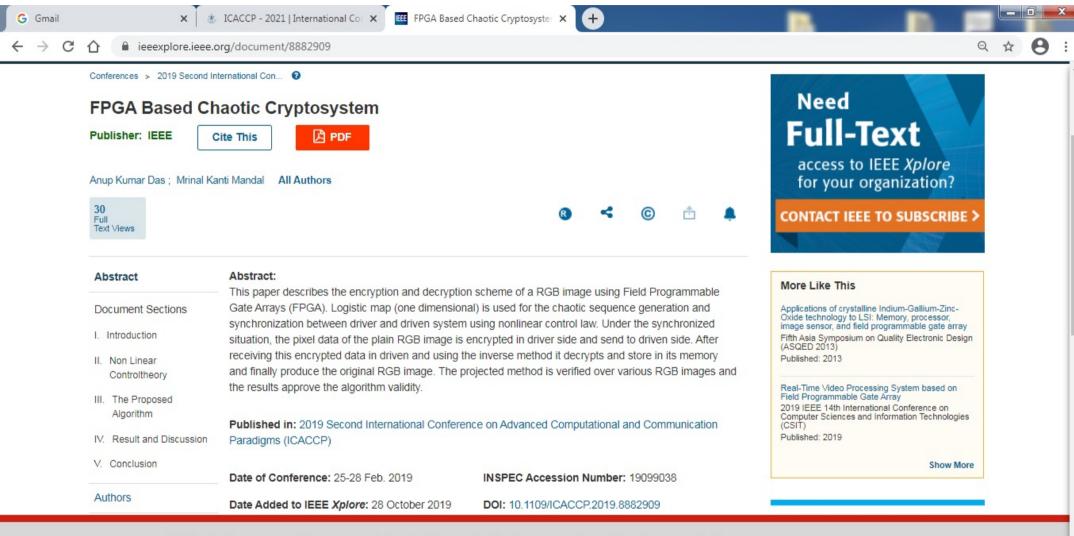
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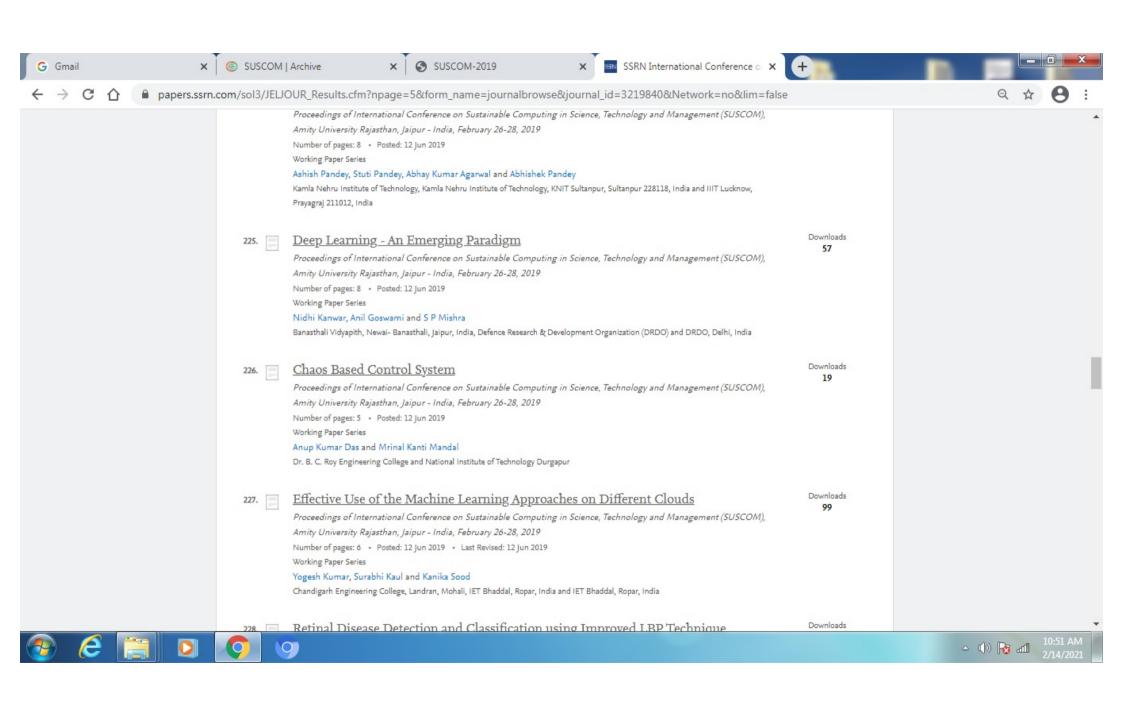


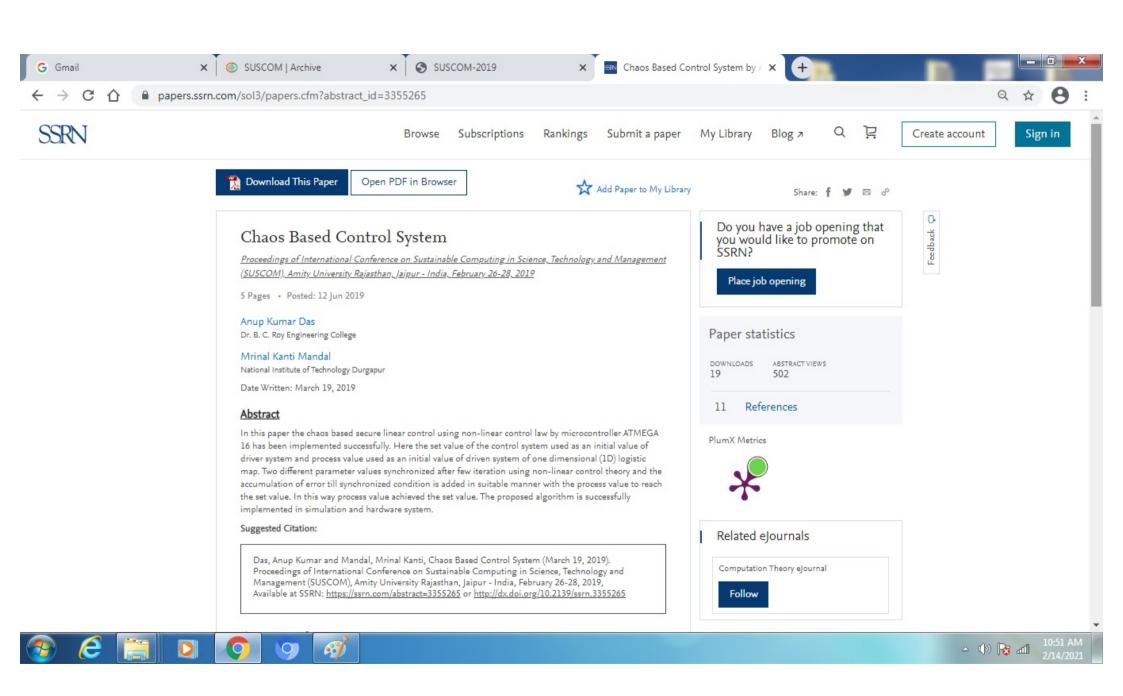






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OPTIMIZATION OF PROCESS PARAMETERS FOR GMAW OF HIGH CARBON STEEL USING TOPSIS

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Abstract: TOPSIS is an extensively used multi-criteria decision making tool. It is simple in form and easy to apply in complex decision making problems. In the present work, TOPSIS is applied for selecting appropriate process parameters for Gas Metal Arc Welding (GMAW) of High-Carbon Steel specimens. Experiments were performed on specimens using MAG welding with varying process parameters. Experimental outcomes are analyzed and the results obtained from the TOPSIS process are depicted in ranking the best alternative corresponding to a set of process parameters. It is found that 160 A of weld current, 30 V of weld voltage and welding torch speed of 370.5 mm/min setting with the highest heat input in the present investigation is giving the best result according to TOPSIS

Keywords: TOPSIS; GMAW; closeness to ideal solution; ranking; optimization.

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Chapter 15 Parametric Optimization of TIG Welding Process on Mechanical Properties of 316L Stainless Steel Using RSM



Subhas Chandra Moi, Asish Bandvopadhyay and Pradip Kumar Pal

Nomenclature

A Welding current (A)
B Welding speed (cm/min)
C Gas flow rate (l/min)

AISI American Iron and Steel Institute

ANOVA Analysis of variance DF Degree of freedom GFR Gas flow rate

PE Percentage elongation

RSM Response surface methodology

TIG Tungsten inert gas
UTS Ultimate tensile strength

15.1 Introduction

Austenitic stainless steel is an important material and very frequently used in industries like automobile, thermal power plant, nuclear power plant, chemical and pharmaceutical industries due to its superior corrosion resistance, high strength, high ductility, formability and weldability. Out of 300 series grade of austenitic stainless steels, AISI 316L is an extra low carbon version of austenitic chromium-nickel stainless steel [1]. It contains molybdenum materials that improve corrosion resistance, strength at elevated temperatures and improve resistance to pitting from chloride ion solutions. The extra low carbon content in 316L austenitic stainless steels minimizes harmful carbide precipitation due to welding. Some equipment of above said industries is manufactured by fabrication (welding).

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Fully nonlinear modelling and coupled analysis of an offshore spar platform

Vinayak Ghosh, Sudharshan Vimmadi, Swarnadip Dey, Shovan Roy, Atul K. Banik*

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Abstract

A coupled numerical analysis has been carried out for the structural responses and motion behavior of a classical spar structure subjected to irregular waves. Four catenary mooring lines restrain the motion of the floating body by the generation of tension due to change in their nonlinear profile. The floating structure is modeled as a hollow thin cylinder, defined by a point mass at the center of gravity, draft, diameter, etc. The surface of spar is discretized with hydrodynamic pressure panels while mooring cables are modeled using a sequence of Morison type elements. An irregular sea state, represented by the JONSWAP spectrum is used to subject the spar against an extreme environmental loading. Natural time period of the spar is obtained and compared with the results of the referred paper. Furthermore, time response of the system for surge and cable tension is also analysed and good agreement is observed. Further, the sensitivity of the system is investigated with the help of fully coupled time domain analysis by changing the length of mooring lines, the vertical position of fairlead point and also the incident angle of the wave spectrum. Considering both shallow water and deep water scenarios, the effect of second order hydrodynamic loading on the structure, using full Quadratic Transfer Functions (QTFs), is also taken into account during the analysis process.

Keywords: spar; coupled dynamic analysis; time domain analysis; sensitivity study

1. Introduction

Deep sea exploration for marine sources of energy, both fossil and renewable, has gain momentum in the recent past. Of these different offshore platforms like Floating Production Storage and Offloading (FPSO) systems, semisubmersibles, Tension Leg Platforms (TLP), Spar Platforms, most are attached to the seabed with the help of flexible mooring cables; either metal links or of polyester material. Among them, spar platforms are smaller in size, and the superstructure is supported by the buoyancy of the hollow cylindrical substructure and the station position of the floater is maintained by slack catenary cables. The metacentric height and the relative distance between the centers of gravity and buoyancy have a direct influence on the stiffness of a spar platform in the pitching and rolling direction which in turn maintains the pitching and rolling stability of the structure (Koo et al. 2004, Karimirad et al. 2011). Due to large mass and relatively small restoring stiffness of spar has very low natural frequency in the horizontal degrees of freedom. This is the reason behind the small response of the structure to ocean waves in the wave-frequency (WF) range. However, in low-frequency (LF) wave exciting forces, the structure may experience large motions known as drift frequency motions.

The dynamic response of spar platforms subjected to wave excitations is evaluated in terms of degrees of freedom of the rigid floater. The damping effect induced by a mooring system plays a major role in reducing the slow-drift motions of a moored spar platform. Thus to predict the motions of a moored vessel precisely, the coupling effects between a structure and its mooring system should be considered. The

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Session No. : TS - 18 SESSION CHAIR: Dr. D.K. MAITI RAPPORTEUR(s): Dr. Rajendran P DATE : 14/12/2016 Тіме : 8.15AM-10.00AM VENUE : TT 513 Buckling Analysis of Composite Laminated Skew Plate of Variable Thickness Under In-plane Compression **SM-6** PRIYANKA DHURVEY Department of Civil Engineering, Maulana Azad National Institute of Technology, Bhopal, India Meshless Natural Neighbor Galerkin Method for the Analysis of Composite Plates Using Higher Order Shear Deformation Theories SM-6 SINGAM SRIVIDHYA¹, BASANTH KUMAR², V K GUPTA², and AMIRTHAM RAIAGOPAL¹ ¹Department of Civil Engineering, Indian Institute of Technology, Hyderabad-502285, India. ²Advanced Systems Laboratory, DRDO, Hyderabad, India Hybrid Brick Elements for Three-Dimensional Stress Analysis in Variable Angle Tow Composites SM-6 Lala Bahadur. A, S: N. Khaderi, and Gangadharan. R Department of Mechanical and Aerospace Engineering, Indian Institute of Technology, Hyderabad Comparative Study on the Effect of Steel Fibers on Reinforced Concrete Beams PRANOY ROY¹ and PRAKASH MONDAL² SM-6 ¹Department of Civil Engineering, Dr B.C. Roy Engineering College, Durgapur, West Bengal ²Department of Civil Engineering, NIT Durgapur, West Bengal Numerical Simulation of Delaminated Plate using Cohesive Zone Material Model NAGENDRANATH A¹, R. K. Gupta² and C. Lakshmana Rao³ SM-6 ¹²Advanced Systems Laboratory, DRDO, Hyderabad, Telangana, 500058. ³Department of Applied Mechanics, IIT Madras. Effect of Damage Modes and Fiber Volume Fraction on the Effective Properties of the Unidirectional Composites **SM-6** K. S. S. REDDY¹, A. RAJAGOPAL², and M. MADHAVI¹ ¹Department of Mechanical Engineering, MVSR Engineering college. ²Department of Civil Engineering, Indian Institute of Technology Hyderabad. Dependence of Lattice-Shape on Overall Stiffness of Ductile Reinforced Brittle Structures SM-6 Amit Kumar and Gaurav Singh Department of Mechanical Engineering, Birla Institute of Technology & Science, Pilani - KK Birla Goa Campus, Zuarinagar, Goa, India 403726 Parametric Instabilities in Variable Angle Tow Composite Laminates Under Axial Compression **SM-6** Surya Samukham, Gangadharan Raju and C.P. Vyasarayani Department of Mechanical and Aerospace Engineering, Indian Institute of Technology Hyderabad, India, 502205 Mixed mode interface debonding characterization in uni-directional CFRP laminates using modified cohesive length SM-6 SUKANYA P JOSHI and VISWANATH R CHINTHAPENTA Micro-Mechanics Lab, Dept. of MAE, IIT Hyderabad, Kandi, Sangareddy, Telangana, India-502285 Progressive Damage Analysis of Single Fiber Composites Pankaj Pandya and Viswanath R Chinthapenta SM-6 Micro-Mechanics Lab, Dept. of MAE, IIT Hyderabad, Kandi, Sangareddy, Telangana, India-502285

SM64

EFFECT OF DAMAGE MODES AND FIBER VOLUME FRACTION ON THE EFFECTIVE PROPERTIES OF THE UNIDIRECTIONAL COMPOSITES

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The aim of present work is to predict the effect of fiber volume fraction and different damage mechanisms such as fiber breakage, fiber-matrix debond and matrix cracks on the effective properties of the unidirectional fiber-reinforced composites based on a micromechanical analysis. The mate-rial properties are calculated using a Finite element method based numerical approach using a three-dimensional micromechanical representative volume element (RVE). The RVE is modeled by considering a square packing array of fibers with circular cross-section. The periodic boundary conditions are applied on the RVE to calculate elastic properties of composite.

SM65

Comparative Study on the Effect of Steel Fibers on Reinforced Concrete Beams

Pranoy Roy^a and Prakash Mondal^b

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This paper presents a comparative study on the behavior of reinforced concrete beams with and without steel fibers under the action of two-point loading, Analysis is conducted using Extended Finite Element Analysis (XFEA) using Abaqus 6.10 and by testing experimentally in loading frame. In this paper, a total of two sets of experiments is used each having three concrete beams, one set control beam and one sets with randomly distributed discrete steel fiber henceforth noted as fiber reinforced concrete (FRC) beam. From the analyses the load-deflection relationships were obtained and compared with the experimental results. The results obtained from numerical studies showed good agreement with the experimental results. There was a difference in behaviour between the RC beams with fibres and without fibres.

SM66

Meshless Natural Neighbor Galerkin Method for the Analysis of Composite Plates Using Higher Order Shear Deformation Theories

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In the present work a meshless natural neighbor Galerkin method for the bending and vibration analysis of plates and laminates is presented. The method has distinct advantages of geometric flexibility of meshless method. The compact support and the connectivity between the nodes forming the compact support are performed dynamically at the run time using the natural neighbor concept. By this method the nodal connectivity is imposed through nodal sets with reduced size, reducing significantly the computational effort in construction of the shape functions. Smooth non-polynomial type interpolation functions are used for the approximation of inplane and out of plane primary variables. The use of non-polynomial type interpolants has distinct advantage that the order of interpolation can be easily elevated through a degree elevation algorithm, thereby making them suitable also for higher order shear deformation theories. The evaluation of the integrals is made by use of Gaussian quadrature defined on background integration cells. The plate formulation is based on first order shear deformation plate theory. The application of natural neighbor Galerkin method formulation has been made for the bending and free vibration analysis of plates and laminates. Numerical examples are presented to demonstrate the efficacy of the present numerical method in calculating deflections, stresses and natural frequencies in comparison to the Finite element method, analytical methods and other meshless methods available in the literature.



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Coupled dynamic responses of a semisubmersible-type Floating Offshore Wind Turbine (FOWT) under the combined action of irregular wave and turbulent wind

Swarnadip Dey, Kaushik Saha, Pooja Acharya, Shovan Roy, Atul K. Banik^{*}

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Abstract

A coupled dynamic analysis of a semisubmersible-type FOWT has been carried out in time domain under the combined action of irregular wave and turbulent wind represented respectively by JONSWAP spectrum and Kaimal spectrum. To account for the turbine-floater motion coupling in a more realistic way, the wind turbulence has been incorporated into the calculation of aerodynamic loads. The platform model is referred from the DeepCwind project and the turbine considered here is the NREL 5MW Baseline. Two physical states of turbine (parked and operating) have been considered to account for the aerodynamic effect of turbine-rotation on actual responses of the FOWT. Higher mean offsets in surge and pitch responses are obtained under operating condition as compared to the parked rotor condition. The mooring line tensions are also observed to be sensitive to the rotation of turbine due to the turbulence of wind and show larger fluctuations in operating state. Further, the study has also been carried out by considering varying sea states and the responses are obtained with respect to different levels of severity of wave loads. In the present study the aerodynamic damping effect becomes more prominent in the case of most severe sea state condition and it has been seen that higher structural responses are exhibited under the parked condition instead of operating condition.

Keywords: FOWT; semisubmersible; irregular wave; turbulent wind; thrust force;

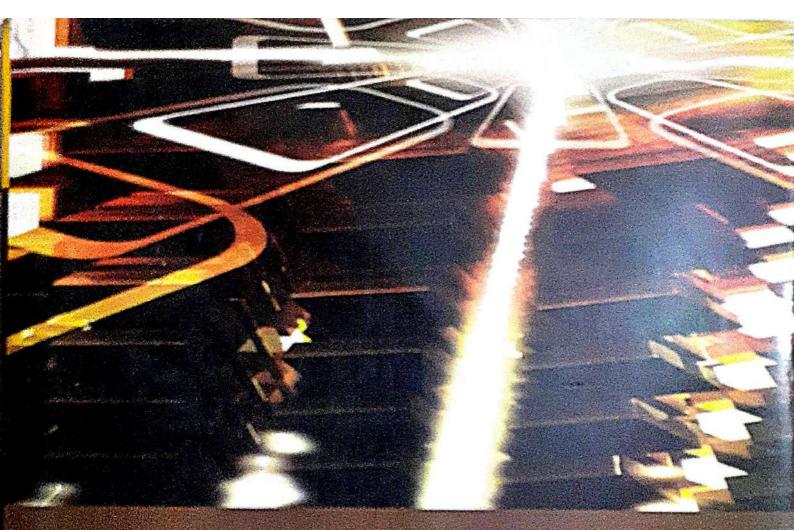
1. Introduction

Wind energy harnessing presents a unique challenge to engineers and researchers worldwide, with a huge potential to setback the energy crisis which is arising due to the continuous depletion of fossil fuels. Considering the abundant wind availability, this in turn can be used to drive turbines for the generation of electricity without any toxic or heat-trapping emissions. In particular offshore wind enables the generation of higher power from fewer turbines due to greater wind speeds and causes lesser noise pollution than its onshore counterpart. From an economic perspective, primarily saving in cost for installation in deeper waters, floating wind turbines are more suitable than fixed type turbines. Thus, in recent years, major focus has been directed towards the development of Floating Offshore Wind Turbines (FOWTs).

The most common approach for design of the floating wind turbines has been to design a support platform and adopting a commercially available wind turbine from the fixed offshore market. Tong (1998) was the first to conceptualize on application of such floating offshore platforms to the wind industry. He investigated the technical and economic aspects of wind farms and also proposed the design of a spar-buoy type FOWT called FLOAT. The engineering challenges that need to be overcome for the

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Advances in Dynamics, Vibration and Control

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COUPLED ANALYSIS AND PARAMETRIC STUDY OF A SPAR SHAPED STRUCTURE WITH DIFFERENT MOORING CABLE CONFIGURATIONS

Vinayak Ghosh¹, Sudharshan Vimmadi¹, Swarnadip Dey¹, Shovan Roy¹, Atul K. Banik¹ Department of Civil Engineering, National Institute of Technology, Durgapur, West Bengal, India mailforvinayakghosh@gmail.com

Abstract. Modeling and analysis of a realistic offshore structure with mooring system is crucial in accurately predicting the responses in extreme environmental conditions. With the gradual development of computing efficiency and algorithms for solving complex differential equations, practical problems can be approached in a more comprehensive manner. This paper deals with the complex modeling of a classical spar platform and mooring cables. The nonlinearity of the system, the interaction between the rigid body and the flexible mooring cables and the response of the structure is investigated by implementing coupled analysis approach in the Time Domain. The structure is modeled as per the data published by Chen et al. (2001). A parametric study is conducted on the system, subjected to different mooring cable orientations and the time response is observed and analyzed.

Keywords: offshore, spar, catenary, coupled dynamic analysis, Ansys

1. INTRODUCTION

The damping effect of mooring lines plays a critical part in reduction of slow drift motions of moored semi-submersibles and moored ships. In order to accurately predict the motion of these floating structures, the coupling effects due to interaction of structure and cable have to be analyzed. Offshore structures like spar platforms have large mass and comparatively very low restoring stiffness, causing the spar to have very small response in the Wave Frequency range. However, in the Low Frequency range, the structure may exhibit significant response, due to the low natural frequency of the system. Mooring cables are used for station keeping of floating structures for their safe operation. The mooring cables add to the hydrostatic stiffness of the spar, lowering the overall natural frequency of the system. The interaction of floating platforms and mooring cables has been studied by several scientists over the years. Complex analysis techniques developed by Ran and Kim (1997) and Omberg et al. (1998) calculated hydrodynamic coefficients (inertia and drag forces) in the frequency domain. Based on these coefficients, wave forces on the structure have been determined using Quadratic Transfer Functions and inverse Fast Fourier Transform, in the time domain. Simplification of the nonlinear manner of the system has been the primary concern for researchers in the recent years. Various linearization techniques have been developed to tackle the shortcomings of a computer model. Boundary Element Method (BEM) has been utilized by Kim et al. (2013) to calculate the hydrodynamic coefficients, linear spring method to simplify the mooring cables. Similar principle has been followed in the work of Yang et al. (2012) where Higher Order Boundary Element Method (HOBEM) is used for hydrodynamic loads and Finite Element based rod theory for mooring dynamics. Computer programs capable of per-

DYNAMIC RESPONSES OF AN FPSO WITH MOORING CABLES INTERACTING DIFFERENT BED SLOPES

Swarnadip Dey¹, Sudharshan Vimmadi¹, Vinayak Ghosh¹, Shovan Roy¹, Atul K Banik¹

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Abstract. The station keeping mooring cables, partially grounded on seabed are important by means of restraining all the motions of the floating structure against certain oblique environmental loading. In this paper this kind of complex realistic problem has been dynamically analyzed through finite element model. A semi-analytical quasi-static formulation for three dimensional partially grounded mooring system problems have already been done by Chai. et.al. 2002. The same problem of an FPSO system, stiffened with multi-legged mooring cables, attached with buoy in each cable partially grounded on horizontal/incline sloped seabed has been successfully modeled here. Further time domain fully dynamic non-linear numerical simulation has been carried outconsidering an irregular JONSWAP wave spectrum in a short sea-state condition. The simulation has been done by using finite element solution software package ANSYS Aqwa 16.2. The structural responses (6 DOF) are depicted and results are compared between the horizontal and incline flat frictionless seabed conditions in this paper.

Keywords: FPSO, Catenary mooring, Nonlinear, Seabed interaction, Dynamic, Time response

1. INTRODUCTION

Now a day's natural hydrocarbon gas and oil extracting project is an emergent growing sector. Storage and offloading are the main integral parts. These parts and their supporting equipment of such project are basically located in deep-ocean against very hostile environments. This issue is getting more challenging to study the entire system stability or proper hydrodynamic responses considering all feasible inside and outside system components.

Floating Production Storage and offloading (FPSO) is a significantly large floating main unit of such system. From the safemarine operational point of view and to get precise positioning and motion control an FPSO is needed to be deployed together with more slender single or multi-legged mooring system. These nonlinear catenary mooring cables are followed byfairlead to partially suspended-partially grounded and then anchored at the end to the seabed. When the buoyancy exceeds the platform weight for any moored stable platform the tension cables provide the net equilibrating vertical forces. To hold the structure in desirable location a significant part of the mooring cablelies on the bed. Basically the entire system can be divided into three phenomenal integrated components.

- 1. Floating structure is excited due to environmental loads (wave, wind and current) interaction.
- 2. Mooring cable changes its nonlinear catenary shape due to inherent slope continuity by arbitrarily orient seabed (horizontal or incline) interaction.

LINEAR AND NONLINEAR COUPLED ANALYSIS OF MOORED FLOATING STRUCTURE: A STATE-OF-THE ART REVIEW

Sudharshan Vimmadi¹, Swarnadip Dey¹, Vinayak Ghosh¹, Shovan Roy¹, Atul K Banik¹

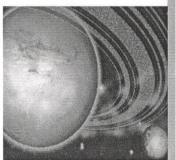
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Abstract. The advancement in the design and analysis of offshore structures has been slowly taken shape over the recent years. The challenges of this field of engineering have been highlighted by various researchers. Some form of simplified techniques have been used to simulate the coupling phenomenon between the wave and the floating structure, the structure with the mooring cables. These hybrid methods have helped overcome the obstacles of modeling a realistic offshore structure, saving time and computational resources in the process. This paper summarizes the various effective methods developed by previous researchers and discusses on their merits and demerits.

Keywords: Coupled dynamics, Floating structure, Mooring cables, Aqwa

1. INTRODUCTION

Offshore structures systems are being used for drilling oil and gas from the seabed over the recent years. With the dawn of better prospects further in the ocean, the shallow water structures have to be upgraded to be able to float and perform efficiently in diverse and extreme environmental conditions. Also, with the need of exploration of renewable energy sources, it has been found that setting up wind farms in deep sea has increased output and efficiency as compared to near shore or onshore ventures. Both of these kinds of projects demand efficient mooring systems to restrain the motion of the offshore floating structures. Normally, moored floating platforms are integrated with a number of components like mooring lines, risers, etc. The mooring system adds to the stiffness of the floating structure, increasing the damping effect. This in turn affects the motion of the platform. However, to accurately predict the response of the platform, the coupling effects of the rigid floater and the slender mooring cables have to be analyzed. The floating platform analysis can be classified into two categories, i.e. conventional quasi static analysis and coupled analysis method. Several researchers have worked on the quasi static method of analysis (Lee and Flory, 1999; Ma et al., 2000 and Lee and Devlin, 2000) where it has been considered that quasi static analysis is an uncoupled analysis of floating platform and its mooring components. But with the increment of the sea depth, the quasi static analysis fails to provide precise evaluation of the interaction effects of the entire system. (Ormberg and Larsen, 1998). In the uncoupled analysis, it has been assumed that mooring cables act like mass-less non-linear spring or respond statically to vessel motions. It was also observed that the uncoupled analysis may provide the larger error in case of FPSO. The need for coupled analysis has been emphasized by Paulling and Webster, 1986. For this method of solution, all the interaction of the system components have been consi-



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Sustainable **Systems**

Editors: Sandip A. Kale (Trinity College of Engineering and Research, Pune, Maharashtra State, India)

Book Description:

The changing energy scenario has now become the focus of researchers, scientists, economists, industries and governments with the objectives of fulfilling current needs through advanced renewable technologies and looking towards the future with sustainable systems. This book comprises fourteen chapters to discuss some noteworthy advances in renewable energy with some sustainable issues. Wind and solar energy are the major renewable energy sources and contribute significantly to renewable energy installations across the globe. A significantly increasing trend of offshore wind turbine installations, wind turbine design and wind farm simulation techniques and vertical axis wind turbines are the subjects used for the first four chapters included in this book. Solar thermal applications are significantly increasing along with PV applications. The middle four chapters are focused on solar thermal energy and photovoltaics. The next two chapters relate to case studies of hybrid wind-PV systems. Chapter Eleven presents an analysis and optimization of barriers to hydropower development in Nepal. In the last two chapters, the global scenario of transportation, its development, policies, and particularly the status in Indian and performance enhancement of e-rickshaws in India based on battery-ultracapacitor hybrid energy sources is presented. In the last chapter, the application of an axiomatic design approach for constructability in design is presented in an interesting manner. (Nova)

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Statistical Implication of Genetic Sequences Using Soft Computing

Shashi Bajaj Mukherjee

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Abstract: Application of statistical Analysis in differentiating coding and noncoding portions of genomic sequences has till date covered very elementary aspects of compositional bias on the one hand, and the quite sophisticated method of linear discriminant analysis on the other. Gene finding is one of the first and most important steps in understanding the genome of a species once it has been sequenced. The complete genomic sequence contains coding as well as non-coding parts. A significant amount of research work has been done to differentiate between the coding and non-coding parts of DNA sequences. In this context, the statistical properties of the frequencies of nucleotides and codons have been considered for the various species such as Drosophila melanogaster, Anopheles_gambiae and Nematoda (Caenorhabditis elegans). Periodic pattern of genomic sequences are expected as a standard recognizing technique for DNA sequence in identification of gene and similar problems. A DNA sequence is converted to a numeric sequence using various types of mappings and standard Fourier technique to analyse and characterise the periodicity by which coding and non-coding sequences can be distinguish. The main mathematical models and computational algorithms adopted are also briefly described and the resulting software classified according to both the method and the type of evidence used. Finally, the several difficulties and pitfalls encountered by the programs are detailed, showing that improvements are needed and that new directions must be considered.

Keywords: DNA, Coding and non-coding sequences, Compositional bias, Codon, Amino acid, discriminating statistic, numerical sequences, Introns and Exons, periodicity]

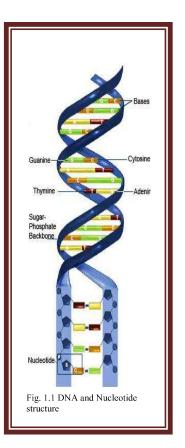
Introduction: DNA and Nucleotides

DNA is the matrix of life. It determines all the characteristics of an organism, and contains all the genetic material that makes us who we are. This information is passed on from generate on to generation in a species so that the information within them can be passed on for the offspring to control their life processes throughout their lifetime. Following is the structure of DNA

and Nucleotides. As shown in Fig. 1.1, a DNA is arranged into a *double helix* structure where two spirals of DNA are intertwined with one another continuously bending in on themselves, but never getting

closer or further away. The lower part of the diagram illustrates a *nucleotide* or *base*, the building blocks of DNA. Nucleotides are present in almost every cell of an organism. A combination of four of

the most prominent nucleotides, adenine, cytosine, guanine and thymine (denoted respectively by A, C, G and T) make up the DNA chain. There are billions of these nucleotides in our genome, and with all the possible permutations; this is what makes all the individuals unique. Nucleotides are situated in adjacent pairs in the double helix nature mentioned. The following rules apply in respect of what nucleotides pair with one another, forming the rungs of the ladder structure [7].



- There are four possible types of nucleotide, adenine, cytosine, guanine and thymine.
- Thymine and adenine can only make up a base pair
- Guanine and cytosine can only make up a base pair
- Therefore, thymine and cytosine would NOT make up a base pair, as is the case with adenine and guanine.

This is illustrated in Fig. 1.2 below, using correct pairings of nucleotides [19]. The diagram is two dimensional; remember that DNA

is structured in a double helix fashion, as shown to the above right. This continuous sequence and the sequence they are in determine an organism's structural, physical and anatomical features.

There are three components to a nucleotide: a pentose sugar, a phosphate group, and a nucleotide base (Fig. 1.3) [20]. Nucleic acids are polymers formed from linking of various nucleotides. The below image is of DNA nucleotides (Fig. 1.4) [18].

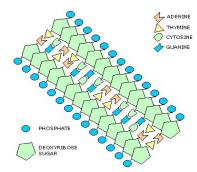
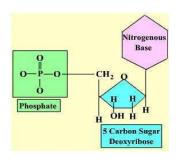


Fig. 1.2 Pairings of nucleotides



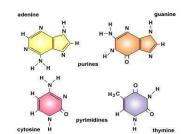


Fig. 1.3 Deoxyribose Nucleotide

Fig.1.4 Structure of the Nucleotides

The Genetic Code

The genetic code is the set of rules by which information encoded in genetic material (DNA sequences) is translated into proteins (amino acid sequences) by living cells. The code defines a mapping between nucleotide triplets, called codons, and amino acids. A codon in a

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nucleic acid sequence usually specifies a single amino acid. Because the vast majority of genes are encoded with exactly the same code, this particular code is often referred to as the canonical or standard genetic code, or simply the genetic code, though in fact there are many variant codes. Thus the canonical genetic code is not universal. In humans, for example, protein synthesis in mitochondria relies on a genetic code that varies from the standard genetic code. Not all genetic information is stored using the genetic code. All organisms' DNA contains regulatory sequences, intergenic segments, and chromosomal structural areas that can contribute greatly to phenotype. Those higherlevel or epigenetic elements operate under sets of rules that are distinct from the codon-to-amino acid paradigm underlying the genetic code [8]. The genetic code consists of 64 triplets of nucleotides. These triplets are called codons. With three exceptions, each codon encodes one of the 20 amino acids used in the synthesis of proteins. That produces some redundancy in the code: most of the amino acids being encoded by more than one codon. One codon, ATG serves two related functions:

- it signals the start of translation
- it codes for the incorporation of the amino acid methionine (Met) into the growing polypeptide chain

The genetic code can be expressed as either RNA codons or DNA codons. RNA codons occur in messenger RNA (mRNA) and are the codons that are actually "read" during the synthesis of polypeptides (the process called translation). But each mRNA molecule acquires its sequence of nucleotides by transcription from the corresponding gene. Because DNA sequencing has become so rapid and because most genes are now being discovered at the level of DNA before they are discovered as mRNA or as a protein product, it is extremely useful to have a table of codons expressed as DNA. Table 1.1 lists the 64 codons with the corresponding amino acids.

All but two of the amino acids (Met and Trp) can be encoded by from 2 to 6 different codons. However, the genome of most organisms reveals that certain codons are preferred over others. In humans, for example, alanine is encoded by GCC four times as often as by GCG. This

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phenomenon is known as 'codon usage bias' ([1], [2], [10], [11], [15], [17]).

AAT	Asn	ACT	Thr	AGT	Ser	ATT	Ile
AAC	Asn	ACC	Thr	AGC	Ser	ATC	Ile
AAA	Lys	ACA	Thr	AGA	Arg	ATA	Ile
AAG	Lys	ACG	Thr	AGG	Arg	ATG	Met*
CAT	His	CCT	Pro	CGT	Arg	CTT	Leu
CAC	His	CCC	Pro	CGC	Arg	CTC	Leu
CAA	Gln	CCA	Pro	CGA	Arg	CTA	Leu
CAG	Gln	CCG	Pro	CGG	Arg	CTG	Leu
GAT	Asp	GCT	Ala	GGT	Gly	GTT	Val
GAC	Asp	GCC	Ala	GGC	Gly	GTC	Val
GAA	Glu	GCA	Ala	GGA	Gly	GTA	Val
GAG	Glu	GCG	Ala	GGG	Gly	GTG	Val
TAT	Tyr	TCT	Ser	TGT	Cys	TTT	Phe
TAC	Tyr	TCC	Ser	TGC	Cys	TTC	Phe
TAA	STOP	TCA	Ser	TGA	STOP	TTA	Leu
TAG	STOP	TCG	Ser	TGG	Trp	TTG	Leu

*When at beginning of gene, ATG signals start of translation Table 1.1 Codons and corresponding Amino Acids

Ala = alanine	Arg = arginine	Asn = asparagine	Asp = aspartic
			acid
Cys = cysteine	Gln = glutamine	Glu = glutamic	Gly = glycine
		acid	
His = histidine	Ile = isoleucine	Leu = leucine	Lys = lysine
Met =	Phe =	Pro = proline	Ser = serine
methionine	phenylalanine		
Thr = threonine	Trp = tryptophan	Tyr = tyrosine	Val = valine

Table 1.2 Amino Acids

The genetic code is almost universal. The same codons are assigned to the same amino acids and to the same START and STOP signals in the vast majority of genes in animals, plants, and microorganisms. However, some exceptions have been found. Most of these involve assigning one or two of the three STOP codons to an amino acid instead.

Collection of Data

Since the separation between coding and non-coding genetic sequence is based on heavy amount of data processing, extreme care must be exercised in the selection of data source and all the steps involved in the manipulation of data. Before the actual work can be embarked on, the input data must be reduced to the required format. GenBank, the universally accepted depository of DNA data may use as the main data source. Genomic databases are a means of storing DNA data for various species of living organisms. GenBank is the US National Institute of Health genetic sequence database. GenBank is a comprehensive database of publicly available annotated nucleotide sequences for more than 240,000 named organisms. complete release notes for the current version of GenBank are available on the National Center for Biotechnology Information ftp site. A new release is made every two months. GenBank is part of the International Nucleotide Sequence Database Collaboration, which comprises the DNA Data Bank of Japan (DDBJ), the European Molecular Biology Laboratory (EMBL), and GenBank at NCBI. These three organizations exchange data on a daily basis.

Methodology: Conversion of the DNA sequence to numeric sequence A sequence of M nucleotides may be formally viewed as a symbol string, $\{x_i\}$, $i = 1, 2, \ldots, M$, where $x_i \in \{A, T, G, C\}$.

We convert the DNA sequence to a number series, using the transformation.

$$f: G \rightarrow N$$

Where G is the set of genomic sequences and N is the set of numeric sequences. In general, the length of the image sequence may or may not be the same as the length of the genomic sequences [3].

Conclusion:

DNA sequences contain portions called coding sequences that serve specific biological function through formation of proteins. Other portions, called non-coding sequences apparently serve no such purpose. Finding dependable methods for classifying DNA sequences as coding or non-coding forms a major part of research in Bioinformatics. Compositional bias ([5], [6], [9]) codon usage measure

[16], Hidden Markov models ([4], [12]) are the major accepted lines of attack. [13] and [14] contain extensive surveys of available methods. For the new thinking any one can concentrates on various statistical properties of the sequences in order to classify them into coding or noncoding. These methods may then be applied to an unknown sequence to determine whether it is coding or non-coding. Same type of analysis is to be carried out for any species. It is recommended to develop effective algorithms for differentiating coding and non-coding regions of DNA sequences to help in detecting genes.

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may hinder their usage for real-time structural damage detection. This paper therefore presents a hovel may hinder their usage for real-time structural in shear frame and plane frame structure using Neural vibration-based approach for damage assessment in shear frame and plane frame structure using Neural vibration-based approach for damage assessment of damage have been considered in the present study. The Network(s). However, two different categories of damage have been considered in the present study. The Network(s). However, two different categories of the storey stiffness and the plane frame is subjected to damage is simulated in the shear frame by reducing the storey stiffness loss in the beam column joint. damage is simulated in the shear traine by redshing stiffness loss in the beam column joint. The current connection damage by introducing rotational systems frequency, mode shape and change in first mode investigation utilizes three input parameters viz. natural frequency, mode shape and change in first mode investigation utilizes three input parameters assessment, free un-damped modal analysis is conducted to shape slope. For shear frame storey damage assessment, free un-damped modal analysis is conducted to shape slope. For shear frame storey damage. Only first mode shape data are utilized to estimate the generate input-output data for network damage severities (5%, 10%, change in mode shape slopes that are fit as input parameter. Four different damage severities (5%, 10%, 10%, change in mode shape stopes that are first, second, third, fifth, and ninth stories to produce the single. 15%, and 20%) are infroduced at the tirst are created for these situations. In case of multiple-damage damage scenarios. A total of 20 samples are created for these situations. In case of multiple-damage damage scenarios. A total of 20 samples and biggest damage intensity (20%) are assimilated at two events, just the least damage differences undamaged. As a result, the samples created from the exceptional stories keeping all build and multiple-damage cases for the investigation utilizing ANN reference model comprising both single-and multiple-damage cases for the investigation utilizing ANN are 92. Moreover, in case of plane frame, rotational springs are introduced at beam-columns joints and 200 data sets are generated including single and multiple damage eventualities. Finally, the network is trained and tested to assess the damage information. The advantage of this approach is its ability to extract optimal information automatically from the first two modal data only.

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ON THE IMPLEMENTATION OF AUTO SEARCH ALGORITHM FOR LOCALISATION OF AE SOURCE: AN EXPERIMENTAL STUDY

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Early detection and localisation of damage/defect in any existing engineering structure is extremely important from techno-economic considerations. It helps in deciding and implementing appropriate remedial measures that aids sustained, safe and economic operation of the structure throughout its design life.

Structural defects like generation of cracks, yielding, failure of bonds, fibre failure etc emits acoustic waves which can be captured in real time using acoustic emission (AF) sensors. Such sensor data can be analysed through automatic procedures for extracting the details such as location, type and extent of structural defects, termed as AE source. This procedure, known as AE technique, has great potential as an effective structural damage detection method. In general, sensors are costly and limited number of sensors are deployed for structural investigations in real time. In this paper experimental data from four AE sensors- R15D by Physical Acoustic Corporation, USA- mounted on a steel plate is utilised for localisation of the AE source. It is done by implementing an analytically developed Auto Search Algorithm (ASA) which is available in literature. The experiment is carried out with a very thin steel plate of dimension $0.254 \text{ m} \times 0.1524 \text{ m} \times 2 \text{ mm}$ and the AE source is placed at x = 0.0508 m, y = 0.0762 m considering upper left corner of plate as x = 0, y = 0. The AE source is simulated by the widely used pencil lead break (PLB) concept as available in literature. In order to localise the AE source using sensor data, the