### **VOLUME I, 2001**

**To Use this Table of Contents:** Scroll down or use the bookmarks in the left-hand frame to move to a new location in this index. Click on a **blue paper title** to view that paper. To return to this index after viewing a paper, click the PREVIOUS MENU bookmark in the left frame.

The Material on this CD-ROM was created from scanning each author's paper originals. Viewing of the text and graphics and the ease of readability will depend largely on content requiring scanning and the quality and/or consistency of each author's paper original.

ISBN 1-880653-51-6 (Set) ISBN 1-880653-52-4 (Vol. I) ISSN 1098-6189 (Set) www.isope.org

edited by:

Jin S. Chung, ISOPE, Cupertino, California, USA Mohamed Sayed, National Research Council Canada, Ottawa, Canada Hiroshi Saeki, Hokkaido University, Sapporo, Japan Toshiaki Setoguchi, Saga University, Saga, Japan

presented at:

The Eleventh (2001) International Offshore and Polar Engineering Conference held in Stavanger, Norway, June 17–22, 2001

organized by:

International Society of Offshore and Polar Engineers

sponsored by:

International Society of Offshore and Polar Engineers (ISOPE) with cooperating societies and associations

#### OFFSHORE TECHNOLOGY REVIEW

Trends in Offshore Safety on the Norwegian Continental Shelf  Gunnar Berge	1
Terra Nova Design Challenges and Operational Integrity Strategy  A. Ewida and J.R Kean	4
Development Options for Mobile Offshore Base Technology  Robert Zueck, Robert Taylor and Paul Palo	13

#### **OFFSHORE TECHNOLOGY**

SUBSEA	
Autonomous Subsea Tie In System (AUSTIN) for Large Diameter Pipelines in Deep Waters  Jostein Aleksandersen, Ivar Langen, Morten Meling and Audun Lien	19
ARCOS Pipeline Repair System Diego Lazzarin and Adalberto Colombo	27
Increased Operability Subsea – More Accurate Tools for Installation and Intervention Svein Ivar Sagatun and Øyvind Tveit	32
Two Different Electrical Properties Can Improve Transoceanic Cable-Route Mapping  Jeff Wynn and Tim McGinnis	37
Pushing the Limits of Seismic Resolution in Deep Water  Thomas M. McGee and J. Robert Woolsey	42
Aluminium Applied for Subsea Structures: Possibilities and Challenges  Christian Knutsen, Ivar Kvale and Jan Halvor Nordlien	46
OFFSHORE SYSTEMS AND DECOMMISSION  Study on a System for Decreasing Vibration of a Hang Hook of Floating Crane  S. Shiraishi, T. Suzuki and T. Hiraishi, H. Kawahara, T. Horichi and N. Nishihara	53
Spudcan-Footprint Interaction During Jack-Up Workovers  D.P. Stewart and I.M.S. Finnie	61
Sand Bed Response to Submerged Water Jet T. O'Donoghue, B. Trajkovic and J. Piggins	66
An Integrated Approach for Fatigue Life Predication of Whole Offshore Platforms  Yong-Ning Wu, Li-Song Song, Hua-Can Fang, Fa-Yan Xu and Meng-Lan Duan	73
Characteristics of Tuned Liquid Damper for Suppressing Wave-Induced Vibration Sheng Dong, Hua Jun Li and Tomotsuka Takayama	79
<b>Experimental Investigation of TLD for Mitigating Wave-Induced Structural Vibration</b> Hua Jun Li, Sheng Dong and Tomotsuka Takayama	84
Criterion of Offshore Jacket Launching Analysis Chul H. Jo, Kyung S. Kim, Jae H. Kim and S.H. Lee	90
Experimental Investigation of a Model Jack-Up Unit on Clay G. Vlahos, C.M. Martin and M.J. Cassidy	97
Application of Probabilistic Models to the Response Analysis of Jack-Ups M.J. Cassidy, G.T. Houlsby and R. Eatock Taylor	106
Structure Optimum Design of Offshore Jacket Platforms Based on Fuzzy Constraint  H.G. Kang, G.J. Zhai, X.B. Liu and F.C. Xu	114
Technical Issues in Platform Removal: Is OSPAR 98/3 Sustainable?  P. William Penney	119
Managing the Challenges of Decommissioning with Technology, Research and Regulations  Sharon Buffington	123
Weather-Dependent Operability for Offshore Single Lift Jacket Deck Removals  Birger J. Natvig, Øyvind Johnsen, Geir Grimsrud and Douglas Smith	

GM-Lift Decommissioning and Installation Vessel  J. Vatsvåg	136
Alternative Low-Cost Wellhead Platform Concept(s) for Marginal Offshore	
Field Developments  H.J. Meek and P.G.F. Sliggers	142
Use of Light Weight Substructures for Oil and Gas Marginal Field Development  Wan Mahmood Wan Ab. Majid and Mohamad Bin Embong	
OFFSHORE MECHANICS	
MOB, MEGA FLOAT AND VLFS  Wave Response and Vibration Control of Flight Control Tower on the Mega Float Structure  Y. Totsuka, H. Ishigaki, M. Kawarada, C. Sato, H. Eto and O. Saijo	154
Stress Analysis for Structurally Discontinuous Parts in a Mega Float Structure  K. Kada, T. Fujita and K. Kitabayashi	161
Effects of Breakwaters on Motions of an Elastic Floating Plate in Waves S. Nagata, H. Yoshida, H. Niizato, Y. Ohkawa and K. Kobayashi	168
Variability of Water Quality Due to the Location of a Mega Float in Tokyo Bay  Yusaku Kyozuka and Souichi Yamaguchi	176
Numerical Simulation of Tidal Current and Seawater Exchange Around a Very Large Offshore Structure Kazuo Nozawa and Masasi Toyooka	183
Variational Principles Related to Motions of an Elastic Plate Floating on a Water Surface  H. Isshiki and S. Nagata	190
Practical Natural Frequency Analysis of Elastic Plate on Water  Hiroaki Eto, Koichi Maruyoshi and Osamu Saijo	198
Coordinated Dynamic Positioning of a Multi-Platform Mobile Offshore Base Using Nonlinear Model Predictive Control	
Jayesh Amin, Raman K. Mehra and Pablo Arambel	206
SEABASETM, the Flexible Alternative  Erik Pettersen	212
Analysis of Drift Force on VLFS by the Near-Field Approach Tomoaki Utsunomiya, Eiichi Watanabe and Naoyuki Nakamura	217
Investigation of Draft Effects on Analysis of Hydroelastic Responses of Pontoon-Type VLFS Sa Y. Hong, Yoon R. Choi and S.W. Hong	222
The Motion of an Elastic Disk Floating on Shallow Water in Waves  Takashi Tsubogo	229
A Theoretical Approach to the Slamming Impact Pressure Acting on the VLFS  Ken Takagi	234
Tsunami-Induced Mooring Force on a Flexible Floating Structure  Xiaodong Liu, Shigeki Sakai, Shusaku Makino, Kota Hanai and Makoto Sasamoto	241

Transit Draft Roll Motion Stability Analysis of the Mobile Offshore Base (MOB) Using Time Varying Coefficients  Samrat Das and Jeffrey Falzarano	248
Transit Draft Heave Motion Analysis of the Mobile Offshore Base (MOB) Using Reverse MI/SO Techniques William Rodrigues and Jeffrey Falzarano	256
Wave-Induced Local Steady Forces on a Column-Supported Very Large Floating Structure  Masashi Kashiwagi	264
Obtaining Accurate Modal Stress-Resultants in Freely Vibrating Plates that Model VLFS  C.M. Wang, Y.C. Wang, E. Watanabe, T. Utsunomiya and Y. Xiang	272
Effect of Viscous Roll Damping on Drift Forces of Multi-Body Floating System in Waves  Yoshiyuki Inoue and M. Rafiqul Islam	279
Air Gap Model Tests on a MOB Module  David Kriebel and Louise Wallendorf	286
Nonlinear Dynamic Responses of a Large Offshore Structure  Kenji Kawano and Tutomu Hashimoto	294
FPSO, TLP AND SPAR  Extreme Response and Fatigue Damages for FPSO Structural Analysis  Chuntian Zhao, Yong Bai and Yung Shin	301
Experience and Risk Assessment of FPSOs in Use on the Norwegian Continental Shelf:  Descriptions of Events  Roger L. Leonhardsen, Gerhard Ersdal and Arne Kvitrud	309
Floating Production System for the Shtockmanovskoye Gas/Condensate Field  Victor M. Potapov, Lev B. Blagovidov and Vladimir V. Minin	315
Coupled Dynamic Response of Moored FPSO with Risers  J.M. Heurtier, P. Le Buhan, E. Fontaine, C. Le Cunff, F. Biolley and C. Berhault	319
<b>Turret Operations in the North Sea: Experience from Norne and Åsgard A</b> Børre Knudsen, Bård A. Leite and Stig A. Mjøen	327
Nonlinear Dynamics of a FPSO and Shuttle Vessel in Tandem Configuration Helio Mitio Morishita, Jessé Rebello de Souza Junior and Claudio Gomes Fernandes	336
Numerical Multiple-Body Simulations of Side-by-Side Mooring to an FPSO Bas Buchner, Adri van Dijk and Jaap de Wilde	343
Structural Design of the Truss Spar — An Overview  J. Wang, S. Berg, Y.H. Luo, A. Sablok and L. Finn	354
Time-Domain Fatigue Analysis for Critical Connections of Truss Spar Y.H. Luo, R. Lu, J. Wang and S. Berg	362
Theoretical Analysis and Experimental Evaluation of the Fishtailing Phenomenon in a Single-Point Moored Tanker	2.50
Alexandre N. Simos, Eduardo A. Tannuri, José A. P. Aranha and André J.P. Leite	369
Global Strength Evaluation for a Medium-Sized Semi-Submersible Drilling Rig Seock-Hee Jun, Yeong-Pyo Kim, In-Hwan Sim and Joo-Ho Heo	375

Automated Hull Optimisation of Offshore Structures Based on Rational Seakeeping Criteria  L. Birk and G.F. Clauss	382
Airgap Prediction: Use of Second-Order Diffraction and Multi-Column Models Bert Sweetman, Steven R. Winterstein, Trond Stokka Meling and Jørn Birknes	390
Model Experiments on Dynamic Positioning System with Steerable Thrusters  Masahiko Nakamura, Hiroyuki Kajiwara, Wataru Koterayama and Toru Komaru	398
<b>Diffraction and Radiation of Waves Around Side-by-Side Moored Vessels</b> <i>R.H.M. Huijsmans, J.A. Pinkster and J.J. de Wilde</i>	406
Nonlinear Time-Domain Analysis of Compliant Offshore Structures by a Semi-Implicit Strategy M.V. Rodrigues and B.P. Jacob	413
Upending of a Spar Offshore Platform: Prediction of Motions and Loading  Igor Prislin, Atle Steen and John Halkyard	421
Effect of Ramp Duration on the Dynamic Response of Spars  Iftekhar Anam and Jose M. Roesset	427
<b>Buoyant Leg Structure Preliminary Design, Constructed Cost and Model Test Results</b> C.B. Shaver, C.C. Capanoglu and C.S. Serrahn	432
Nonlinear Response of ISSC TLP in High and Steep Random Waves  Z.M. Wang and C.H. Kim	440
Directional Sea Response of a Mini-TLP  J.M. Niedzwecki, P.F. Liagre, L.E. Borgman and P. Teigen	447
Wave Interaction Effects for Non-Compliant TLP P. Teigen, J.M. Niedzwecki and S.R. Winterstein	453
OCEAN RESOURCES AND ENERGY TECHNOLOGY	
GAS HYDRATES  Global Occurrences of Gas Hydrate  Keith A. Kvenvolden and Thomas D. Lorenson	462
Density Change of CO <sub>2</sub> -Dissolved Water in Hydrate Forming Region  R. Kojima, K. Yamane and I. Aya	468
Gas Hydrate and Seeps – Effects on Slope Stability: The "Hydraulic Model"  Martin Hovland, Dan Orange, Per Arne Bjørkum and Ove Tobias Gudmestad	471
Two Phase Flow Dynamics for Production of Methane Hydrate Y. Kobayashi	477
A Remote, Multi-Sensor Station to Monitor Conditions Near the Sea Floor within the  Hydrate Stability Zone  J. Robert Woolsey, Thomas M. McGee and Robin C. Buchanan	483
Numerical Simulation of Agglomeration of CO <sub>2</sub> Droplets Covered with Hydrate Film  K. Yamane, R Kojima, I. Aya, L. Tang and S.M. Masutani	
Unexpected Natures of CO <sub>2</sub> Hydrate Membrane in Saturated Water: An Explanation by the Free Water Molecule Model	
I. Aya, K. Yamane, R. Kojima, T. Yamamoto and H. Nariai	495

Droplets of Dry Ice and Cold Liquid CO <sub>2</sub> for Self Transport of CO <sub>2</sub> to Large Depths  Bjørn Kvamme	498
Kinetics of Hydrate Formation from Nucleation Theory  Bjørn Kvamme	508
Molecular Dynamics Simulations as a Tool for the Selection of Candidates for Kinetic  Hydrate Inhibitors  Bjørn Kvamme	517
OCEAN MINING  Resedimentation Analysis from Seafloor Photographs  T. Yamazaki, E. Kuboki and D. Uehara	528
<b>Dynamic Positioning Control for the Buffer of a Deep-Sea Mining System Using FIR Filter</b> <i>Ki H. Kim, Hang S. Choi, Woo J. Seong and Kyu Y. Lee</i>	536
Chemical Compositions of Deep-Sea Sediment Where Artificial Rapid Deposition  Event Occurred  T. Fukushima, K. Harada, Y. Shibamoto and E. Kuboki	541
RENEWABLE AND OCEAN ENERGY  A 3D Parametric Study of a Rectangular Bottom-Mounted OWC Power Plant  Y.M.C. Delauré and A. Lewis	548
<b>Time Domain Control of a Single Mode Wave Energy Device</b> U.A. Korde, M.P. Schoen and F. Lin	555
OWC-Caisson Economy and Its Dependency on Breaking Wave Design Loads F. Neumann and A.J.N.A. Sarmento	561
Optimum Control of Oscillation of Wave-Energy Converters  Johannes Falnes	567
Power Quality Assessment from the LIMPET Wave-Power Station  R.G. Alcorn and W.C. Beattie	575
An Investigation into the Importance of the Air Chamber Design of an Oscillating Water Column Wave Energy Device  J.W. Weber and G.P. Thomas	581
Stress Analysis of Impulse Turbine Blades A. Thakker, H.B. Khaleeq, F. Hourigan and J. Jarvis	589
Preliminary Study on Wave Energy Utilization in Sri Lanka T. Watabe, H. Yokouchi, S.D.G.S.P. Gunawardane, B.R.K. Obeyesekera and U.I. Dissanayake	596
Numerical Analysis of Wells Turbine Performance Using a 3D Navier-Stokes Explicit Solver  A. Thakker, P. Frawley and E. Sheik Bajeet	604
Noise Characteristics of Turbines for Wave Power Conversion  M. Takao, K. Itakura, T. Setoguchi, T.H. Kim, K. Kaneko and M. Inoue	609
CA9: Analysis of a Stall-Resistant Aerofoil in View of Wave Power Conversion  A. Thakker, P. Frawley and E.Sheik Bajeet	614
A 3-Dimensional Numerical Simulation of Impulse Turbine for Wave Energy Conversion  Hyeong-Gu Lee, Ill-Kyoo Park, Tae-Hoon Kim, Yeon-Won Lee and Toshiaki Setoguchi	620

Experimental and CFD Analysis of 0.6m Impulse Turbine with Fixed Guide Vanes  A. Thakker, P. Frawley, H.B. Khaleeq, Y. Abugihalia and T. Setoguchi	625
Comparison of 0.6m Impulse and Wells Turbines for Wave Energy Conversion Under Similar Conditions	
A. Thakker, P. Frawley, H.B. Khaleeq and E.S. Bajeet	630
Numerical Simulation of 0.6m Impulse Turbine for Wave Power Conversion Under Different Flow Conditions  A. Thakker, H.B. Khaleeq and A.R. Ansari	634
Experiment on the Energy Gain of Floats-Type Wave Generator  K. Hadano, T. Saito and M. Hashida	
Impulse Turbine for Wave Power Conversion with Air Flow Rectification System  H. Maeda, M. Takao, T. Setoguchi, K. Kaneko, T.H. Kim and M. Inoue	646
POLAR AND ICE ENGINEERING	
POLAR DEVELOPMENTS  Meeting the Challenges of Arctic Communications at the Summit Science Camp on  Greenland's Icecap	452
Mike McKibben, John Kelly and Todd Valentic	033
James M. Hamilton	656
Oil and Gas Exploration at the Arctic Shore: Social Issues  Sergey V. Krivitsky, Alexander S. Tsvetsinsk, Dilizhan A. Mirzoev and Andrey S. Krivitsky	661
ICING Study of Icing Rate and Related Meteorological Parameter Distributions During Atmospheric Icing Events  K. Savadjiev and M. Farzaneh	665
Extreme Value Analysis of Ice Accretion Data from Norwegian Measurement Rack Network  Konstantin Savadjiev, Masoud Farzaneh and Svein Fikke	671
ISO 12494 "Atmospheric Icing of Structures" and How to Use It  Mogens H. Foder	678
Aircraft Icing Forecast W. Fuchs and M. Lütkebohmert	686
Numerical Modelling of Snow-Shedding Effects on a 110 kV Overhead Power Line in Slovenia  Janez Jakše, Mohamed Thabet Al Harash and Ghyslaine McClure	600
	090
Analytical Modelling of Ice Load for a Family of Dry Ice Accretion Shapes  Krzysztof Szilder, Edward P. Lozowski and Gerhard Reuter	695
JOIA (JAPAN OCEAN INDUSTRY ASSOCIATION): ICE RESEARCH  Ice and Earthquake Loads on a Structure in the Okhotsk Sea — Annual Report of the JOIA  Project, FY1999  Kazuyuki Kato, Yasumi Toyama, Yutaka Yamauchi, Tetsushi Kiyokawa, Naoki Nakazawa and	
Akira Kurokawa	700

Failure Mode of a Sea Ice Sheet – Cleavage Cracking  Hisao Matsushita, Zenji Kamio, Juntaro Ushikoshi, Masafumi Sakai, Takahiro Takeuchi, Takashi  Terashima, Satoshi Akagawa, Naoki Nakazawa and Hiroshi Saeki	707
Ice Load Equation by Medium Scale Field Indentation Test Data  Takahiro Takeuchi, Muneo Kawamura, Masafumi Sakai, Naoki Nakazawa, Takashi Terashima,  Zenji Kamio, Hisao Matsushita, Akira Kurokawa, Satoshi Akagawa and Hiroshi Saeki	713
Wave Modification in Water Waves with the Free Surface Covered by Grease Ice Shinya Okumura, Yukio Sato and Hiroyuki Enomoto	721
Physical Characteristics of First-Year Sea Ice in Notoro Lagoon: Summary of Five Years' Field Test on Mechanical Properties  Juntaro Ushikoshi, Zenji Kamio, Hisao Matsushita, Masafumi Sakai, Takahiro Takeuchi, Takashi Terashima, Satoshi Akagawa, Naoko Nakazawa and Hiroshi Saeki	727
ICE COVER  Variations in Air-Ice Drag Coefficient Due to Ice Surface Roughness  S. Prinsenberg and I.K. Peterson	733
Tide-Induced Drift Velocities and Deformations of Ice Cover on the Northeastern Shelf of Sakhalin Island  Elena Tikhonchuk, George Shevchenko and Victor Tambovsky	739
Experimental Studies of Ice Cover Inhomogeneity  Vladimir I. Seliverstov, Sergey G. Gomolskiy and Alexander E. Farafonov	744
ICE FORCES  Validation of Low Level Ice Forces on Coastal Structures  Joachim Schwarz	749
Simulations of Ice Ridge Forces on Conical Structures  B. Sand and G. Horrigmoe	754
Loading Regime of Ice-Structure Interaction  Alexander T. Bekker, Tatyana E. Uvarova, Sergei D. Kim, Vladimir I. Seliverstov and Elizaveta A.  Kharitonova	761
Strength Characteristics of Hummock Formations G.A. Surkov, V.N. Astafyev, A.M. Polomoshnov, S.V. Zemlyuk and P.A. Truskov	770
<b>Design of Offshore Ice-Resistant Platforms for Seismic Regions of Continental Shelf</b> <i>A.V. Kotov, A.A. Malyutin, V.V. Kotov, S.L. Karlinsky and G.V. Zhukov</i>	775
Model Testing of an Arctic Shuttle Barge System for Loading of Oil in Ice Sveinung Løset, Arnor Jensen, Ove T. Gudmestad, Ola Ravndal and Svein Inge Eide	779
Investigation of Extreme Ice Loads on Offshore Structures  Alexander T. Bekker, Olga A. Sabodash, Aleksey V. Venkov and Olga S. Sclueva	<i>788</i>
Internal Structure of First-Year Hummocks G.A. Surkov	796
<b>Experimental Friction Coefficients Between DUT-1 Synthetic Model Ice and Materials</b> Zhijun Li, Guangwei Li, Yuexia Qu and Yongxue Wang	799
Experimental Study of Ice Force on Combined Cone Yuexia Qu, Yongxue Wang, Zhijun Li and Guangwei Li	805

## **VOLUME II, 2001**

**To Use this Table of Contents:** Scroll down or use the bookmarks in the left-hand frame to move to a new location in this index. Click on a **blue paper title** to view that paper. To return to this index after viewing a paper, click the PREVIOUS MENU bookmark in the left frame.

The Material on this CD-ROM was created from scanning each author's paper originals. Viewing of the text and graphics and the ease of readability will depend largely on content requiring scanning and the quality and/or consistency of each author's paper original.

ISBN 1-880653-51-6(Set) ISBN 1-880653-53-2 (Vol. II) ISSN 1098-6189 (Set) www.isope.org

edited by:

Jin S. Chung, ISOPE, Cupertino, California, USA Tamotsu Matsui, Osaka University, Osaka, Japan Hermann Moshagen, Statoil, Stavanger, Norway

presented at:

The Eleventh (2001) International Offshore and Polar Engineering Conference held in Stavanger, Norway, June 17–22, 2001

organized by:

International Society of Offshore and Polar Engineers

sponsored by:

International Society of Offshore and Polar Engineers (ISOPE) with cooperating societies and associations

#### PLENARY PRESENTATION

Suction Piles: Their Position and Application Today  Tor Inge Tjelta	1
ÅSGARD TRANSPORT	
<b>Design of the Åsgard Transport Gas Trunkline for Thermal Buckling</b> Per R. Nystrøm, Knut Tørnes, Jan S. Karlsen, Geir Endal and Erik Levold	7
Asgard Gas Transport System: Precommissioning and Commissioning  Jarleiv Maribu, Christian Falck and Philip Burman	18

Asgard Transport Pipeline — Onshore Section         Arne Ingvar Helland, Anders Ohm and Arve Johannessen	26
Asgard Transport Gas Pipeline — New Landfall Solution at Kalstø  Stein Ryfetten and Erik Bjertness	33
PIPELINES	
Geo-Hazard Assessment for Pipelines Crossing the Continental Slope  Marco Venturi and Sabrina Bughi	42
Risk-Based Condition Assessment and Inspection Planning for Submarine Pipeline Systems  Hroar Nes and Lars Sortland	47
Parameter Study of Long Free Spans  Tore Søreide, Gunnar Paulsen and Finn Gunnar Nielsen	55
Hydrodynamic Drag of a Pipeline in Broken Ice M.A. Kamyshev, A.M. Kamyshev, N.V. Shaybo and G.N. Sokolovsky	63
Numerical Comparison of Stability and Flow Pattern Over Offshore Pipelines in Trench Seungbae Lee, Chul H. Jo, Sung-Wook Jang and Sung-Geun Hong	68
Burst and Gross Plastic Deformation Limit State Equations for Pipes: Part 1 — Theory Finn Kirkemo	76
Burst and Gross Plastic Deformation Limit State Equations for Pipes: Part 2 — Application Finn Kirkemo and Harald Holden	85
Assessment of Corroded Pipelines: Past, Present and Future  O.H. Bjørnøy and M.J. Marley	93
Background and Development of DNV-RP-F101 "Corroded Pipelines"  O.H. Bjørnøy, G. Sigurdsson and M.J. Marley	102
RBI Planning for Pipelines  M.J. Marley, C.H. Jahre-Nilsen and O.H. Bjørnøy	110
Inherent Safety Level in Different Pressure Containment Criteria  L. Collberg, K.J. Mørk and M.J. Marley	118
Effect of Spoilers on Flow Around Submarine Pipelines  Lee Woon Chew and Liang Cheng	126
Local Buckling of UOE and Seamless Steel Pipes  A.M. Gresnigt and R.J. van Foeken	
Prediction Model for Decommissioned Offshore Pipelines  R. Bijker and Z. Chen	143
Design and Installation Aspects in the Use of High Strength Steels for Deep and Ultra- Deepwater Pipelines  T. Sriskandarajah, P. Ragupathy, G. Anurudran and R. Wilkins	
Dynamic Fracture Analysis of a Ring-Stiffened Cylinder Subjected to a Strong  Acoustic Wave  K.S. Kim, C.H. Jo, S.B. Choi and J.H. Kim	
On the Forces Exerted on Buried Pipe in Liquefied Ground  Yasuo Tanaka, Akio Kuruma, Tsuyoshi Asada and Yoshihiro Mizoguchi	

Mass Gravity Flow Modelling Michele Drago and Alessandro Terenzi	166
Dual Offshore Pipeline Stability in Trench Chul H. Jo, Kyoung H. Min and Young S. Shin	173
Seismic Response and Vibration Control for Free Spanning Submarine Pipelines  J. Zhou, X. Li and C.X. Ma	180
Dynamic Versus Static Lateral Buckling of Subsea Pipelines  T. Sriskandarajah, P. Ragupathy and R. Wilkins	185
The Smart Plug: A Remotely Controlled Pipeline Isolation System  Jostein Aleksandersen and Edd Tveit	192
<b>3-D Dynamic Vibration for the Offshore Pipeline Subjected to Wave Forces</b> <i>H.H. Lee, G.L. Liaw and P.Y. Chung</i>	200
RISERS, CABLES AND MOORING	
Tower Riser Concept for West Africa  Jim Hamilton, Terje Clausen and Mike McSherry	206
Stationary and Hopf Bifurcations of Equilibrium Positions of a Cylinder Situated in Near and Far Wake Fields of an Upstream Cylinder  Wusheng Wu, Shan Huang and Nigel Barltrop	214
<b>Evaluation of Effect of Contact Between Top Tensioned Risers in Deep and Ultra Deep Waters</b> Magne K. Nygård, Fikry R. Botros and Henrik Hannus	222
Riserless Casing While Drilling Using a Dual Gradient Mud System Sigbjørn Sangesland, Geir Tandberg and Jøren Breda	227
Nonlinear Dynamic Response of a Steel Catenary Riser at the Touch-Down Point  Luciano de A. Campos and Clóvis Arruda Martins	234
<b>Dynamics in the Touchdown Region of Catenary Moorings</b> Jason I. Gobat and Mark A. Grosenbaugh	239
An Analytic Model for Static Analysis of Catenary Risers G. Moe and Ø. Arntsen	248
Local Riser Impact: F.E. Model Validation Using Laboratory Impact Tests S.R. Wilmshurst, H.H. Chan, C.P. Ellinas and T. Moros	254
Local Riser Impact: The Effect of Neoprene Coatings S.R. Wilmshurst, H.H. Chan, C.P. Ellinas and T. Moros	261
An Assessment of the Application of the Hilbert Spectrum to the Fatigue Analysis of Marine Risers	260
B.M. Gravier, N.J. Napal, J.A. Pelstring, D.A. Jordan and R.W. Miksad	
Numerical Analysis of Wire Ropes Considering Coupled Extensional and Torsional Behaviour	-, -, -,
José R.M. de Sousa, Marcos Q. de Siqueira, Gilberto B. Ellwanger, Léa M.B. Troina, Márcio M. Mourelle and Luís Cláudio S. Costa	281

Numerical Prediction of the Dynamics of a Sea-Plow System  James J. Burgess	288
Effect of the Selection of Mooring System on Characteristics of Platforms in Wave and Ice Conditions	
E. Toropov, O. Gladkov, A. Gintovt, D. Mirzoev, A. Bolshev and S. Frolov	295
Mooring a Drilling Semi Over a Pre-Installed Riser System – West Alpha at Snorre B  Erik Falkenberg, Jun Xu, Grzegorz Odor, Simen Moxnesand Hans H. Bruu	299
Dynamic Analysis of the DICAS Mooring Configuration for Floating Systems  G.B. Matter, J.S. Sales Jr., S.H. Sphaier, S.H.S. Correa and I.Q. Masetti	306
AUV AND UNDERWATER CONTROL	
Deep and Long Range AUV "URASHIMA"  Taro Aoki, Tadahiro Hyakudome, Toshiaki Nakamura, Kenkichi Tamura, Hiroshi Ochi, Takashi Murashima, Satoshi Tsukioka, Hidehiko Nakajoh, Tadahiko Ida, Katsufumi Akazawa and Kikuo Hashimoto	314
Performance of a Tip-Driven Electric Thruster for Unmanned Underwater Vehicles S.M. Abu Sharkh, S.R. Turnock and G. Draper	321
Integron-Based Control Architecture for AUVs  Roberto Luiz C.B. Ramos and José Reinaldo Silva	325
Hydrodynamic Mitigation of Washover Effects Associated with Surface-Towed  Antenna Bodies  James H. Clark	333
Effects of Unsteady Lift and Cable Tension on Design of a Control System of a  Towed Vehicle  Satoru Yamaguchi, Wataru Koterayama and Takashi Yokobiki	339
ENVIRONMENT ENGINEERING	
Oil Spreading in Cold Waters – A Model Suitable for Broken Ice  Janne K.Ø. Gjøsteen	346
Design Criteria for a New Generation of Oil Skimming Vessels  Günther F. Clauss, Rolf Habel and Martin Vannahme	352
A Review Analysis of International and Greek Databases Concerning Oil Spills: The Case of a New Greek Oil Spill Database	
Nikolas P. Ventikos, Konstantinos P. Dilzas and Harilaos N. Psaraftis	360
Development of Oil Boom System for Stormy Weather  Eiichi Kobayashi, Yoshiharu Shigeiri, Yoshiyuki Nishimura, Kiyoto Oe, Seigi Yamase and Kunihiro Ikegami	366
Research and Development of Oil Skimmer for Stormy Weather Shirou Ono, Hideo Yamaga, Yuiti Katoh, Yoshiharu Shigeiri, Hiroomi Ozawa, Hiroyuki Nakagawa and Hideyuki Omori	374
Special Information-Analytical System on the Shelf Arctic Seas Environmental Conditions  Dilijan A. Mirzoev, Alexander S. Tsvetsinsky, Valentin S. Tuzhilkin, Boris V. Arkchipov and Alexander A. Vorontsov	381

The Relationships between the Winter North Western Siberia Wind Velocity and the North Atlantic Oscillation	
Vladimir N. Kryjov	387
Structural Design of Movable Gate of Coastal Floating Unit  H. Kusumoto and Y. Takeda	391
An Experimental Study of Heated Surface Jet in a Wave Environment  M. Di Natale and D. Vicinanza	396
Analysis of Breakwater-Induced Environmental Effects at Pescara (Adriatic Sea, Italy) Channel-Harbor F. Lalli, D. Berti, M. Miozzi, F. Miscione, B. Porfidia, L. Serva, E. Vittori and G.P. Romano	404
GEOTECHNICAL ENGINEERING	
SOIL PROPERTIES  Probability Analysis of Soil Instability Under Random Waves  Shaoli Yang, Jingdong Liu and Lars Grande	409
Using a $\sqrt{t_{60}}$ Method to Determine the Coefficient of Consolidation of Two Clays  T.W. Feng	413
Thermo-Viscoplastic Model for Soft Clays Nobuharu Abe	417
Method of Examining Data Measured in the Constant-Rate-of-Strain Consolidation Test  M. Shimizu and J. Imamura	425
Influence of Inherent Particle Characteristics on the Flow Behavior and Strength Properties of Particulate Materials  Beena Sukumaran and Alaa K. Ashmawy	430
Elasto-Viscoplastic Modeling of Consolidation Behavior of Natural Clays Nobuharu Abe	437
Dependence of Liquid Limit on Grain Size Distribution  Mitsuharu Fukuda, Seiji Suwa, Takao Uno, Sung Zae Park and Gyeong Hwan Jeong	442
Elasto-Plastic Volume Change of Unsaturated Compacted Clay  I. Zakaria	446
<b>Deep Penetration in Soft Clay with Strength Increasing with Depth</b> Q. Lu, Y. Hu and M.F. Randolph	453
Mitigation of Seismic Hazard on Retaining Structures — A Numerical Experiment  Hemanta Hazarika	459
Mechanical Properties of Foamed Alumina Cements  Jong-Shin Huang	465
OFFSHORE INVESTIGATIONS  Analytical Technique for the Interpretation of Measured Pore Pressures in Shallow  Marine Sediments	
Glen R. Andersen, Philip J. Valent and S. Peter Gonzales	469
Response of Coulomb-Damped Poroelastic Seabed to Waves  Ching-piao Tsai, Tsong-Lin Lee and D.S. Jeng	476

Geotechnical Properties of Marine Sediments from Acoustic Measurements  Horst G. Brandes	
<b>Sample Quality of Pleistocene Clay and Influence of Residual Effective Stress</b> <i>F. Rito, N. Ohmukai, H. Tanaka and M. Tanaka</i>	
Sample Quality Evaluation of Soft Clays Using Six Types of Samplers  Masanori Tanaka, Hiroyuki Tanaka and Dinesh R. Shiwakoti	493
The Role of Fines in the Shear and Liquefaction of a Volcanic Soil 'Shirasu' as a Reclamation Material  M. Hyodo, Y. Nakata, N. Yoshimoto, Y. Kato and T. Okabayashi	501
Empirical Formula on Floor Response Spectrum  Li-Ling Hong and Yu-Chin Chen	508
SOIL DYNAMICS Influence of Clay Content and Clay Type on Cyclic Behavior of Compacted Intermediate Soils  M.A. El Mesmary, Y. Nabeshima and T. Matsui	512
Influences of Wave Force on Liquefaction Behavior of Seabed Soil  Lien-kwei Chien and Chih-hsin Chang	518
Effects of Fabric on Steady State and Liquefaction Resistance  Yao-Chung Chen and Jiun-Chi Chuang	524
Liquefaction Behavior of Toyoura Sand Under Cyclic Strain Controlled Triaxial Testing Kazunori Uchida and James David Stedman	530
Seismic Response of Reinforced Earth Wall Faced by Concrete Block Norihiko Sakata, Itsuo Sakashita, Mitsunobu Aoshima and Tamotsu Matsui	537
SUCTION FOUNDATION  Field Testing of Suction Embedded Plate Anchors  Bob Wilde, Hans Treu and Tom Fulton	544
Ultimate Horizontal Loading Capacity of Suction Piles  Sangchul Bang and Yeongki Cho	552
A Comparison of Uplift and Bearing Behaviour of Plate Anchors in Soft Clay  N. Santosh Rao and Manoj Datta	560
Field Measurements on the Holding Power of Mooring Anchors  Yoshi-hiko Maeno, Motoyasu Ishikawa, Yuji Kumagai and Hirofumi Kawamoto	566
Installation and Pull-Out Capacity of Stiffened Suction Caissons in Cohesive Sediments  A.R. House and M.F. Randolph	574
FOUNDATIONS  Capacity of Driven Piles in Clays and Sands on the Basis of Pile Load Tests  Carl J.F. Clausen and Per Magne Aas	581
A Field Investigation into the Performance of Compaction Grout piles  Adel M. El-Kelesh and Tamotsu Matsui	587
Friction Pile-Soil Interaction Subjected to Cyclic Axial Loads  Kazem Fakharian	594

Anchor Selection and Installation for Shallow and Deepwater Mooring Systems  **Roderick Ruinen and Gijs Degenkamp**  **Roderic	600
A Case Study on Lateral Movement of Bridge Abutment Won-Pyo Hong, Young-Suk Song and Seung-Joo Lee	607
A Centrifuge Study of Suction Pile Installation in Sand Youseok Kim, Seongwoon Kim, Joongbai Park, Sungjoon Kim, Heungseok Kim and Kyoungo Kim	615
Centrifuge Modelling of Suction Pile Installation Using a Percussion Technique  H.G.B. Allersma, J.R. Hogervorst and M. Pimoulle	620
Installation of Offshore Concrete Structure with Skirt Foundation Naoki Masui, Hiroshi Yoneda, Yosinobu Zenda, Masato Ito, Yasuhiro Iida and Jon Hermstad	626
Dynamic Loading to Sea Bed by Direct Dumping M. Miyake, T. Yanagihata, T. Tsurugasaki and S. Baba	631
Effect of Pile Diameter on Bearing Mechanism of Cast-in-Place Bored Piles  K. Oda and T. Matsui	639
Full-Scale Monitoring of Troll A Concrete Platform: A Huge Gravity-Based Structure on Soft Clay  Cecilie Huslid	647
Effect of Rate of Loading on Uplift Capacity of a Model Pile in Clay  Abdullah I. Al-Mhaidib	656
Guidance for Design of Suction Caissons Against Buckling During Installation in Clay Soils  R. Pinna, C.M. Martin and B.F. Ronalds	662
RECLAIMED LANDS  Characteristics of Heavy Metal Migration in Contaminated Soil by Electrokinetic Technique  Soo-Sam Kim, Sang-Jae Han, Seung-Yong Jung and Yeon-Soo Jang	669
Stress Distribution in Reclaimed Land Under a Geogrid-Reinforced Granular Pad  E.C. Shin, D.H. Kim, B.M. Das and E.S. Lee	676
Applicability and Performance of Substitutional Filling Materials for Compaction Methods in Field Tests  Hideo Tsuboi, Hirofumi Shono, Kenji Harada and Tamotsu Matsui	681
Model Tests on Consolidation Behavior of Soft Clay Ground Improved by Plastic Board Drain	
Seung Kyong You, Kazuhiro Oda and Tamotsu Matsui	687
Electrokinetic Strengthening of Marine Clay Adjacent to Offshore Foundations S. Micic, J.Q. Shang and K.Y. Lo	694
Assessment of Dynamic Property of Reclaimed Lands from Observed Microtremors  Kiyoshi Hayakawa, Tamotsu Matsui, Teruyuki Hamada and Yukihiko Kani	702
ADDITIONAL PAPERS	
Conductor Survival in Lightweight Upper Ocean Working Cables  Walter Paul and Doug Bentley	708
Acceleration of Self-Weight Consolidation for Dredged Clay Using Plastic Board Drain Ken-ichi Sato, Tadaaki Nomura and Nobuo Yoshida	715

Stability Analysis of Extensible Flexible Marine Pipes Transporting Fluid	
Somchai Chucheepsakul, Tseng Huang and Tinnakorn Monprapussorn	. 722
Direct Heated Flowlines in the Åsgard Field Svein Dretvik and Atle Harald Børnes	. 730

### **VOLUME III, 2001**

**To Use this Table of Contents:** Scroll down or use the bookmarks in the left-hand frame to move to a new location in this index. Click on a **blue paper title** to view that paper. To return to this index after viewing a paper, click the PREVIOUS MENU bookmark in the left frame.

The Material on this CD-ROM was created from scanning each author's paper originals. Viewing of the text and graphics and the ease of readability will depend largely on content requiring scanning and the quality and/or consistency of each author's paper original.

ISBN 1-880653-51-6(Set) ISBN 1-880653-54--0 (Vol. III) ISSN 1098-6189 (Set) www.isope.org

edited by:

Jin S. Chung, ISOPE, Cupertino, California, USA Marc Prevosto, Ifremer, Plouzané, France Norimi Mizutani, Nagoya University, Nagoya, Japan

presented at:

The Eleventh (2001) International Offshore and Polar Engineering Conference held in Stavanger, Norway, June 17–22, 2001

organized by:

International Society of Offshore and Polar Engineers

sponsored by:

International Society of Offshore and Polar Engineers (ISOPE) with cooperating societies and associations

Data Interpretation and System Identification in Hydrodynamic Model Testing

#### PLENARY PRESENTATION

C.T. Stansberg	1
METOCEAN	
Continuous Space Discrete Time Markov Models for Multivariate Sea State	
Parameter Processes	
Valérie Monbet and Pierre-François Marteau	10
Two Methods for Simulating the Bivariate Process of Wave Height and Direction	
P. Ailliot and M. Prevosto	15

Joint Distribution for Wind and Waves in the Northern North Sea  Kenneth Johannessen, Trond Stokka Meling and Sverre Haver	19
Expected Wave Height by Wave Direction at Japanese Coastal Zone Yasutaka Saito, Ryoko Suzuki, Shuhei Notomi, Osamu Saijo and Kyoichi Okamoto	29
Joint Occurrence of Sea States and Associated Durations  Takvor H. Soukissian and Zoe Theochari	33
Performance of Three Wave Models on Aegean Sea: First Results  Takvor H. Soukissian, Leonidas Perivoliotis, Aristides M. Prospathopoulos and Anastassios  Papadopoulos	40
Modeling of Hurricane Waves in Hawaiian Waters  Christopher D. Martino, Kwok Fai Cheung, Amal C. Phadke and Samuel H. Houston	46
On an Efficient Numerical Model for Freak Wave Simulations  Didier Clamond and John Grue	54
Study of Freak Waves by Use of Wavelet Transform  Jasna Bogunovic Jakobsen, Sverre Haver and Jan Erik Odegard	58
Application of Wavelet-Based Trispectra to Detect Short-Time Duration Nonlinear Wave Phenomena EJ. Yi and E.J. Powers	65
Spatial Evolution of Water Surface Waves: Numerical Simulation and Experiment of Bichromatic Waves  Karsten Trulsen and Carl Trygve Stansberg	71
Higher-Order Spectral Estimators and Nonlinear System Identification  Yngve Birkelund and Edward J. Powers	78
Improved Characterizations for Design Waves S. van Iseghem, G. Deleuil and P. Guerin	85
Representativity of Some Standard Spectral Models for Waves  M. Olagnon	92
HYDRODYNAMICS	
NUMERICAL WAVE TANK  A Mixed Analytical-Numerical Time Domain Approach to Second-Order Diffraction  Karine Pelletier and Pierre Ferrant	100
Time-Dependent Nonlinear Finite Element Models for Wave Propagation over Gently Varying Depths  Conceição J.E.M. Fortes and J. Leonel M. Fernandes	108
Modeling of Wave Shoaling in a 2D-NWT Using a Spilling Breaker Model  Stéphan Guignard and Stéphan T. Grilli	
Modeling of Freak Wave Generation in a 3D-NWT  Carlo Brandini and Stéphan Grilli	124
Modeling of Tsunami Generation by an Underwater Landslide in a 3D-NWT Stéphan T. Grilli and Philip Watts	132

Reproduction of Fully-Nonlinear Multi-Directional Waves by a 3D Viscous Numerical Wave Tank  J.C. Park, Y. Uno, H. Matsuo, T. Sato and H. Miyata	140
On a 2-D Numerical Wave Tank in Viscous Fluid  C.M. Dong and C.J. Huang	148
Synthesizing Nonlinear Transient Waves in Random Seas Ulrich Steinhagen and Günther F. Clauss	156
Analysis of the Three-Dimensional Sloshing Flows in the Ship Liquid Cargo  Yonghwan Kim	166
<b>Experimental Simulation of Tailored Design Wave Sequences in Extreme Seas</b> Günther F. Clauss, Csaba Pákozdi and Ulrich Steinhagen	173
Generation of Surface Waves by Turbulent Wind Flow  Andy T. Chan	181
<b>Development of a Numerical Ocean Basin for Predicton of Ringing Effects on Platforms</b> Søren Peter Kjeldsen and Pierre Bonmarin	186
Non-Linear Wave Structure Interactions at Artifical Reefs Günther F. Clauss, Rolf Habel and Csaba Pákozdi	194
A Stationary Flow Approximation for Breaking Wave Crests and Its Application to the Impact of Extreme Waves on Vessels and Offshore Structures  Alastair D. Jenkins	201
Numerical Simulation of Shallow Water Waves around Coastal Structures by a Chimera Potential-Flow Method  Hamn-Ching Chen and Tsung-Lung Liu	205
Numerical Estimation of Ship-Generated Wave Pattern S. Shiotani	
Experimental and Numerical Study of a Half-Submerged Pile-Supported Breakwater  Gaelle Duclos, Alain H. Clément, Lionel Gentaz and Christophe Colmard	221
FORCES  Forecasting Wave-Induced Response for Offshore Floating Structures  Anne Karin Magnusson, Ole Tom Vårdal, Bjørn Åge Hjøllo, Rasmus Myklebust, Magnar Reistad and Kjell Hansen	229
Hydrodynamic Interaction between Two Cylinders in Steady Flow  Kjell Herfjord and Mads Bryndum	237
Long-Wavelength Approximation of Wave Force on Two-Body Axisymmetric System  T. Bjarte-Larsson and J. Falnes	244
Radiation by Large Elongated Floating Bodies by Finite Element Method Using Second Order Elliptic Far Field Boundary Condition S.K. Bhattacharyya, S. Sathyapal and C.P. Vendhan	250
Drag Coefficients of Long Vertical Pipe Moving in Deep Ocean: An Adaptive Algorithm for Multi-Input/Multi-Output  Jin S. Chung and Dong Ho Nam	257
Statistical Properties of Non-Linear Froude-Krylov Forces on Cylinders  Felice Arena and Francesco Fedele	264

Non-Linear Wave Interactions with a Submerged Horizontal Cylinder  J.R. Chaplin	272
Computation of Non-Linear Wave Reflections and Transmissions from a Submerged Horizontal Cylinder T. Schønberg and J.R. Chaplin	280
Nonlinear Wave-Body Interactions by the Chimera Laplace Method  Chang-Ho Kang and Hamn-Ching Chen	288
Inundation Effect and Quartic Approximation of Morison-Type Wave Loading  X.Y. Zheng and C.Y. Liaw	295
DYNAMIC RESPONSES  Time-Domain Simulation of Large Amplitude Ship Roll Motions by a Chimera  RANS Method  Hamn-Ching Chen, Tuanjie Liu and Erick T. Huang	299
Distribution of Maxima of Non-Linear Barge Rolling with Medium Damping  Marc Prevosto	
Some Remarks on the Nonlinear Modelling of Parametric Rolling  Alberto Francescutto, Daniele Dessi and Roberto Penna	317
On the Roll Motion of a Trimaran in Beam Waves  Alberto Francescutto	321
A Study on Long-Period Moored Ship Motions in a Harbor Induced by a Resonant Large Roll Motion Under Long-Period Waves Shigeki Sakakibara, Katsuhiko Saito, Masayoshi Kubo, Satoru Shiraishi, Toshihiko Nagai and Fumihiko Yazaki	326
Stability Investigation of a Pontoon Barge in Wave Basin  Erick T. Huang and Hamn-Ching Chen	334
3-D Dynamic Behavior of Moored Floating Structure of a Nuclear Power Plant Due to Tsunami Based on Non-Distorted Model Tests  Masaaki Ikeno, Hiroyoshi Tanaka and Masafumi Matsuyama	339
Current Effects on Extreme Response Value Statistics of Offshore Structures Subjected to Wave and Current Tomoyo Taniguchi and Kenji Kawano	347
Interactions of Fully Nonlinear Waves with Submerged Bodies by a 2D Viscous NWT  Armin Tavassoli and M.H. Kim	
The Relative Motion and Wave Elevation Between Two Floating Structures in Waves  Ming-Chung Fang and Gung-Rong Chen	361
Numerical Investigation of Nonlinear Wave Effects Around Multiple Cylinders P. Teigen and K. Trulsen	369
Wave Scattering by Multiple Floating Membranes  T.L. Yip, T. Sahoo and Allen T. Chwang	379
An Application of Scattering Frequencies to Hydroelasticity  Michael H. Meylan	385
A Convergence Study of Second-Order Wave Elevation on Four Cylinders  Jørn Birknes	392

VORTEX SHEDDING AND VORTEX-INDUCED VIBRATIONS  Experiments for High Reynolds Numbers VIV on Risers  J.J. de Wilde and R.H.M. Huijsmans	400
Vortex-Induced Vibration of Single and Multiple Risers in a Sheared Current  R.H.J. Willden, J.M.R. Graham and G. Giannakidis	406
Wake Development and Hydrodynamic Forces on a Rotary Circular Cylinder with High α Numbers  Xuequan E, Caimao Luo and Jianmin Yang	411
Numerical Simulations of Vortex-Induced Vibrations of Slender Flexible Offshore Structures S. Etienne, F. Biolley, E. Fontaine, C. Le Cunff and J.M. Heurtier	
VIV Analysis of Risers by Complex Modes G. Moe, Ø. Arntsen and C. Hoen	426
Optimizing Sensor Locations for Identification of Riser VIV Modes  Karl E. Kaasen	431
Estimation of Hydrodynamic Forces on an Irregularly Oscillating Cylinder Using Symmetrical Vortices Model  Akiyoshi Bando, Koji Otsuka and Yoshiho Ikeda	437
COUPLED MOORING-STRUCTURE DYNAMICS  A New Method for Coupled Dynamic Analysis of Platforms  Gautam Chaudhury	444
Coupled Analysis Strategies for Deepwater Spar Platforms O.C. Astrup, A. Nestegård, M. Ronæss and N. Sødahl	449
Fully Coupled Response Simulations of Theme Offshore Structures in Water Depths of Up to 10,000 Feet  Sungeun Kim and Paul D. Sclavounos	457
Variability of TLP Motion Analysis Against Various Design Methodologies/Parameters  M.H. Kim, A. Tahar and Y.B. Kim	467
Comparison of Numerical Models for the Capability of Hull/Mooring/Riser Coupled  Dynamic Analysis for Spars and TLPs in Deep and Ultra-Deep Waters  M.H. Kim, E.G. Ward and R. Haring	474
Effect of Coupling of Mooring Lines and Risers on the Design Values for a Turret Moored FPSO in Deep Water of the Gulf of Mexico  J.E.W. Wichers and P.V. Devlin	480
COASTAL ENGINEERING	
WAVE-STRUCTURE INTERACTIONS  Wave Breaking-Induced Dynamic Pressure Due to Submerged Breakwater  Koji Kawasaki and Koichiro Iwata	488
Laboratory Study on the Interaction Between Regular Obliquely Incident Waves and Vertical Walls  You chang Li. Theo chan Sun. Guo hai Dong. Shuang guan Yu. En zong Niu and Kai Mao	105
Yu-cheng Li, Zhao-chen Sun, Guo-hai Dong, Shuang-quan Xu, En-zong Niu and Kai Mao  Performance of a Double-Walled Barrier with a Front Wall of Inclined Plate Array  Takayuki Nakamura, Tohru Kohno and Yoshimitsu Morita	

Wave Reflection over a Sloping Beach  Hsien-Kuo Chang, Tai-Wen Hsu and Jin-Cheng Liou	506
Analysis and Comparison of the Forces by the Nonlinear Long Waves on the Piled System at Derince Port Turkey	512
E. Irtem, N. Gedik and A.C. Yalciner	512
Hydrodynamic Forces on a Submerged Plate  Mikio Takaki	518
PORT AND HARBOR <b>Harbor Facilities and Water Area Investigation Unit</b> Toshiyuki Kano, Yasuhiro Matsushita, Yoshiaki Takahashi and Satoshi Ueda	525
The Quay Construction with Concrete Caisson in Belde Container Port in Turkey  R. Bakis and M. Bilgin	532
Basic Research on the Prediction of the Wave Growth at Harbour Facing to the Pacific Ocean	525
Kenji Sasa, Masayoshi Kubo, Satoru Shiraishi and Toshihiko Nagai	537
Study of the Capacity of Breakwater with Channel to Exchange Water  Syuuji Morita and Ichiro Deguchi	545
Characteristics of Wave Overtopping in a Harbor Induced by Typhoon 9918  Tetsuya Hiraishi	553
Investigation of Seismic Response and Stability of Breakwaters Under Seepage Flows  Y.K. Liu and T. Zhu	559
WAVES	
Study on the Characteristics of the Coastal Wind Fields in Keelung  John Z. Yim and Chung-Ren Chou	564
Effect of Coastal Topography on Wave Climate in Shallow Water  Masataka Yamaguchi and Yoshio Hatada	569
The Evolution of Wallops Spectra in Decreasing Depths  R. Gentile, L. Rebaudengo Landò and G. Scarsi	575
DRBEM Analysis on Wave Oscillation Due to Energy Dissipation Sung-Shan Hsiao, Jaw-Guei Lin and Hui-Ming Fang	581
The Bottom Boundary Layer Flow in the Prebreaking Zone of Shoaling Waves  Chang Lin and Hwung-Hweng Hwung	587
Basic Research on Frequency Properties of Long Period Waves at Harbour Facing to the Pacific Ocean  Kenji Sasa, Masayoshi Kubo, Satoru Shiraishi and Toshihiko Nagai	593
Experiments on the Bragg Reflection of Waves by Different Types of Artificial Bars  Tai-Wen Hsu, Hsien-Kuo Chang, Li-Hung Tsai and Yi-Xin Li	
An Extended Boussinesq Model and Its Application to Long Period Waves  Md. Hasanat Zaman, Katsuya Hirayama and Tetsuya Hiraishi	
Influence of Directional Angle to Typhoon Swell Prediction  Jea-Tzyy Juang and Po-Chin Lin	

A Neural Network Approach to the Problem of Recovering Lost Data in a Network of Marine Buoys	
S. Puca, B. Tirozzi, G. Arena, S. Corsini and R. Inghilesi	620
POROUS BREAKWATER  Experimental Study on the Influence of the Crest Width on the Deformation of  Submerged Breakwater  Susumu Araki, Toshihiro Miyazaki, Ichiro Deguchi and Yoshiyasu Fujiwara	624
Waves Passing Submerged Porous Structures with Multiple Regions  Jaw-Fang Lee and Yo-Ming Cheng	631
Three-Dimensional Study on the Wave-Induced Flow Inside and Around a Permeable Structure Norimi Mizutani, Aliasghar Golshani and Dong-Soo Hur	638
Theoretical Analysis on Wave Transmission, Reflection and Stability of Rubble Mound Breakwater with a Granular Model R. Koh	645
WAVES AND SEABED  Behaviour of a Model Breakwater Element on a Sandy Seabed  Gilliane Sills, Omar Fergui, Geir Svanoe, Alf Torum and Trygve Ilstad	651
Waves over Submerged Parabolic Shoal in the Presence of Uniform Current  Md. Hasanat Zaman, Tetsuya Hiraishi and Hiroyoshi Togashi	658
On the Propagation of a Solitary Wave over Rigid Sand Ripples  C.J. Huang and C.M. Dong	666
TIDE AND CURRENT  Numerical Study on Simulation of Tidal Exchange of Hakata Bay  Kensaku Furusho and Yusaku Kyozuka	674
Stochastic-Numerical Model of Tidal Current Field for Jiaozhou Bay of Yellow Sea D.F. Liu, L.Sh. Kong, J.C. Zuo, Y.F. Yu and Z.D. Cao	682
Numerical Simulation of Tidal Flow Around Hangzhou Bay with a Three Dimensional Ocean Circulation Model  Zhaochen Sun, Shuxiu Liang and Guohai Dong	686
Observation of Coastal Current by Acoustic Doppler Profile 2 km Offshore of Tsuyazaki, Fukuoka, Japan  Takeshi Kasa, Yusaku Kyozuka and Masaru Inada	692
ADDITIONAL PAPERS	
Comparing Extreme Wave Estimates from Hourly and Annual Data Steven R. Winterstein, Gudmund Kleiven and Øistein Hagen	700
Incident Irregular Waves and Long Waves in Surf Zone Gui-hai Dong, Wen-ya Ye, Zhi-li Zou and Mei Chang	708

and

# The Second (2001) International Deep-Ocean Technology Symposium

### **VOLUME IV, 2001**

To Use this Table of Contents: Scroll down or use the bookmarks in the left-hand frame to move to a new location in this index. Click on a blue paper title to view that paper. To return to this index after viewing a paper, click the PREVIOUS MENU bookmark in the left frame.

The Material on this CD-ROM was created from scanning each author's paper originals. Viewing of the text and graphics and the ease of readability will depend largely on content requiring scanning and the quality and/or consistency of each author's paper original.

ISBN 1-880653-51-6(Set) ISBN 1-880653-55-9 (Vol. IV) ISSN 1098-6189 (Set) www.isope.org

edited by:

Ivar Langen, Høgskolen i Stavanger, Stavanger, Norway Tetsuo Yao, Osaka University, Osaka, Japan Jay Koo, ExxonMobil Research and Engineering Company, Annandale, New Jersey, USA Ronald H. Knapp, University of Hawaii, Honolulu, Hawaii, USA Jin S. Chung, ISOPE, Cupertino, California, USA

presented at:

The Eleventh (2001) International Offshore and Polar Engineering Conference held in Stavanger, Norway, June 17–22, 2001

organized by:

International Society of Offshore and Polar Engineers

sponsored by:

International Society of Offshore and Polar Engineers (ISOPE) with cooperating societies and associations

#### PLENARY PRESENTATION

#### **Deepwater Technology and Deepwater Developments**

Demo 2000: Qualifying Deepwater E&P Technology by Pilot Demonstration  Morten Wiencke	6
Need for a New Paradigm in Offshore Industry-University Cooperation  Jose M. Roësset	11
TUBULAR STRUCTURES AND FATIGUE	
TUBULAR STRUCTURES  The Strength of Multiplanar Gap KK-Joints of Rectangular Hollow Sections Under  Axial Loading  D.K. Liu and J. Wardenier	15
Developments in Fatigue Design Standards for Offshore Structures  I. Lotsberg and Per K. Larsen	23
Stress Intensity Factors of Through-Thickness and Surface Cracks in Tubular Y-Joints S.P. Chiew, S.T. Lie, C.K. Lee and Z.W. Huang	30
<b>Testing of Beam-to-RHS Column Connections without Weld Access Holes</b> <i>K. Miura, Y. Makino, Y. Kurobane, M. Tanaka, K. Tokudome and G.J. van der Vegte</i>	37
Prediction of Ductile Failure in Tubular Steel Members Using ABAQUS  D.C. Brooker and B.F. Ronalds	45
Design Recommendations for Stiffened and Unstiffened L-Joints Made of CHS and RHS under Fatigue Loading  D. Karcher and R. Puthli	51
SCFs and Fatigue Design of Multi-Planar Tubular DT-Joints Spyros A. Karamanos, Arie Romeijn and Jaap Wardenier.	59
FATIGUE: A Joint Industry Program  Full Scale Fatigue Testing of Side Longitudinals in FPSOs  I. Lotsberg, D.Ø. Askheim, T. Haavi and S.J. Maddox	67
Comparison of Measurements and Finite Element Analysis of Side Longitudinals  P. Rucho, S. Maherault, W. Chen, A. Berstad and G.E. Samnøy	
Stress Concentration Factors in Side Shell Longitudinals Connected to Transverse Webframes	
Tore Ulleland, Mattias Svensson and Einar Landet  Recommended Hot Spot Analysis Procedure for Structural Details of FPSOs and Ships Based on Round-Robin FE Analyses	
Wolfgang Fricke  Recommended Hot-Spot Stress Design S-N Curves for Fatigue Assessment of FPSOs	
S.J. Maddox  Fatigue Life Improvement of Scallops in Ships/FPSOs Using Finite Element Analysis  Mia Norman and Inge Lotsberg	
COMPOSITES AND SMART STRUCTURES	
Testing of Windows for the Amundsen-Scott South Pole Station  Piyush K. Dutta and Charles Clark	111

The Fracturing Processes of Freezing Composites Piyush K. Dutta	118
Characterization of Sub-Zero Response of Vinylester FRP in Civil Infrastructure Renewal  J. Rivera and V.M. Karbhari	124
Modeling of Piezoelectric Composite Laminates Using a Third-Order Plate Theory  Y.L. Zhou	131
Experimental Consideration in Mechanical Property of Accumulated Coal Fly Ash  D. Suetsugu, Y. Miyata and K. Kogure	140
The Suitability for Using Glass and Fly Ash in Portland Cement Concrete  Mustafa Tuncan, Bekir Karasu and Muhsin Yalcin	146
Development of a New Breakwater with Steel-Concrete Composite Cylindrical Shell Structure Setsuo Iwata, Susumu Matsuno, Kazuhiro Yasuda and Hiroshi Tanaka	153
Post-Fire Flexural Response of GRP Composite Ship Panels C.P. Gardiner, A.P. Mouritz, Z. Mathys and C.R. Townsend	160
Environmental Degradation Associated with Graphite/Epoxy Composites  S.T. Mear, H.G. Wheat and H.L. Marcus	168
Hygrothermal Conditioning of Composites  Barry A. Coutermarsh	175
Performance of a Quantitative Ultrasonic Technique in Evaluating In-Plane Elastic Constants of Carbon-Epoxy Laminates Subjected to Low Level Impacts Kenneth G. Kellogg	179
Affordable Processing of Thick Section Composite Structures  U.K. Vaidya, W. Young and C. Ulven	186
Fiber Optic Sensor System (FOSS) for Filament-Wound Gas Cylinders R.H. Knapp, T.A. Shimabukuro and I.N. Robertson	191
Plastic Strain and Residual Stress in a Ground Fe-Cr/TiN Composite Shigeki Takago, Toshihiko Sasaki, Hideaki Watanabe and Yukio Hirose	197
Interface Element for Strength Analysis of Joint Between Dissimilar Materials  Hidekazu Murakawa, Hisashi Serizawa, Zhenqi Wu and Yukio Ueda	201
Adhesive Bonding as an Alternative for Underwater Structural Repair  Patricia Dolez and Brian Love	206
Performance of Structural Epoxy Adhesives in Extreme Temperature Environments  Ayman Mosallam and Piyush K. Dutta	211
Fabrication of a Composite Superstructure Using a New Assembly Method Sarah E. Mouring and Ronnal P. Reichard	218
Effect of Environment on the Integrity of CFRP/Concrete Bond Rajan Sen, Gray Mullins, Mohsen Shahawy and John Spain	222
MATERIALS, WELDING AND CORROSION  Modern High-Strength Steels with Minimum Yield Strengths up to 690 MPa and High  Component Safety  HJ. Kaiser, A. Kern, T. Niessen and U. Schriever	227

Fitness-for-Purpose Failure and Corrosion Control Management in Offshore Oil and Gas Development	
Jeremy C. Price	234
Sour Service X65 Seamless Linepipe for Offshore Special Applications  E. Anelli, D. Colleluori, J.C. Gonzalez, G. Cumino, H. Quintanilla and M. Tivelli	242
The Effects of Alloying Elements on Thermal Fatigue and Thermal Shock Resistance of the HSLA Cast Steels	250
J.H. Park, H.J. Kim and I.B. Kim	230
Evaluation of Strength of Friction Welded 6061 Alminum Alloy Pipe Joints by Heat Input and Burn-Off Length  H. Ochi, T. Sawai, Y. Yamamoto, K. Ogawa and Y. Suga	256
Hybrid Welding of Steel for Offshore Applications Christian Walz, Ingo Stiebe-Springer, Magdy El Rayes, Thomas Seefeld and Gerd Sepold	263
Effect of Number and Size of Cracks on Fatigue Behavior of Alumina Akira Yoshikawa, Kiyohiko Ikeda, Koichi Kaizu and Katsushige Adachi	267
Fatigue Strength of AL-6XN Superaustenitic Stainless Steel  Brian Metrovich, Eric J. Kaufmann, John W. Fisher, Xiaohua Cheng, Ben T. Yen and Zuozhang Ma	272
Evaluation of Joint Strength of 6061 Aluminum Alloy Joint Welded Under Inertia Type Friction Welding by Heat Input and Burn-Off Length T. Sawai, H. Ochi, Y. Yamamoto, K. Ogawa and Y. Suga	
The Influence of Nickel and Nitrogen on Impact Toughness Properties of Low Alloy Basic Electrode Steel Deposits  Tomasz Wegrzyn	282
Automatic Control of Penetration by Monitoring Reverse Side Shape of Molten Pool in All Position Welding of Fixed Pipes  Yasuo Suga, Daisuke Takenaka, Yuto Hibikiya and Koichi Ogawa	286
Effect of Contact Detecting Method on Pre-Heating Time and Tensile Strength in 6061, 2017  Aluminum Alloy to SUS304 Stainless Steel Friction Welding  Katsuyoshi Morikawa, Yoshio Ohue, Ryouji Tsujino, Hiroshi Yamaguchi and Koichi Ogawa	292
Finite Element Analysis of Hot Cracking Under Welding Using Temperature-Dependent Interface Element	
Masakazu Shibahara, Hisashi Serizawa, Hidekazu Murakawa and Yukio Ueda	297
Statistical Investigation for Optimum Welding Condition of 2017 Aluminum Similar Alloy Friction Welded Joints Ryoji Tsujino, Katsuyoshi Morikawa, Hiroshi Yamaguchi, Koichi Ogawa and Hiizu Ochi	30 <i>1</i>
Fatigue Resistance of Welded Details Enhanced by Ultrasonic Impact Treatment (UIT)  Sougata Roy, John W. Fisher, Ben T. Yen	
A Study on Residual Stress Distribution Measurement of Dual Phase Stainless Steel by Means of X-Ray Method  Vigorous Wei, Invest He. Tookikika Sasaki and Vukio Hirosa	214
Xiaopeng Wei, Juwen He, Toshihiko Sasaki and Yukio Hirose	314
X-Ray Stress Measurement of Ni-Al systemCoating Layer Prepared by Self-Propagating High-Temperature Synthesis Reaction  Takayuki Murotani, Juwen He, Toshihiko Sasaki and Hajime Hirose	319

# COLLISION, MECHANICS AND EARTHQUAKE ENGINEERING

COLLISION AND IMPACT  Three-Dimensional Hydroelastic Water Entry: Preliminary Results  B. Donguy, B. Peseux, L. Gornet and E. Fontaine	324
Structural Response of a Thin Plate by Underwater Explosion Loading M. Arami, T. Kakinouchi and T. Shibue	331
Hydroelastic Formulation in Order to Achieve More Accurate Prediction of Hydrodynamic Loads  A. Bereznitski, B. Boon and V. Postnov	337
Slamming and Whipping Analysis of Large Container Ship  Ivo Senjanovic and Joško Parunov	343
<b>Designing for Wave Impact on Bow and Deck Structures</b> Ø. Hellan, O.A. Hermundstad and C.T. Stansberg	349
Large-Scale Experiments with Slender Cylinders in Breaking Waves  J. Wienke, U. Sparboom and H. Oumeraci	358
Nonlinear Wave-Structure Interactions on Floating Production Systems  C.T. Stansberg and F.G. Nielsen	363
High-Energy Ship Collision with Jacket Legs  Jørgen Amdahl and Atle Johansen	373
FE Approach to the Ship Grounding Event  J. Kajaste-Rudnitski and P. Kujala	378
On the Design of New Material Protective Device for Ship Collision  Tokiko Takabayashi, Kuniaki Shoji, Shigeo Mita and Chisato Nonomura	385
MECHANICS AND ANALYSIS  Post-Ultimate Strength Behaviour of Long Rectangular Plate Subjected to Uni-Axial Thrust  Tetsuya Yao, Masahiko Fujikubo, Daisuke Yanagihara and Tomoyuki Murase	390
New Simplified Model for Collapse Analysis of Stiffened Plates and Its Application to Offshore Structures  Patrick Kaeding and Masahiko Fujikubo	398
Experimental and Numerical Analysis of Aluminium Columns Subjected to Fire  Nina Kristin Langhelle and Jørgen Amdahl	
An Optimal Design Study on Pitched Beams  Ki-Sung Kim, Nam-Gu Kang and Hyoung-Jin Park	414
The Effect of Yield Stress on the Initiation of Fatigue Crack Occurred From a Round Hole C.H. Lin, G.S. Lin and C.S. Lee	420
EARTHQUAKE ENGINEERING  A Method for Including Ovalization Effects of Tuular Member on Cross-Section Properties  H. Karadeniz	426
A Case Study of Applicability of Seismic Bearing Capacity Method to Open Piled Pier with Vertical Steel Piles  Takayuki Suzuki, Shigeru Ueda, Tomoyuki Ikeuchi and Makoto Ishida	433

Study on the Seismic Response of a Semi-Submerged Bridge Including the Hydrodynamic Force	
Shigeru Ueda, Kazuyoshi Kihara, Koichi Inoue, Jun Hirai and Shunichi Ikesue	441
Damages due to the Eastern Marmara Earthquake (EME) at Port Structures Y. Yüksel, E. Çevik, Y. Çelikoglu, T. Bostan, H.I. Özmen and O. Özgüven	447
RELIABILITY, RISK AND SAFETY	
RELIABILITY, RISK AND SAFETY  Safety of Offshore Installations – Making ALARP Principle More Practicable  Chengi Kuo	452
On the Risk of Structural Failure on Norwegian Offshore Installations  Arne Kvitrud, Gerhard Ersdal and Roger L. Leonhardsen	459
On the Importance of Human and Organizational Factors in Design, Construction and Installation of Engineered Systems  Roger R. Stoelsnes, Ove Tobias Gudmestad and Robert G. Bea	465
Use of accident and Incident Data for Safety Optimisation  Jan Erik Vinnem and Nils Helge Rørå	475
Reassessment of Jacket Type of Platforms Subject to Wave-in-Deck Forces: Current Practice and Future Development  Katrine Hansen and Ove Tobias Gudmestad	482
Reliability Assessment of a Mooring System Sverre Haver, Kjell Larsen and Trond Stokka Meling	490
Case Study: Effects of Wind Loading on Structural Reliability  Emmanuel Fakas, Suhartodjo Tuty, Beverley F. Ronalds and Rodney Pinna	498
Quantifying Uncertainty due to Imperfect Force Prediction Models: A General Methodology with Applications to Fluid Drag Loads  Tina Kashef, Steven R. Winterstein and Rune Torhaug	503
Probability Distributions of Mechanical Damage for Offshore Marine Platforms  D. De León and E. Heredia-Zavoni	
Possibilistic Inspection Planning Technique Based on Fuzzy Reliability Concepts  Hari B. Kanegaonkar	516
Modified FMEA for Fishing Vessels: A Fuzzy Set and Grey Theory Approach A. Pillay, J. Wang, G.M. Jung, Y.S. Kwon, C.G. Loughran, T. I'Anson, A.D. Wall and T. Ruxton	522
Value and Risk: A Basis for a Balanced Performance Assessment Criterion for Maintenance in Offshore Engineering Constructions  Jayantha P. Liyanage, Tore Markeset, Jens Kørte and Uday Kumar	529
Expert Judgment and Risk Perception  Rolf Skjong and Benedikte H. Wentworth	537
Life Cycle Structural Integrity of North Sea Installations  A. Stacey, M. Birkinshaw and J.V. Sharp	545

#### ADVANCED SHIP AND OCEAN TECHNOLOGY

Second-Order Free Surface Effect on Cavitating 3-D Hydrofoils  Sakir Bal	554
Evaluation Method of Passenger Comfort for Training Ships in Irregular Seas  Ritsuo Shigehiro, Takako Kuroda and Yoichi Arita	562
Simulation of Modern Surface Ships with a Wetted Transom in a Viscous Flow Tingqiu Li and Jerzy Matusiak	570
Bayesian Estimation of Directional Wave Spectra for Ship Guidance System  Toshio Iseki and Daisuke Terada	577
Statistical Design of Fenders for Berthing Ship Shigeru Ueda, Ryo Umemura, Satoru Shiraishi, Shuji Yamamoto, Yasuhiro Akakura and Seigi Yamase	583
Fatigue Design Method of Ship Structural Members Based on Fatigue Crack Growth Analysis  K. Terai, Y. Tomita, K. Hashimoto and N. Osawa	589
Experimental Study on Thermo-Flow Field during Gas Flame Heating Nobutaka Shinkai, Yasumitsu Tomita, Naoki Osawa, Kiyoshi Hashimoto and Junji Sawamura	595
Fatigue Strength Tests of Side Longitudinal Frames under Constant Amplitude Loading  Yasushi Kumakura, Nobu Iino, Hajime Kawano, Kouta Shibasaki and Shunichi Kawachi	602
Bulk Carrier Corrosion Modelling  C.P. Gardiner and R.E. Melchers	609
OFFSHORE ENGINEERING EDUCATION	
Engineering an Offshore Engineering Curriculum  W.W. Massie and J.H. Vugts	616
Offshore Engineering Education Seen from the Viewpoint of an Adjoint Professor  Ove Tobias Gudmestad	620
Industry-University Educational Cooperation: A University Perspective W.W. Massie	625
Industry-University Education Co-operation – An Industry Perspective F.C. Lange	628
DEEPWATER RESEARCH STUDIES	
An Experimental Research Study of a Mini-TLP  J.M. Niedzwecki, P.F. Liagre, J.M. Roesset, M.H. Kim and P. Teigen	631
Dynamic Analysis of Mooring Lines by Using Three Different Methods  Xiaohong Chen, Jun Zhang, Peter Johnson and Mehernosh Irani	635
<b>Toward the Design of New Technologies for Deep-Water Anchorages</b> <i>R.E. Olson, A.F. Rauch, R.B. Gilbert, J.L. Tassoulas, C.P. Aubeny and J.D. Murff</i>	643
The Behavior of a Tanker-Based FPSO in Hurricane Waves, Winds, and Currents  E.G. Ward, Mehernosh B. Irani and Robert P. Johnson	650

Deepwater Production System Risks  E.G. Ward, Robert B. Gilbert, Jihad Jaber and Andrew J. Wolford	654
THE 2ND INTERNATIONAL DEEP-OCEAN TECHNOLOGY SYMPOSIUM	00 7
Recent Progress of the Deep Ocean Technology in JAMSTEC  Hiroyasu Momma, Taro Aoki and Katsuyoshi Kawaguchi	660
<b>Deep Water Production Technology and Perspectives in Brazil</b> Pedro José Barusco Filho and Mauricio da J.A. de Aratanha	664
Deep Ocean Research Activity in China Ji-Mao Zhu	668
Acoustic Systems of the AUV "URASHIMA"  Toshiaki Nakamura, Takuya Shimura, Hiroshi Ochi, Taro Aoki, Yasutaka Amitani, Kenkichi Tamura, Satoshi Tsukioka, Takashi Murashima, Hidehiko Nakajoh, Takao Sawa and Tadahiro Hyakudome	674
The HUGIN 3000 Survey AUV  Karstein Vestgard, Roar Hansen, Bjorn Jalving and Odd Arild Pedersen	679
Design and Deepwater Tests of MODUS – the Deployment and Recovery Vehicle for GEOSTAR 2 – Seafloor Stations  Günther F. Clauss, Sven Hoog and Hans W. Gerber	685
Improvement on the Vergence Control Mechanism of an Underwater Stereo Camera Bong-Hwan Jeon, Pan-Mook Lee and Chong-Moo Lee	693
ADDITIONAL PAPER	
Repair and Structural Upgrade of R/C Columns Using Polymeric Composite Laminates  Medhat A. Haroun, Hussein M. Elsanadedy, Carla V. Yland and Ayman S. Mosallam	698