

# The Proceedings of The Third (1993) International OFFSHORE AND POLAR ENGINEERING ONFERENCE

Singapore, 6-11 June 1993

Copyright © 1993 by International Society of Offshore and Polar Engineers,  
Golden, Colorado. All Rights Reserved.

ISBN 0-880653-05-2 (set)  
LCCN 92-076219

## CONTENT

### VOLUME I, 1993 (ISBN 1-880653-06-0)

#### PLENARY SESSION PAPERS

**Offshore Production Systems for Ultra-Deep Water in the Gulf of Mexico Part II: Vessel Systems**  
Hin Chiu ..... 1

**Outline of R&D of the Superconducting MHD Ship "YAMATO-1"**  
Yohei Sasakawa, Setsuo Takezawa and Kazumi Sugawara ... 12

**Research and Development of Techno-Superliner**  
Hisayoshi Endo and Kazuo Sugai ... 20

#### U.S. SUPERCONDUCTING MHD PROPULSION

**Electromagnetic Marine Propulsion: Recent Advances and Future Challenges**  
Gabriel D. Roy ..... 24

**Technology Challenges and Optimization of Superconducting Electromagnetic Thrusters  
for Small Undersea Vehicle Applications**  
J.S.C. Meng, P.J. Hendricks, J.D. Hrubes and C.W. Henoch ... 31

**Liquid-Metal Sliding Electrical Contacts for Homopolar Motors and Generators**  
Nancy Ma, John S. Walker, Gita Talmage, Samuel H. Brown and Neal A. Sondergaard ... 39

**Analytical and Experimental Studies of the Cyclic Magnetohydrodynamic Thruster Designs**  
D.L. Aumiller Jr., J.B. Gilbert II, M.J. Coslo and T.F. Lin ..... 46

## **LARGE LNG CARRIERS & DOUBLE HULL TANKERS**

<b>Design and Construction of a Double Hull VLCC</b> K. Iwai, K. Kondo, Y. Sezaki and M. Sasaki .....	54
<b>Strength of Double Hull Ship Cellular Components Under Axial and Lateral Loads</b> Alan Ah-Kum Pang, James M. Ricles, Le-Wu Lu, Robert J. Dexter and Jeffrey E. Beach .....	62
<b>Dynamic Load Approach for Double Hull Tanker</b> S. Kawachi, K. Shigematsu and T. Kushima .....	70
<b>Fatigue Analysis for 300K Double Hull VLCC</b> Hyon-Soo Bong, Man-Soo Kim, Sung-Kon Han and Kyung-Seok Lee .....	78
<b>Fatigue of Welded High-Strength Steel Ship Structures</b> R.J. Dexter, J.W. Fisher, J.E. Beach .....	86
<b>Study on Impact Pressure Due to Sloshing in Mid-Sized LNG Carrier</b> Satoshi Yamamoto, Satoru Shioda, Yasuhiko Ashitani and Fukuhiko Kataoka .....	92
<b>Large LNG Carrier</b> Isao Kawabe, Masashi Kawamura, Eiji Aoki and Mitutoshi Tabata .....	99
<b>A Breakthrough for Future LNG Carriers: The Trend of Size Enlargement</b> Naoyuki Itoyama, Susumu Kahara, Kazuaki Yuasa and Yoshihiro Suetake .....	108
 <b>OCEAN RESOURCES AND ENERGY</b>	
<b>Transfer of Offshore Technology from the Arctic to the Antarctic</b> John Yates, Paul Cunningham .....	116
<b>Development of a Mouse Hole Shock Absorber for Offshore Drilling Operations</b> Dennis B. Friesen and Chia Meng Teck .....	127
<b>Development of Mid-Layer Floating Type Marine Cultivation Facility</b> Mineo Okamoto, Osamu Nagahama, Gentaro Kai and Naoyuki Takatsu .....	132
<b>Geotechnical Comparison Between Deep-Sea and Seamount Sediments</b> Tetsuo Yamazaki, Katsuya Tsurusaki, Keiji Handa and Yasuo Tomishima .....	137
<b>Vibration-Control of a Pipe String for Mining Manganese Nodules by the Shape of Buffer</b> K. Aso, K. Kan, H. Doki, T. Ohkoshi and T. Natori .....	143
<b>Deep Sea Aggregate Mining Technology in Japan</b> Yoshio Narumi and Atsumi Sekine .....	149

<b>Offshore Dredging Problems in Indonesia and its Environmental Issues</b> Partanto Prodjosumarto .....	154
---	-----

## **WAVE ENERGY**

<b>Impulse Turbine with Self-Pitch-Controlled Tandem Guide Vanes for Wave Power Conversion</b> T. Setoguchi, K. Kaneko, H. Maeda, T.W. Kim and M. Inoue ..	161
<b>The Prediction of Performance of Biplane Wells Turbine</b> S. Raghunathan .....	167
<b>On the Study of the Performance of OWC Due to Nonuniform Chamber Pressure</b> I.H. Cho and S.W. Hong .....	176
<b>On-Line Phase Control for OWC Devices in Irregular Seas</b> J.N.B.A. Perdigao and A.J.N.A. Sarmiento .....	182
<b>Motion and Performance of Floating Double-Acting Wave-Energy Pump</b> K. Kawaguty and H. Ueki .....	190
<b>Shoreline Wave Power, Electrical Generation on Islay</b> S.J. McIlwaine and T.J.T. Whittaker .....	198

## **ENVIRONMENTAL PROTECTION**

<b>The Stability of Permafrost and Gas Hydrates Subject to Global Warming</b> Peter Englezos and Savvas G. Hatzikiriakos .....	203
<b>Basic Study of Ultraviolet Reflection on Coastal Sand</b> Toshimasa Kawanishi, Hironobu Kadomatsu, Kimiyo Sato and Naohiko Watanabe .....	211
<b>Oil Spill and the Environmental Damage from Blownout Oil/Gas Wells: An Integrated Approach</b> R. Das, R. Rai and R.K. Mukerjee .....	216
<b>Laboratory Experiments of Oil Spreading in Brash Ice</b> Mohamed Sayed and Sveinung Loeset .....	224
<b>A Numerical Model for the Movement of Oil Slick at Ocean</b> Dong Y. Lee and Hang S. Choi .....	232
<b>Laws of Turbulent Diffusion and Their Engineering Application Near Chinese Coastal Waters</b> Beibei Ling, Yufang Zhao and Yong Yong Ling .....	238

## OFFSHORE STRUCTURES, JACK-UPS AND JACKETS

<b>Application of Jack-Up Site Specific Assessment in Sarawak Shell Berhad/Sabah Shell Petroleum</b> Munawar Mohd Amin .....	242
<b>Stress Concentrations in Leg Nodes of a Jack-Up Rig</b> M. Baerheim and L. Collberg .....	249
<b>The Seismic Response Analysis for an Artificial Island Using a Pseudo-Static Method</b> Bao-rong Cheng, Zhao-chang Zheng and Jian Su .....	258
<b>Two Dimensional Analysis of a Tethered Subsea Unit During the Launch and Recovery Process</b> S. Huang and D. Vassalos .....	263
<b>Some Considerations on the Structural Jacket Transportation Analysis Considering the Barge Flexibility</b> Gerson Salles Veriangeri and Agustin J. Ferrante .....	268
<b>Safety Assessment of Offshore Jackets in Both Undamaged and Damaged Conditions</b> Jeom K. Paik and Hwa K. Lim .....	279
<b>Installation of a 479 Feet Water Depth Platform in South China Sea</b> Ming-Tuck Sam and Lap-Yuen Cheung .....	288

## TLP's AND COMPLIANT STRUCTURES

<b>Review of Hydrodynamic Challenges in TLP Design</b> B.J. Natvig and P. Teigen .....	294
<b>On-Site Experiment for Upping Procedure of Pre-Fabricated Tendon of TLP</b> M. Morikawa, Kuniteru Ishikawa, Hideyuki Suzuki and Koichiro Yoshida .....	303
<b>Snorre TLP Tow and Installation, Summary of Preparation, Offshore Work and Experience</b> Jan Muren, Arild K. Sandvik and Sigmund Lunde .....	310
Earthquake Response of the Tension Leg Platform Under Unbalanced Initial Tension Toshimasa Kawanishi, Shinobu Ohashi, Hiroaki Takamura and Hiroshi Kobayashi .....	319
<b>Simplified Modeling for the Nonlinear Response of Tension Leg Platforms in Deep Water</b> C.P. Johnson, B.B. Mekha and J.M. Roesset .....	326
Double-Frequency Wave Loads on a Compliant TLP Y.H. Liu, M.H. Kim and C.H. Kim .....	334

<b>Dynamics of Tension-Leg-Platforms Under Current and Earthquake Forces</b> K. Venkataramana, Shozo Toyoda and Kenji Kawano .....	341
<b>Suitability of Anchor Systems for TLP Foundations in Soft Soils</b> Manoj Datta and E. Shakeri .....	345
<b>Design of Semi-Submersible Tender Assisted Drilling and Workover Systems for Harsh Weather Applications</b> J. Chaudhuri .....	352
<b>Application of the Turret Moored Platform (TMP) to Floating Production Developments in South East Asia</b> D T Brown, J A Witz and M Slater .....	361
<b>Wave-Induced Low Frequency Motions of Compliant Offshore Structures with Nonlinear Moorings</b> Shin-ichi Aoki, Toru Sawaragi and Michael Isaacson .....	369
<b>The Dynamic Response Characteristics of Compliant Vertical Bottom-Pivoted Cylinders in Waves</b> Nicholas Haritos and Murray Townsend .....	377
<b>Responses of an Articulated Tower in Waves and Currents</b> Moo H. Kim and Z. Ran .....	385
<b>Setdown of a Moored Gravity Platform</b> B. Padmanabhan and R.C. Ertekin .....	392
<b>OFFSHORE STRUCTURES</b>	
<b>Boundary Element Analysis on Three Dimensional Cracks in Sucker Rods</b> JiaQuan Wei, BoMing Zhong and TianYou Fan .....	401
<b>Application of a Reduction Technique to the Nonlinear Dynamic Analysis of Offshore Structures</b> Breno Pinheiro Jacob and Nelson Francisco Favilla Ebecken .....	407
<b>On Arbitrary Function in Terms of Bernoulli's Equation</b> Yuhua Fu .....	414
<b>Platform Continuance of Classification Program</b> David F. Grimm .....	418
<b>Current Practice for Design of Offshore Concrete Structures</b> Henrik Grosch, Dan-Evert Brekke and Erik Aldstedt .....	425

<b>Combining Case-Based and Rule-Based Reasoning for Offshore Structure Design</b> Chee-Kiong Soh and Ai-Kah Soh .....	435
<b>Pressure Vessel Inspection Program</b> David F. Grimm .....	443
<b>GEOTECHNICAL ENGINEERING</b>	
<b>Some Aspects of Offshore Soil Dynamics</b> Vijay K. Puri, Braja M. Das and Shamsher Prakash .....	451
<b>Load Distribution in a Pile Group</b> E. Evgin, F.W. Firlotte and J.C. Osler .....	462
<b>Dynamic Analysis of Offshore Platform Due to Periodic Waves</b> H. Ishida, K. Kurosaki and T. Komura .....	468
<b>A Use of Super Lime Pile Method for Improvement of Saturated Loose Sandy Soils</b> T. Mitsunari, N. Isemoto, M. Yasui, M. Shimoda, M. Bessho and M. Hanada .....	475
<b>Behavior of Shaft Capacity for Pile Under Cyclic Axial Loading in Clay</b> Z.C. Chen, J.X. Wang and B.Q. Ye .....	479
<b>Model Pile Study of Friction Load Transfer in Clay</b> Sheng-Huoo Ni and Dai-Ming Wu .....	486
<b>Permeability of Oil-Contaminated Sands</b> Echol E. Cook, Bimal C. Devkota and Byungchul Yeo .....	491
<b>Two-Dimensional Regional Analysis for Land Subsidence</b> Robert Yun-Pin Chin and Guang-Yih Sheu .....	496
<b>Sedimentation Rate and Mississippi Delta Sediment Instability</b> Charles E. Adams, Jr. and Harry H. Roberts .....	503
<b>Application of Dynamic Monitoring on Pile Installations in Sarawak Shell</b> James Foo Ee Kiu and Melvyn Tan .....	511
<b>Strip Foundation on Sand Underlain by Soft Clay with Geogrid Reinforcement</b> K.H. Khing, B.M. Das, V.K. Puri, S.C. Yen and E.E. Cook .....	517
<b>Re-Examination of Laterally Loaded Piles in Clays Using Improved p-y Curves</b> D. Wu, B.B. Broms and V. Choa .....	522
<b>The Effect of Cementation of <math>K_0</math> of Sand</b>	

Fanyu Zhu and Jack I. Clark .....	528
<b>Nonlinear Analysis of Incompressible Soil Foundation for Gravity Arctic Structures</b>	
Hong Ou Kim and Sukhyung Lee .....	534
<b>Creep of Plate Anchors in Soft Clay</b>	
R.N. Dass, E.C. Shin, B.M. Das, V.K. Puri and S.C. Yen .....	538
<b>Experimental Studies on Plate Anchors in Layered Marine Soils</b>	
S. Narasimha Rao and Y.V.S.N. Prasad .....	544
<b>Strength and Pore Pressure of Silty Clay Under Repeated Stress</b>	
Qijing Yang .....	551
<b>Soil-Mechanic Aspects of Seabed Instability</b>	
Ikuo Towhata and Masaharu Fukue .....	556
<b>Dynamic Response of Poro-Elastic Seabed Around a Mooring Anchor with Pretension</b>	
Tomiya Takatani, Yoshi-hiko Maeno, Tetsuya Hiraishi and Tomotsuka Takayama .....	567
<b>Simulation Model for Unsteady Phenomena of Submarine Soil</b>	
Ryosuke Kitamura and Masami Uematsu .....	573
<b>Liquefaction and Densification of Loosely Deposited Sand Bed Under Water Pressure Variation</b>	
Hiroshi Nago, Shiro Maeno, Takayuki Matsumoto and Yasushi Hachiman .....	578
<b>Strength and Deformation Behaviour of Lime Treated Marine Clays</b>	
S. Narasimha Rao, G. Rajasekaran and K.V. Subba Rao .....	585
<b>Numerical Analysis of Wave-Induced Liquefaction in Seabed</b>	
Fusao Oka, Atsushi Yashima, Mitsuru Kato and Yutaka Nakajima .....	591
<b>Methodology of Estimation of Scouring Around Large-Scale Offshore Structures</b>	
Hidehiro Katsui and Takao Toue .....	599
<b>Elasto-Plastic Behavior of a Seabed Around a Concrete Block Due to Water Wave Pressure</b>	
H. Kuwahara and S. Ohmaki .....	603
<b>Advanced Soil Improvement Methods for Liquefaction in Japan</b>	
T. Tabata, K. Shiota and T. Saito .....	610
<b>On the Scattering Problems of an Inclusion with Spring Contacts</b>	
Jen-Chung Sung and Deng-Ching Wong .....	615
<b>Geotechnical Study on Seabed Deposits in Osaka Bay</b>	
T. Matsui .....	622

<b>Maritime Applications of Polymer Geogrid Technology</b> T.S. Croskey, Jr. ....	630
<b>Deformation Behavior of Granular Material Along the Stress Path of Neutral Loading</b> Han-Wei Yang .....	634
<b>Soil Improvement for an Offshore Development Project: Development of Design Procedure and Case History</b> Eun Chul Shin .....	639
<b>Effects of Calcium Carbonate on Geotechnical Properties of Sediments in Tokyo Bay</b> T. Nakamura, M. Fukue and K. Naoe .....	647
<b>Failure Criterion of a New Light Geotechnical Material SLS</b> Tej B.S. Pradhan, Goro Imai, Masamitsu Hamano and Yuji Nagasaka .....	652
<b>The Seabed Response Under a Plane Progressive Wave</b> Khalid El-Zahaby and M.S. Rahman .....	660
<b>Field Observation of Wave-Induced Porewater Pressures</b> T. Sakai, H. Mase, D.T. Cox and Y. Ueda .....	667
<b>Instability of Sand Seabed Near Shoreline and Wave-Induced Porewater Pressure</b> M. Shimizu and H. Noda .....	674
<b>Pore Pressure Generation and Drainage Underneath Gravity Structures</b> R.P. Boeije, M.B. de Groot and P. Meijers .....	681
 <b>ADDITIONAL PAPERS</b>	
<b>Response and Fatigue Damage Prediction of Jack-Up Platforms</b> S.T. Quek, C.G. Koh and X.M. Li .....	686

**VOLUME II, 1993** (ISBN 0-880653-07-9)

**PIPELINES**

**Limit States of Pipes Under Tension and Bending**

Yong Bai, Ragnar T. Igland and Torgeir Moan ..... 1

**Beam Mode Buckling of Buried Pipelines in a Layered Medium**

Yaw-Jeng Chiou and Shue-Yeong Chi ..... 10

**Towards Rational Deformation Limit States for Buried Pipelines**

Zhilong Zhou and D.W. Murray ..... 18

**Predicting the Bursting of Damaged Pipes by the FEM**

K. Kormi and D.C. Webb ..... 25

**Loads on a Prototype-Scaled Horizontal Pipeline in Intermediate Water**

Frank Preser and Wilhelm Dursthoff ..... 32

**The Lift Force on Pipeline in Waves with High Keulegan-Carpenter Number**

Chia Chuen Kao and Heng Haur Chow ..... 41

**Oceanographical Measurements for the Sea of Marmara Crossing of the Hamidabad Natural Gas Pipeline System**

Adnan Akyarli and Yalcin Arisoy ..... 47

**Effect of Ship Anchor Impact in Offshore Pipeline**

A.I. AL-Warthan, J.S. Chung, H.-P. Huttelmaier and G.G.W. Mustoe ..... 54

**The Deformation of Freely Whipping Pipes**

Wang Bin ..... 62

**Effects of Hydrotesting on Pipeline Design Safety**

Guoyang Jiao ..... 69

**Self-Burial of Pipelines at Span Shoulders**

B.M. Sumer and J. Fredsoe ..... 74

**Local Scour Around a Submarine Pipeline with a Spoiler Attachment**

Yee Meng Chiew ..... 82

**A Laboratory Study of Local Scour Beneath Submarine Pipelines in a Wave-Current Interacted Flow**

Faridah Jaffar Sidek and Abdul Aziz Ibrahim ..... 88

<b>On the Mechanics of Spanning in Submarine Pipelines</b> Max Irvine .....	98
<b>Analysis of Offshore Pipeline Flotation During Storms in Liquefiable Soils</b> Raj Siddharthan and Gary M. Norris .....	106
<b>Multiphase Production: Prototype Development and Application Study</b> Armando Favi and Giovanni Chiesa .....	114
<b>Gas Entrainment in Liquid Slugs</b> O.J. Nydal and P. Andreussi .....	120
<b>Slug Detection System for Two-Phase Flowlines</b> P. Andreussi, S. Pintus and O.J. Nydal .....	129
<b>A Model for Transient Analysis of Gas-Liquid Slug Flow in Pipelines of an Offshore Well Head</b> T.N. Wong and A. Gilchrist .....	142
<b>Flow Regime Behavior in the Vicinity of the Wellhead Flowline Junctions in Subsea Completions</b> S. Song, A.D. Hill and A.L. Podio .....	151
<b>Study of Flow Regime Transitions of Oil-Water-Gas Mixtures in Horizontal Pipelines</b> A-H. Lee, J-Y. Sun and W.P. Jepson .....	159
<b>Experimental Study of Slug Flow Characteristics in Horizontal, Multiphase Flows</b> X. Zhou and W.P. Jepson .....	165
<b>Numerical Analysis of Non-Steady State Swirling Flow in a Vessel</b> Genichi Komatsu, Koichi Kameoka and Kazuhisa Matsumoto .....	171
<b>Direct Electrical Heating of Subsea Pipelines</b> Jens Kristian Lervik, Harald Kulbotten, Gunnar Klevjer and Terje Lauvdal .....	176
<b>Application of Electric Heat Tracing System to Offshore Pipelines</b> H. Takaki, A. Iwasaki, S. Oiwa and J. Kurano .....	185
<b>A Simple Flexural Test Machine</b> D. Budney and S. Bouey .....	190
<b>Weight Reduction of Flexible Pipes Using Aluminium Alloys</b> Andre Sugier, Francois Ropital, Jose Mallen and Jean Rigaud .....	194
<b>Limitation and Comparison of S-Lay and J-Lay Methods</b> Chul H. Jo .....	201

<b>Plastic Design of Bends in Pipelines</b> A.M. Gresnigt and R.J. van Foeken .....	207
<b>The Statpipe Subsea Shore Approach Bridge Tunnel - Its Damage, Design Modifications and Repair</b> K. Harneshaug, K. Waagaard and B. Berge .....	220
<b>Trends in Diverless / Remotely Controlled Hyperbaric Pipeline Tie-Ins</b> G. Hutt and I. Pachniuk .....	226
<b>Partial Stabilisation at St. Joseph</b> Mike McGuinness and Dave Cooke .....	235
<b>Laying Arctic Gas Pipeline Across Baidaratskaya Gulf</b> R.M. Shakirov .....	242
<b>The Use of a New PC Simulation Tool to Optimize the Offshore Oil Transportation Problem</b> Stephen J. Rowe and Alan H. Woodyard .....	247
<b>Microbial Induced Corrosion and Subsea Pipeline Failure</b> A.K. Samant and P.F. Anto .....	254
<b>Inspection of Offshore Pipelines by Using In-Line Inspection Tools</b> A.O. Barbian, M. Beller and W. Garrow .....	262
<b>Prospects of Offshore Oil and Gas Pipelines Construction on the Russian Shelf</b> M.A. Kamyshev .....	268
 <b>RISERS, INSTALLATION &amp; INSTRUMENTATION</b>	
<b>Design and Installation of Snorre Field TLP Rigid Riser System</b> Frank K. Lim and Ragnar Nielsen .....	272
<b>Dynamic Monitoring for Analysis Verification of Snorre TLP Rigid Risers</b> T. Lower and A. Skogvang .....	280
<b>Lifetime In-Service Monitoring of the Emerald Instrumented Flexible Riser</b> G J Lyons, H Mahlouji, M H Patel and D T Brown .....	286
<b>A Fully Compensated High-Pressure Riser Telescope</b> Arnfinn I. Nergaard .....	294
<b>Computational Analysis of Deep Water Risers During Installation and Hangoff</b> Suzana Rastelli Sattamini and Agustin J. Ferranti .....	301
<b>Eigenvalues of a Long Vertical Pipe by DEM, FEM and Exact Solution</b>	

H.-P. Huttelmaier, Jin S. Chung, G.G.W. Mustoe, Zhao-chang Zheng and Bao-rong Cheng ..... 311

**Strength of Threaded Connection for Lifting Pipes**

Kuniteru Ishikawa, Masao Morikawa, Yoshimi Ono, Noboru Kawasaki and Akio Shimanuki ..... 315

**Extreme Response of a Flexible Riser System Using a Complete Nonlinear Long-Term Approach**

Knut-Aril Farnes and Torgeir Moan ..... 321

**Kinematics of Transported Mass Inside Risers and Pipes**

Tseng Huang ..... 331

**MECHANICS OF CABLES AND MOORING**

**Optimization Methodology for Installation of Deep Ocean Ranges**

Solomon C.S. Yim, Mohamed Mtira and John W. Leonard ..... 337

**Mechanics of Submerged Cables: Asymptotic Solution and Dynamic Tension**

J.A.P. Aranha, C.P. Pesce, C.A. Martins and B.L.R. Andrade ..... 345

**A Robust Element for Static Analysis of Marine Cables**

H.R. Riggs and T.K. Leraand ..... 357

**Axial Cable Stretching Due to Strumming and the Possibility for Resonance**

Samuel M. Welch and Marshall P. Tulin ..... 364

**Modelling Tension and Torque Properties of Fibre Ropes and Splices**

C M Leech, J W S Hearle, M S Overington and S J Banfield ..... 370

**Modelling the Long-Term Fatigue Performance of Fibre Ropes**

J W S Hearle, M R Parsey, M S Overington and S J Banfield ..... 377

**Bruce Field Electrical Catenary Umbilical Novel Design for Hostile Environment Application**

J. Chaudhuri ..... 384

**Development of an In-Line Splice for ROV Tether**

S.J. Banfield and F. Liu ..... 392

**Concrete Anchors for Offshore Mooring Systems**

K. Karal, J. Hermstad, O. Nedrebo and J.M. Keaveny ..... 396

**Optimization of the Pearl Harbor Anchor**

Sheng S. Lin and Myles Nakamura ..... 402

**Description of a Deep Water Mooring System - Tanker Bottom Disconnectable Riser Turret Mooring System**

Jie-cheng Chen and Hong Zhang .....	408
<b>Experimental and Numerical Study on Tanker Mooring Tension and Motion in a Multi-Buoy Berth</b>	
Tetsuya Hiraishi, Tomotsuka Takayama, Kinji Sekita and Tadashi Torii .....	414
<b>Modelling the Dynamic Response of Single Point Mooring Systems to Hydrodynamic Loading</b>	
N. Haritos and D.T. He .....	420
<b>The Analysis of the Dynamics of Mooring Line in Time Domain and Frequency Domain</b>	
Xiaohong Chen and Xianglu Huang .....	428
<b>Effect of Non-Linear Structural Damping on Cable Lateral Vibrations</b>	
Mohammed Raouf and Yu Ping Huang .....	435
 <b>AUV, ROV &amp; ROBOTICS</b>	
<b>Development of Expendable Optical Fiber Cable ROV System</b>	
Taro Aoki, Satoshi Tsukioka, Yoshio Kasutani, Naoto Ietsugu, Toshihiro Nakae and Satoshi Terakubo .....	445
<b>Control System Design of an ROV Operated Both as Towed and Self-Propulsive Vehicle</b>	
H. Kajiwara, W. Koterayama, M. Nakamura, H. Terada and T. Morita .....	451
<b>Development of an ROV for Sea Bottom Investigations Over a Wide Area</b>	
Wataru Koterayama and Masahiko Nakamura and Osamu Kishimoto .....	455
<b>Research Developments in ROV Hydrodynamics</b>	
P. Sayer .....	463
<b>Wind-Tunnel Experiments on a Laminar Flow Underwater Vehicle</b>	
Alan R. Packwood and Adrian Huggins .....	468
<b>Tele-Manipulation Using Guided Contour Tracking</b>	
Ole Jakob Elle, Trygve Thomessen and Terje K. Lien .....	473
<b>A Navigation System for Underwater Vehicles in Unstructured Environment</b>	
G. Conte and S.M. Zanoli .....	481
<b>A Novel System for Underwater Vehicle Navigation in and Around Offshore Structures</b>	
N. McLaren, C. Kuo and A. Pandelus .....	488
<b>Intervention of Advanced Subsea Robotics at a 1000 MSW Template Manifold</b>	
Joao Mauricio Rosario, Marcos A.P. Saramago, Luis Carlos P. Messina, Hans R. Niemann and Eckard Aust .....	494

<b>3D-Trajectory Control for an Autonomous Underwater Vehicle HSEI-I</b> Xinqian Bian, Guoqing Xia, Xiaocheng Shi and Fuguang Ding .....	502
<b>A Control System Architecture for an Autonomous Underwater Vehicle HSEI-I</b> Xiaocheng Shi, Fuguang Ding, Xinqian Bian and Guoqing Xia .....	507
<b>Increase in Navigation Safety by Developing Distributed Man-Machine Control Systems</b> Y.P. Kondratenko and V.L. Timchenko .....	512
 <b>ICE MECHANICS</b>	
<b>Ice Loading on a Multifaceted Conical Structure</b> M.B. Irani and G.W. Timco .....	520
<b>Experimental Study of Ice-Cylindrical Pile Interaction</b> Alexander T. Bekker, Andrew N. Perepelitsa, Vladimir I. Seliverstov and Lev V. Kim .....	529
<b>Total Ice Forces on Multi-Legged Offshore Structures</b> T. Takeuchi, H. Saeki and T. Yamashita .....	532
<b>Structure-Ice Interaction for a Bohai Bay Oil Production Project</b> Jan-Erik Lindholm, Kimmo Makela and Zheng Cang Bo .....	538
<b>Influence of Electric Field On the Properties of Body-Ice Contact</b> V.A. Igoshin, E.R. Egorov, P. Paasivuori and E. Yarvinen .....	548
<b>Phenomenological Constitutive Model for Columnar Ice</b> M.D. Coon and G.S. Knoke .....	550
<b>A Constitutive Relation for Sea Ice Based on Thermodynamics and Damage Mechanics</b> Zhao Xie and Vernon A. Squire .....	557
<b>Lagrangian Discrete Parcel Simulation of River Ice Dynamics</b> Hung Tao Shen, Yi-Ching Chen, Akio Wake and Randy D. Crissman .....	562
<b>A Numerical Modeling of the Plane Static Deformation in Ice Cover</b> V.I. Danilenko, R.V. Goldstein and N.M. Osipenko .....	567
<b>Compressive Failure of Polycrystalline Ice Under Impact</b> Piyush K. Dutta .....	573
<b>The Effect of Transverse Inhomogeneity on Deformations and Stresses in an Ice Cover</b> Mikael Nystrom .....	581
<b>On the Characteristics of Uniaxial Compressive Strength and Elastic Modulus of Natural Sea Ice</b>	

T. Takeuchi, K. Enoki, S. Okamoto and H. Saeki .....	585
<b>Physico-Mechanical Model of Self-Excited Processes by Sea Ice Compacting</b>	
V.N. Smirnov, V.G. Korostelev and I.V. Stepanov .....	589
<b>Analysis of Spatial Heterogeneity of Ultimate Ice Compressive Strength</b>	
G.A. Surkov and P.A. Truskov .....	596
<b>Utility of Passive Observations for Operational Sea Ice Modelling</b>	
Venkata R. Neralla, Rene O. Ramseier and Warren J. Gross .....	600
<b>An Analysis of Ice Rubble Shear Strength Data</b>	
J.C. Chao .....	607
<b>Creep and Failure of Ice Under Monotonic Loading</b>	
Anatoly M. Fish .....	613
<b>Elastic-Plastic Analysis of Narrow Truncated Floating Ice Wedge</b>	
S.K. Choi and M.K. Yi .....	619
<b>Damage Evolution During Impact of an Ice Bar with Lateral Confinement</b>	
Dale G. Karr and Xin Sun .....	626
<b>Preliminary Measurements of Acoustic Emission in Young Artificial Sea Ice</b>	
P J Langhorne, M F Tan and B D Russeell .....	634
<b>Method for Evaluation of First-Year Ice Hummock Strength</b>	
G.A. Surkov and P.A. Truskov .....	640
<b>Sea Ice Strength Variability Due to Various Ice Column Axis Orientation</b>	
A.M. Polomoshnov and P.A. Truskov .....	643
<b>ATMOSPHERIC ICING</b>	
<b>An Heuristic Freezing Spray Model of Vessel Icing</b>	
R.Z. Blackmore and E.P. Lozowski .....	648
<b>Icing on Insulator String of HV Transmission Lines and Its Harmfulness</b>	
Fuheng Su and Yimei Jia .....	655
<b>Helicopter Icing in VMC Below Low Stratus Clouds</b>	
Werner Fuchs .....	659
<b>Ice Accretion on Conductors Energized by AC or DC: A Laboratory Investigation of Ice Treeing</b>	
M. Farzaneh and J.-L. Laforte .....	663

<b>Flashover Performance of Insulators in the Presence of Short Icicles</b> M. Farzaneh and O.T. Melo .....	672
--	-----

## **ICE-BREAKING & NAVIGATION**

<b>The Northeast-Passage: A Nautical Challenge for the Next Century</b> Norvald Kjerstad .....	679
---	-----

<b>Multipurpose Icebreaker for the Finnish National Board of Navigation</b> Paavo Lohi and Tuomo Karppinen .....	686
---	-----

<b>Development of Multipurpose Icebreaker and Offshore Construction Vessel: New Approach to Technical and Operational Requirements</b> Terje P. Tellefsen and Lennart Hagelstam .....	691
--	-----

<b>A Study on the Stem Angle and Icebreaking Capability of Icebreaking Vessels</b> Kyungsik Choi .....	699
---	-----

<b>Experimental Investigations of Some Polar Sailing Problems</b> F. Katsman, M. Ovsyannikov, A. Utkin and Y. Zaitsev .....	704
--	-----

<b>Ice Transference of Bering Strait</b> Lev P. Yakunin and Oleg N. Retinski .....	710
---	-----

## **BROKEN ICE BEHAVIOR**

<b>The Effect of Waves on Pancake Ice Collisions</b> Susan Frankenstein and Hayley H. Shen .....	712
---	-----

<b>A Model for the Motion and Bending of an Ice Floe in Ocean Waves</b> Michael Meylan and Vernon A. Squire .....	718
--	-----

<b>Ocean Wave Propagation in an Ice Field with Varying Concentration</b> Vernon A. Squire .....	724
--	-----

<b>Experimental Study on the Control of Ice Movement with a new Design of Ice Boom</b> Kunio Enoki, Chimataro Ishii, Sei Kunimatsu, Toshihiko Yamashita and Hiroshi Saeki .....	730
--	-----

<b>Study on Drift Ice Control Utilizing Arch Formation of Ice Floes</b> Fumihiro Hara, Sei Kunimatsu, Hiroshi Saeki, Kunio Enoki and Yoshio Muraki .....	736
---	-----

<b>Discrete Element Modelling of Forces Exerted on a Boom for Ice Management</b> Sveinung Loeset .....	742
---	-----

<b>Collision Events Between Adjacent Ice Floes Driven by an Ocean Wave Field</b> Philip J Rottier and Vernon A Squire .....	747
<b>Studies on the Fluid Forces Acting on and the Movement Velocity of Floating Ice Floes</b> Kunio Enoki, Koji Hojo, Chimataro Ishii and Hiroshi Saeki .....	752
<b>Experiments of Crushing Interaction Between Ice Foes</b> Mohamed Sayed and Claude Daley .....	758

## VOLUME III, 1993 (ISBN 0-880653-08-7)

### OCEAN WAVES

<b>The Use of Classical Maximum Likelihood Method for Estimating Directional Wave Spectra from Heave-Pitch-Roll Time Series</b> E.K. Skarsoulis and G.A. Athanassoulis .....	1
<b>Statistical Properties of Random Waves in Surf Zone</b> Wen-Hen Yang and Chi Chao Tung .....	9
<b>Some Characteristics for Waves Motion in Real Fluid</b> Ho-Shong Hou and Chen Yang-Yin .....	16
<b>Statistic Analysis of Wave Parameters for the China Sea</b> G.Q. Yao, B.C. Ding, J.Y. Wang and Z.X. Ma .....	22
<b>Wave Group Evolution, Wave Deformation, and Breaking: Simulations Using <i>LONGTANK</i>, a Numerical Wave Tank</b> Pei Wang, Yitao Yao and Marshall P. Tulin .....	27
<b>Bow Impact and Deck Wetness: Simulations Based on Nonlinear Slender Body Theory</b> Wusheng Song and Hajime Maruo .....	34
<b>Surface Roughness in the Wake of a Steady Breaking Wave</b> James H. Duncan .....	39
<b>Laboratory Measurements of Breaking Inception and Post-Breaking Dynamics of Steep Short Crested Waves</b> Ali R. Kolaini and Marshall P. Tulin .....	45
<b>Wind Forcing and Breaking Dissipation Effects on Nonlinear Evolution of Energetic Wave Groups</b> Jiyue J. Li .....	52
<b>Acoustical Measurement of Laboratory Breaking Waves</b> Ali R. Kolaini .....	57
<b>Wave Breaking Phenomena of Irregular Waves Combined with Opposing Current</b> Yu-cheng Li and Guo-hai Dong .....	64

### COASTAL ENGINEERING

**Mean Wave Height Variations in the Northeast Atlantic (Jan. 1881 - Dec. 1989)**

	19
Gunnar Furnes and Magnar Reistad .....	71
<b>Kinematics in a Groin Field: Data Analysis and Numerical Modelling</b>	
Herwig Noethel, Klaus-Peter Holz and Vallam Sundar .....	76
<b>Hamilton's Principle for Water Waves and the Green-Naghdi Theory</b>	
Do Young Kim .....	84
<b>Numerical Simulation of Solitary Wave Runup on Slopes</b>	
Zhao-Chen Sun .....	90
<b>Computation of Wave Breaking on Sloping Beach by VOF Method</b>	
Yongxue Wang and Tsung-chow Su .....	96
<b>Dissipation of Wave Height and Force by Flexible Floating Body</b>	
Tetsuya Hiraishi and Tomotsuka Takayama .....	102
<b>A Numerical Model for the Prediction of Reflection Characteristics of Permeable Seawalls</b>	
V. Mallayachari and V. Sundar .....	106
<b>Laboratory Study of the Wave Pressure Acting on the Upright Breakwater with Slope Parapet</b>	
Gao Xiuli .....	111
 <b>HYDRODYNAMICS FORCES</b>	
<b>Effects of Wave Directionality on the In-Line Loading of a Vertical Cylinder</b>	
John R. Chaplin, Kesavan Subbiah and Mehernosh B. Irani .....	116
<b>Extreme Wave Action on Large Horizontal Cylinders Located Above Still Water Level</b>	
Eng-Soon Chan .....	121
<b>Random Wave Forces on Vertical Cylinders in Directional Seas</b>	
L. Rebaudengo Lando, G. Scarsi, S. Stura and A.C. Taramasso .....	129
<b>A Study on Random Wave Force Coefficients Using Numerical Simulation of Flow Field</b>	
Changhong Hu and Wataru Koterayama .....	137
<b>Diffacted Wave Field and Dynamic Forces on Offshore Structures</b>	
Keming Sun .....	143
<b>The Statistical Distribution of Wave Current Forces Acting on a Slender Circular Cylinder in Irregular Waves</b>	
Yu-cheng Li and Ming He .....	151
<b>Extreme Nonlinear Wave Loads on a Vertical Truncated Circular Cylinder in Nonlinear Irregular Stokes-Like Waves</b>	

Cheung Hun Kim, Willard J. Pierson, Jr. and Leo J. Tick .....	158
<b>Hydrodynamic Forces on Rectangular Cylinders Horizontally Submerged in Waves and Currents at Low KC Numbers</b>	
D. Hamel-Derouich .....	168
<b>Wave Forces on Vertical Circular Cylinders</b>	
Jaw-Fang Lee and Yuan-Jyh Lan .....	176
<b>Estimation Method on Wave Force Acting on a Submerged Sphere</b>	
Norimi Mizutani and Koichiro Iwata .....	184
<b>Hydrodynamic Forces Acting on a Floating Body in a Harbor of Arbitrary Geometry</b>	
K. Takagi, S. Naito and K. Hirota .....	192
<b>PC-Based Wave Load Computation for Large Volume Multi-Column Structures</b>	
M.H. Kim, R.S. Mercier, G. Gu, C. Wu and D. Botelho .....	200
<b>Hydrodynamic Force on Smooth Horizontal Cylinder in Uniform Oscillatory Flow</b>	
Hai-gui Kang .....	208
<b>Nonlinear Wave Induced Seepage Force on Cylinder in Shallow Water</b>	
D.H. Qiu, H. Wang and J. Zang .....	216
<b>Wave Loading and Runup Predictions for the Molikpaq Platform</b>	
Michael Isaacson and Ken Gaida .....	221
<b>An Evaluation and Extension of the Shallow Draft Diffraction Theory</b>	
Bas Buchner .....	230
<b>Hydrodynamic Forces Acting on Finite-Length Circular Cylinder Oscillating in a Uniform Flow</b>	
Kunihiro Hoshino, Shunji Kato, Masakatu Saito and Hiroshi Sato .....	242
<b>Scattered Waves Around a Submerged Disk</b>	
Xiping Yu and Allen T. Chwang .....	254
<b>An Optimum Configuration of Vertical Cylinders for Control of Incident Waves</b>	
Yusaku Kyojuka and Kazunori Kitano .....	260
<b>A Sectional Model of Hydrodynamic Force on a Vibrating Cylinder in Current</b>	
Zhijie Wu .....	266
<b>Wave Slamming on a Horizontal Circular Cylinder</b>	
Michael Isaacson and Sundar Prasad .....	274
<b>Impact Loading and Water Entrance Characteristics of Prismatic Bodies</b>	

A.P. New, T.S. Lee and H.T. Low .....	282
<b>Forces on and Flows Around a Horizontal Rectangular Cylinder Submerged in Regular Waves</b>	
Shinichi Arai .....	288
<b>Hydrodynamic Characteristics for Groups of Interacting Axisymmetric Bodies Submerged Near the Sea Surface or the Sea Bed</b>	
S.A. Mavrakos .....	294
<b>Numerical Boundary Element Computation of Submerged Body-Surface Wave Interaction</b>	
Harijono Djojodihardjo, Bonifacius B. Prananta and Silvester B. Aman .....	304
 <b>HIGHER-ORDER EFFECTS</b>	
<b>Free Decaying Test and Simulation of Slow Drift Motion of Prototype Floating Structure "POSEIDON"</b>	
M. Saito, S. Kato and Y. Ohkawa .....	312
<b>A Strip Theory for the Second-Order Wave Forces on Submerged Slender Bodies</b>	
G.P. Miao, Y.Z. Liu and Z.X. Mi .....	321
<b>Low Frequency Motions of FPSO in Short and Long Crested Waves</b>	
Y. Inoue, W. Xue, N. Yamagishi and H. Yokozawa .....	329
<b>A Second-Order Numerical Study of Low-Frequency Semisubmersible Motions</b>	
D. Pizer and P. Sayer .....	337
<b>A Least-Square Finite Element Scheme for Motion Analysis</b>	
Qing Qin and Terry D. Petty .....	347
<b>The Significance of Slowly Varying Forces on the Design of Catenary Moorings for Semisubmersible Units</b>	
R.V. Ahilan and J.H. Harrison .....	352
<b>Low Frequency Motions of A Moored Ship in a Regular Wave Group with Sea Current</b>	
Tadeusz Szelangiewicz .....	358
<b>Subharmonic Resonance of Mooring Buoy Drift Motion in Nonlinear Waves</b>	
Jiaming Wu and Yuanlin Li .....	364
<b>Time-Domain Second-Order Diffraction-Radiation by Two-Dimensional Floating Bodies</b>	
Joseph Y.T. Ng and Michael Isaacson .....	368

## **VORTEX SHEDDING & OSCILLATIONS**

<b>An Experimental Investigation of the Near Flow Around a Cylinder in a Reversing Planar Flow</b> I.A. Sibetheros, R.W. Miksad and K.F. Lambrakos .....	376
<b>Finite Element Simulation of the Development of Vortex Shedding from a Pair of Circular Cylinders</b> Guang Ren and Jens G. Balchen .....	384
<b>An Engineering Approach to Characterize the Lock-In Phenomenon Generated by a Current on a Flexible Column</b> Laurent Foulhoux and Vincent Saubestre .....	392
<b>Simulation of Flows Around a Rotating Cylinder by a Diffusing Vortex Scheme</b> Y.T. Chew, M. Cheng and S.C. Luo .....	404
<b>Flow Around a Vortex-Excited Vibrating Cylinder in Planar Oscillatory Flow</b> Kenjorou Hayashi, Kouji Fujima and Toshiyuki Shigemura .....	409
<b>The Cell Length of Vortex Shedding of Flow Around a Circular Cylinder</b> Shouping Dong .....	417
<b>Forces on a Pipeline Oscillating in Transverse Direction in Steady Current</b> B.L. Jensen, B.M. Sumer and J. Fredsoe .....	424
<b>An Unsteady Wake-Source Model for Flow Past an Oscillating Body</b> S.C. Wong, Y.T. Chew, H.T. Low and K.T. Tan .....	431
<b>Viscous Forces Acting on Oscillating Roughened Cylinders</b> Koji Otsuka, Futoshi Niwa and Yoshiho Ikeda .....	436
<b>The Kinematics of Oscillatory Flows Past Cylindrical Structures</b> T. Bruce, W.J. Easson and C.A. Greated .....	444
<b>Transverse Oscillations of Elastically-Mounted Cylinders in Waves</b> N. Chioukh and R. Narayanan .....	450
<b>The Onset of Streamwise Vortical Structure and the Early Features of Coherent Structure Behind a 2-D Circular Cylinder</b> G.C. Ling and Z.B. Wu .....	458
<b>WIND &amp; CURRENT EFFECTS</b>	
<b>Wind Effects on Offshore Platforms: A Wind Tunnel Model Study</b> H.T. Low and T.S. Lee .....	466

<b>Effect of Primary Resonance on Galloping of Tall Prismatic Structures</b> Mohamed Abdel-Rohman .....	471
<b>Shear-Flow/Free-Surface Interaction in a Density-Stratified Fluid</b> Athanasios A. Dimas and George S. Triantafyllou .....	479
<b>The Computation of Relative Velocities by Geostrophic Method of Black Sea Waters in the West and in Front of the Bosphorus</b> N. Taspinar and T. Konuk .....	487
<b>The Linear Stability of Non-Parallel Boundary-Layer Flow Over Compliant Walls Subjected to Fluid Loading</b> W.K. Chong, K.S. Yeo and B.C. Khoo .....	493

## **FLUID MOTION**

<b>Effect of Momentum Injection on the Fluid Dynamics of Bluff Bodies</b> V.J. Modi, A. Dobric and T. Yokomizo .....	501
<b>Waves Generated by a Ship Travelling in Stratified Water</b> Haw L. Wong and Sander M. Calisal .....	514
<b>Nonlinear Free Surface Flow Around a Vertical Cylinder During Earthquakes</b> Bang-Fuh Chen .....	519
<b>Dynamic Effects of Sea-Bed Motion on Fluid Flow</b> C.J. Tang .....	523
<b>Flow Past a Finite Length Circular Cylinder</b> S.C. Luo .....	530
<b>Numerical Simulation of Flow Around Two Cylinders in Various Arrangements</b> Yun Fat Chan and Kit Lam .....	535

## **DYNAMIC RESPONSES**

<b>Fluid-Structure Interaction of Arbitrary Shaped Offshore 3-D Structures by Earthquakes</b> T. Nakamura and Y. Tanaka .....	542
<b>Experimental Study on Flexible Floating Circular Plates Subjected to Vertical Ground Motions</b> Ryuji Endo, Masahiro Ando, Takuji Hamamoto and Nobuyoshi Tosaka .....	550
<b>Real Time Motion Simulation of a Moored Semisubmersible for Dynamic Stability</b> K. Song, T. Petty and T. Bone .....	558

<b>Motions of Floating Bodies in Waves, Moored by Elastic Lines in a Sea with a Breakwater</b> Shuichi Nogata, Takashi Fujita, Seijiro Miyake, Toshiaki Makihata and Kazuki Oda .....	568
<b>Nonlinear Motions of Tethered Floating Buoys</b> John W. Leonard, Krisnaldi Idris and Solomon C.S. Yim .....	576
<b>Qualitative Behaviour of a Linear Oscillator Subjected to Motion-Dependent Wave Forces</b> Kai-Yang Lam, Chih-Young Liaw, Hin-Fatt Cheong and N. Jothi Shankar .....	582
<b>Stochastic Responses of Offshore Structures Under Multi-Directional Waves, Wave-Current and Fluid-Structure Interactions</b> H. Karadeniz .....	588
<b>Active Control Effects on Dynamic Response of Offshore Structure</b> Kenji Kawano .....	594
<b>A Study on Two-Dimensional Submerged Multiple-Bodies</b> L.H. Huang and J.K. Yong .....	599
<b>Motion and Hydrodynamic Pressure of Semi-Submerged Twin-Hull Body in Waves</b> Ming-Chung Fang and Wei-June Shyu .....	605
<b>A Frequency Domain Approach for Modelling the Dynamic Response of Offshore Structures to Hydrodynamic Loading in the Morison Regime</b> N. Haritos and Halil Karadeniz .....	613
<b>Effect of Lateral Keel and Blisters on Semisubmersibles for the Minimization of Heave Motion</b> Kazuo Nishimoto and Andre J.P. Leite .....	621
<b>Experimental Study of Motion of Single and Multiple Tankers Moored to SPM System</b> Hong Zhang and Ming-guang Sun .....	629
<b>Roll Damping of a Sharp-Cornered Barge and Roll Control by a New-Type Stabilizer</b> Yoshiho Ikeda, Toshifumi Fujiwara and Toru Katayama .....	634
<b>Dynamic Instability of a Parametrically Excited Ship Rolling Model</b> C.Y. Liaw .....	640
<b>The Linear Stability Derivatives of Series 60 Model by the Transient Maneuvering Method</b> Seung-Keon Lee, Jin-Ahn Kim and Hyo-Jae Jo .....	648
<b>Nonlinear Coupling Responses of the Platform Rolling and Pitching in Regular Sea</b> Lin Yan, Ji Zhoushang and Yang You .....	653
<b>Application of Path Integral Solution to Ship Rolling Motion</b>	

Sun H. Kwon, Dae W. Kim and Jung H. Chung ..... 657

**Experimental Evaluation of Offshore Supply Boat Performance in Calm Water and Waves –  
Part I**

Robert Latorre ..... 661

**LABORATORY MODELLING**

**Wave Field in a Laboratory Wave Basin with Partially Reflecting Boundaries**

Michael Isaacson and Thomas Mathai ..... 669

**Practical Procedures for Estimation of Viscous Scale Effects in Model Testing of  
Floating Structures**

Kjell Larsen and Erling Huse ..... 677

**Experimental Validation of Directional Wave Maker Theory with Side Wall Reflections**

E.P.D. Mansard and M.D. Miles ..... 686

**Forces on Streamlined Bodies: Scale and Roughness Effects**

V. Mishkevich ..... 694

**ADDITIONAL PAPERS**

**Spatial Response Distribution of Large Floating Islands Subjected to Stochastic Waves  
and Seaquakes**

T. Hamamoto, H. Kamura, T. Misumi and Y. Tanaka ..... 701

**Aerodynamic Stability of Square, Trapezoidal and Triangular Cylinders**

M.G. Yazdani, S.C. Luo, T.S. Lee and Y.T. Chew ..... 709

**Two- and Three-Dimensional Simulations of Vortex-Induced Vibration of a Circular Cylinder**

H.M. Blackburn and G.E. Karniadakis ..... 715

**VOLUME 4, 1993 (ISBN 0-880653-09-5)**

**TUBULAR STRUCTURES**

<b>Overview of Current International Design Guidance on Hollow Structural Section Connections</b> Jeffrey A. Packer .....	1
<b>Parametric Study on Multiplanar K-Joints with Gap Made of Rectangular Hollow Sections by Means of the Finite Element Method</b> F. Mang, S. Herion and O. Bucak .....	8
<b>Fatigue Design Recommendations and Guidance for Repair on KK Multiplanar Gap and Overlap Joints Made of Square Hollow Sections</b> E. Panjeh Shahi, J. Wardenier, A. Verheul, R.S. Puthli and D. Dutta .....	16
<b>Fatigue Behaviour and Influence of Repair on Multiplanar K-Joints Made of Circular Hollow Sections</b> A. Romeijn, J. Wardenier, C.H.M. de Koning, R.S. Puthli and D. Dutta .....	27
<b>The Parametric Stress Analysis of Multiplanar Tubular DT Joint</b> Tie-yun Chen and Huiyuan Zhang .....	37
<b>The Distribution of SCF Along Hot Line of Tubular T-Joints</b> Li Shaofu and Xie Meng .....	45
<b>Study of Fatigue Limit Under Variable-Amplitude Loading Conditions</b> Yasumitsu Tomita, Kiyoshi Hashimoto, Naoki Osawa and Yoshihiro Nakamura .....	48
<b>Multiaxial Fatigue Study in Tubular Joints</b> A. Abel and S. Wu .....	56
<b>Fatigue Life of Repair-Welded Tubular Joints in Offshore Structures</b> Henning Agerskov and Jan Behrendt Ibsø .....	62
<b>Fatigue Life Prediction of Offshore Tubular Joints</b> S. Seetharaman, D.S. Sreedhar and A.G. Madhava Rao .....	70
<b>Procedure for Stochastic Fatigue Analysis of Forged Nodes for Offshore Platforms</b> Luigi Perna, Stefano Odorizzi, Renato Facciolli and Roberto Piva .....	77
<b>An Analytical Procedure for Fatigue Damage in Offshore Structures</b> C.W. Woo and D.L. Li .....	85
<b>On Fatigue Crack Propagation Behavior Using a New Parameter <math>\_A</math></b> Sae-Wook Oh, Young-Chul Park, Chung-Weon Hue and Kwang-Young Kim .....	92

<b>The Effect of Loading Sequence on Fatigue Crack Growth of an Offshore Structural Steel</b> W. Zhang and R. Brook .....	98
<b>Fatigue Behaviour of Welded Hollow Section Joints and Their Connections Made of High-Strength Steels</b> F. Mang, O. Bucak and H. Stauf .....	104
<b>A Model for Fatigue Life Prediction of Offshore Welded Stiffened Steel Tubular Joints Using FM Approach</b> D.S. Ramachandra Murthy, P. Gandhi and A.G. Madhava Rao .....	117
<b>Reserve, Residual and Ultimate Strength Analysis of Offshore Structures: State of the Art Review</b> Colin J Billington, Helen M Bolt and J Keith Ward .....	125
<b>Ultimate Strength of Dented Tubular Steel Members</b> J.T. Loh .....	134
<b>Structural Strengthening, Modification and Repair Techniques Implemented by Divers or ROVs</b> M Lalani and A F Dier .....	146
<b>The Static Behaviour of Semi-Rigid Multiplanar Connections Between I-Beams and Rectangular Hollow Section Columns</b> L.H. Lu, J. Wardenier and R.S. Puthli .....	158
<b>The Behaviour and the Static Strength of Unstiffened I-Beam to Circular Column Connections Under Multiplanar In-Plane Bending Moments</b> G.D. de Winkel, H.D. Rink, J. Wardenier and R.S. Puthli .....	167
<b>Stiffness and Yield Strength of Simple V-Joint of Offshore Structure</b> Keiji Nakacho and Yukio Ueda .....	175
<b>The Ultimate Capacity of Multiplanar TT- and KK-Joints: Comparison with AWS and API Design Codes</b> J.C. Paul, Y. Makino and Y. Kurobane .....	183
<b>Rotational and Axial Flexibility of Tubular T-Joints</b> Iraj Hoshyari and Richard Kohoutek .....	192
 <b>STEEL MATERIALS</b>	
<b>Fatigue Strength of Fillet Welded Joints with Undercuts</b> M. Onozuka, Y. Kumakura, O. Ushirokawa and I. Tsuji .....	199

<b>Analysis of Fatigue Strength Improvement by Weld Toe Grinding</b> H.L.J. Pang .....	206
<b>Minimum Fracture Toughness Calculation for Fusion Welded Offshore Structures</b> Guoyang Jiao .....	211
<b>Statistical Characteristics of Wave-Induced Load and Simulation Method of Wave Loading Pattern for Fatigue Design</b> Yasumitsu Tomita, Hiroshi Kawabe and Tetsuji Fukuoka .....	216
<b>Development of As-Rolled Type HF-ERW Casings with High Resistance to Collapse</b> Hiroshi Murayama, Motofumi Koyuba and Masafumi Shoji .....	222
<b>The Weldability and Properties of Duplex and Superduplex Stainless Steels</b> R N Gunn .....	228
<b>Large Duplex and Super Duplex Forgings for Subsea Applications</b> G. Hochoertler and K. Haberfellner .....	234
 <b>MEASUREMENTS &amp; APPLICATIONS</b>	
<b>Development of Bi-Metallic Tubular Connections</b> M. Ogasawara, F. Khoyama and E. Tsuru .....	239
<b>Analysis of C-Core Sandwich Plate Decking</b> T.C. Fung, K.H. Tan and T.S. Lok .....	244
<b>The Young's Modulus and Residual Stress of CVD-Coated Film</b> Masaaki Ohtsuka, Hideaki Matsuoka, Yukio Hirose and Hitoshi Ishii .....	250
<b>Young's Modulus of Surface-Layer of Thin Film</b> N. Takano, H. Notoya and Y. Hirose .....	258
<b>Testing and Evaluation of Materials for Metal Seated Ball Valves</b> C.H. Ahlen and T. Wenn .....	261
 <b>CORROSION FATIGUE &amp; SSC A</b>	
<b>Optimization of Crack Length Measurement by DCPD in DCB Specimens</b> J. Yu, J.C. Barker and R. Brook .....	268
<b>Some Environmental Aspects of Sulphide Stress Corrosion Cracking Stainless Steels</b> J.C. Barker, J. Yu, R. Brook and M.B. Kermani .....	273
<b>Influence of Additional Elements on SCC Resistance in Extruded Al-Zn-Mg-La System Alloys</b>	

Y. Kishi, Y. Hirose, I. Tsukuda, S. Nagai and K. Higashi .....	279
<b>Effect of Mode I and Mode II Loading on Behavior of SCC Initiation in High Strength Steel</b> Masayuki Syouzu, Yukio Hirose and Zenjiro Yajima .....	285
<b>Stress Corrosion Cracking of Type 316 Steel Single Crystals in Chloride Solution</b> H. Uchida, S. Inoue and K. Koterazawa .....	291
<b>Fractography of Crack Growth in Stress-Corrosion Cracking and Corrosion Fatigue of a Number of Offshore Steels</b> I.S. Cole and R. Brook .....	296
<b>Fractal Character of Stress Corrosion Cracking in SNCM439 Steel</b> Masashi Kurose, Masaaki Tsuda and Yukio Hirose .....	303
<b>Cathodic Protection and the Thickness Effect: A Final Conclusion?</b> I.S. Cole, O. Vittori and G. Cerretti .....	309
<b>Durability of GFRP in Corrosive Environment</b> Y. Fujii, A. Murakami, K. Katou, T. Yoshiki, Z. Maekawa and H. Hamada .....	317
<b>Preferential Corrosion Properties in CO<sub>2</sub> Containing Environment and Mechanical Properties of Welded Joints of Line Pipes</b> Shigeru Endo, Moriyasu Nagae and Takashi Wada .....	321
<b>BEM Analysis of Potential Distribution in Harbor Structures Under Cathodic Protection</b> M. Iwata, Y. Huang and Y. Fujimoto .....	327
<b>Synergic Effects of Offshore Well Casing Protection and Corrosion Survey</b> P.F. Anto and R. Dutta .....	334
<b>COMPOSITE MATERIALS</b>	
<b>Behavior of Fiber-Reinforced Plastics as Construction Materials in Extreme Environments</b> Piyush K. Dutta and Richard G. Lampo .....	339
<b>Accelerated Testing of Fiber Reinforced Polymer Plates to Predict Long-Term Behavior</b> Salem S. Faza, Hota V.S. GangaRao and Seshagiri Ajjarapu .....	345
<b>Characterization of Fatigue Behavior of Fiber Reinforced Plastic Beams and Joints</b> Hota V.S. GangaRao, Sotiris N. Sotiropoulos and V. Nagaraj .....	351
<b>Advanced Flexible Pipe Materials for Aggressive Hydrocarbon Service</b> R.T. Hill and J.C. Measamer .....	359
<b>Diagnosis of the Subsequent Failure Mechanisms of Composite Laminates</b>	

S.C. Max Yen, M.A. Wright and P. Stumpff .....	365
<b>Vibration Analysis of Symmetrically Laminated Composite Rectangular Plates</b> J.H. Chung and T.Y. Chung .....	373
<b>Characterization and Sintering Behaviors of SiC Whisker-Reinforced Al<sub>2</sub>O<sub>3</sub> Composites by Composite Powders with Amorphous Silica Coatings</b> Chih-Cheng Chen, Fu-Su Yen and S.C. Max Yen.....	380

## **WELDING TECHNOLOGY**

<b>HISTAR Offshore: Weldability Aspects of Quenched and Self-Tempered Steel Sections for Offshore Applications</b> Jean de la Hamette, Fernand Becker, Guy Lessel, Jean-Michel Dengler and Patrick Seil .....	386
<b>Computer-Aided Design of Welded Tubular Connections</b> Suen, Der Shiuan and John H. Wu .....	393
<b>The Weld Zone Hardness and Serviceability of Zeron 100 Super Duplex Stainless Steel</b> C.F.G. Baxter, J. Irwin and R. Francis .....	401
<b>Welding of Zeron 100 Super Duplex Stainless Steel</b> C.F.G. Baxter, A.W. Stevenson and G.R. Warburton .....	408
<b>Welding of the Super Duplex Stainless Steel Sandvik SAF2507<sup>TM</sup> (UNS S32750)</b> Sven-Ake Fager and Lars Odegard .....	416
<b>The Transport Properties of Argon Rich Shielding Gas in Hyperbaric Welding</b> Yoji Ogawa .....	424
<b>Fuzzy Control of Arc Length in Hyperbaric TIG Arc Welding</b> Y. Suga, T. Suetomi and K. Kobayashi .....	429
<b>Qualification Trials of the "MOSS" Modular Orbital Welding System</b> V.R. dos Santos, J.C. Teixeira and J.F. dos Santos .....	434
<b>Automatic Welding Procedures for X80 Pipeline Systems</b> R.A. Teale and Milton Randall .....	441

## **NDT, MEASUREMENTS & INSPECTION**

<b>Influence of Inevitable Uncertainties on Inspection Planning for Deteriorating Structures</b> Y. Fujimoto, A.M. Swilem, Z. Zong, M. Iwata and K. Nagai .....	445
<b>Non-Destructive Evaluation of Toughness for In-Service Superheater Tubes of Fossil</b>	

**Fuel Boiler**

F. Nogata, K. Seo, M. Kusaka, H. Takahashi, Y. Hirose, Sae-Wook Oh and K. Matsui ..... 454

**X-Ray Stress Measurement of WC-Co Alloy: X-Ray Study of Plastic Deformation of WC-Co Alloy**

Myung-Hwan Boo, Sae-Wook Oh, Noboru Takano, Yoichi Kishi and Yukio Hirose ..... 458

**Computer Aided X-Ray Radiography Image Processing Inspection for Welding**

Kun-Li Wen, Jiunn-Liang Lin and Shi-Shing Chang ..... 462

**Using the Analysis of Stress Wave to Build the Research and Experiment of Ultrasonic Film Measurement**

Shi-Shing Chang, Der Shiuan Suen and John H. Wu ..... 467

**MECHANICS & MARINE APPLICATIONS****Structural Response of Underwater Half Drop Shaped Shell**

Y. Yasuzawa ..... 475

**Dynamic Stiffness Analysis of Circular Cylindrical Shells**

A.Y.T. Leung and W.E. Zhou ..... 482

**Conventional Roof, Unconventional Approach**

Y.T. Huang ..... 489

**On the Unusual Properties of Circular Cylindrical Pressure Shells and Countermeasures**

Zuoshui Xie and Jiping Xu ..... 493

**Ultimate Longitudinal Strength of a Bulk Carrier**

Tetsuya Yao and Plamen Ivanov Nikolov ..... 497

**Effect of Attachment Length on Stress Intensity Factors of Surface Semi-Elliptical Cracks at Toe of Fillet Welds**

S.T. Lie ..... 505

**Dimensional Method in Structural Optimization**

Daniel M. Rosyid ..... 510

**Full-Range Nonlinear Analysis of Fatigue Behavior of Reinforced Concrete Structures by Finite Element Method**

Yu-pu Song, Shun-bo Zhao, Rui-min Wang and Shu-yao Li ..... 520

**Finite Element Analysis for Plastic Large Deformation and Anisotropic Damage**

I.S. Nho, Jong G. Shin and S.J. Yim ..... 526

**Creep-Buckling Analysis of a Simply-Supported Viscoelastic Beam**

Jong Gye Shin and Jong Kui Kim .....	533
<b>Elastoplastic Optimal Design of Frame and Truss Structures Using Repeated Sensitivity Analysis</b>	
Masahiko Fujikubo, Tetsuya Yao, M. Abdul Rahim and Yuji Murakami .....	538
<b>Dynamic Behavior of a Ship Hull on Still Water Surface Due to a Moving Load</b>	
Jong-Shyong Wu and Jer-Jia Sheu .....	546
<b>Global Strength Analysis of a Floating Body in Irregular Waves</b>	
Xinming Tang and Yungang Liu .....	554
<b>Structural Optimal Design with Consideration of Normal Maintenance and Failure Cost During Its Service Life</b>	
Mingcheng Zhu and Xila Liu .....	561
<b>RELIABILITY</b>	
<b>Reliability Assessment of a Flexible Pipe Hanging in a U-Shape</b>	
Nils Terje Nordsve and Sverre Haver .....	566
<b>Reliability Analysis of Production Ships</b>	
Xiaozhi Wang, Torgeir Moan and Guoyang Jiao .....	575
<b>Failure Probability of Southern North Sea Platform Under Environmental Loading</b>	
M. Si Boon, L. Vanderschuren, J.W. van de Graaf and P.S. Tromans .....	585
<b>Variability in Load and Strength for a Jack-Up Structure</b>	
Jan Inge Dalane, Sverre Haver and Ivar Langen .....	592
<b>Reliability Analysis of Drag-Dominated Offshore Structures</b>	
Daniel Karunakaran, Bernt J. Leira and Torgeir Moan .....	600
<b>Reliability of Offshore Jackets Using Point Estimation</b>	
Krishnaiyengar Rajagopalan .....	606
<b>Reliability Analysis of Deep Water Pipelines During Laying, for Combined Pressure, Tension and Bending Loads</b>	
Ragnar T. Igland and Torgeir Moan .....	613
<b>Reliability Analysis of Torsional Strength on Ship Hulls by Means of Stochastic Transfer Matrix Method</b>	
Wenjiao Shao and Yunlong Jin .....	622
<b>Structural Reliability Analysis of Cracked Tubular Joints</b>	
L.V.S. Sagrilo, M.S.R. Freitas, E.C.P. de Lima and N.F.F. Ebecken .....	627

## **SAFETY & ASSESSMENT**

<b>Safety Case for High Hazard Potential Installations - The Way Forward</b> A.R. Qureshi .....	631
<b>The Role of Human Factors in the Safety of Marine Systems</b> C. Kuo .....	638
<b>Bulk Carriers - The Challenge</b> J M Ferguson .....	644
<b>Analysis and Validation of the Safety Conditions While Operating After a Gas Kick During the Oil Well Drilling Stage</b> Raffaele Romagnoli .....	658
<b>Subsea System and Pipeline Safety Evaluation</b> C P Ellinas, K A J Williams, J Gledhill and C M Evans .....	662

## **IMPACT & DAMAGE**

<b>Influence of Rotational and Vertical Motions on Fluid Force on a Floating Body in Collision</b> Yukio Ueda, Hidekazu Murakawa, Katsuyuki Nabeta and Dianxiang Xiang .....	669
<b>Numerical Simulation of a Ship Colliding Against a Pier Structure</b> L.T. Kisielewicz, K. Ando, A. Petitjean and M. Kiyomiya .....	677
<b>Preliminary Experiment for Damage Detection of Offshore Structures</b> T. Hamamoto and I. Kondo .....	685
<b>Residual Strength and Repair of Dent-Damaged Steel Tubulars</b> William M. Lamport, James M. Ricles and Troy E. Gillum .....	693
<b>A New Bound Solution for Quadrangular Plates Subjected to Impulsive Loads</b> Weimin Chen .....	702
<b>On the Participating Factor of Plates Impacted by Flat-Headed Cylindrical Projectiles</b> Weimin Chen .....	709