

MARINE INSTRUMENTATION AND CONTROL

THOMSON DSOUZA



MARINE INSTRUMENTATION AND CONTROL

Editor

Thomson Dsouza



**DISCOVERY PUBLISHING HOUSE
INDIA**

CONTENTS

Chapter No	Chapter Name	Page No
	<i>Preface</i>	<i>v</i>
1.	Advanced Development of Sensors' Roles in Maritime-Based Industry and Research: From Field Monitoring to High-Risk Phenomenon Measurement Aditya Rio Prabowo, Tuswan Tuswan and Ridwan Ridwan	1
2.	Review and Prospects for Autonomous Observing Systems in Vessels of Opportunity Teresa L. Rosa, A. Miguel Piecho-Santos, Roberto Vettor and C. Guedes Soares	79
3.	Adaptable Monitoring Package Development and Deployment: Lessons Learned for Integrated Instrumentation at Marine Energy Sites Brian Polagye, James Joslin, Paul Murphy, Emma Cotter, Mitchell Scott, Paul Gibbs, Christopher Bassett and Andrew Stewart	111
4.	Research and Analysis of Pressure-Maintaining Trapping Instrument for Macro-Organisms in Hadal Trenches Hao Wang, Jiawang Chen, Yuhong Wang, Jiasong Fang and Yuping Fang	141
5.	Cyberattack Models for Ship Equipment Based on the MITRE ATT&CK Framework Yonghyun Jo, Oongjae Choi, Jiwoon You, Youngkyun Cha and Dong Hoon Lee	161
6.	Design and In Situ Validation of Low-Cost and Easy to Apply Anti-Biofouling Techniques for Oceanographic Continuous Monitoring with Optical Instruments Tiago Matos, Vânia Pinto, Paulo Sousa, Marcos Martins, Emilio Fernández, Renato Henriques and Luis Miguel Gonçalves	185

7.	In Situ Measurements of Plankton Biorhythms Using Submersible Holographic Camera	203
	Victor Dyomin, Alexandra Davydova, Nikolay Kirillov, Sergey Morgalev, Elena Naumova, Alexey Olshukov and Igor Polovtsev	
8.	A Complex of Marine Geophysical Methods for Studying Gas Emission Process on the Arctic Shelf	227
	Artem A. Krylov, Roman A. Ananiev, Denis V. Chernykh, Dmitry A. Alekseev, Ermolay I. Balikhin, Nikolay N. Dmitrevsky, Mikhail A. Novikov, Elena A. Radiuk, Anna V. Domaniuk, Sergey A. Kovachev, Georgy K. Timashkevich, Vladimir N. Ivanov, Dmitry A. Ilinsky, Oleg Yu. Ganzha, Alexey Yu. Gunar, Pavel Yu. Pushkarev, Andrey V. Koshurnikov, Leopold I. Lobkovsky and Igor P. Semiletov	
	Index	257

INDEX

A

- Acrylonitrile butadiene styrene (ABS) 185, 187
- Adaptable Monitoring Package (AMP) 112
- Advanced Along-Tracking Scanning Radiometer (AATSR) 29
- Advanced Very High Resolution Radiometer (AVHRR) 29
- Aerosol optical depth (AOD) 28
- Application programming interfaces (APIs) 117
- Artificial intelligence (AI) 37, 50
- Atmospheric corrosion monitoring (ACM) 54
- Automatic Identification System (AIS) 162
- Autonomous observation systems (AOS) 81
- Axisymmetric finite element model 148

B

- Ballast water management system (BWMS) 162

C

- Circuit board data transmission 153
- Coating breakdown/corrosion (CBC) 50
- Computational fluid dynamics (CFD) 2
- Continuous Plankton Recorder (CPR) 83, 86
- Convolutional neural network (CNN) 47, 50
- Coupled multi-electrodes (CMEs) 51, 52
- CPUE (Catches Per Unit Effort), 93
- Cross Model Cross Mode (CMCM) 38
- Cyber Threat 161

D

- Decision Support System (DSS) 96
- Defense in depth (DiD) 163
- Denial-of-service (DoS) 162
- Digital imaging correlation (DIC) 60
- Direct current (DC) 114
- Doppler velocity log (DVL) 9, 67
- Dynamic link library (DLL) 171
- Dynamic motion unit (DMU) 14

E

- Echosounder transducer 115
- Electrical resistance (ER) 51
- Electrochemical impedance spectroscopy (EIS) 49
- Electrochemical noise (EN) 50
- Electronic Chart Display and Information System (ECDIS) 162
- Electronic navigational chart (ENC) 166
- Empirical mode decomposition (EMD) 37, 60
- Energy-saving devices' (ESDs) 18
- Environmental Monitoring 112, 138
- Essential Climate Variables (ECV) 80
- Essential Ocean Variables (EOV) 80, 89
- Experimental modal analysis (EMA) 38, 42

F

- Fiber Bragg grating (FBG) 41, 42, 60
- Fiber-reinforced polymer (FRP) 63
- File transfer protocol (FTP) 82
- Finite element (FE) 43
- Finite element method (FEM) 2

Fishery and Oceanography Observing System (FOOS) 85, 107
 Fishery Observing System (FOS) 85
 Flow and Benthic Ecology (FLOWBEC) 112
 Fluorine tin oxide (FTO) 191
 Framework for Ocean Observing (FOO) 80, 106
 Frictional force 154
 Frictional test 154
 Fundy Ocean Research Centre for Energy (FORCE) 112

G

Galvanic anode cathodic protection (GACP) 49
 Global Maritime Distress and Safety System (GMDSS) 5
 Global navigation satellite system (GNSS) 9
 Global Ocean Observing Systems (GOOS) 80
 Global Ocean Surface Underway Data (GOSUD) 82
 Global Positioning System (GPS) 165
 Graphical user interface (GUI) 117

H

High voltage resistant 146

I

Industrial control system (ICS) 169
 Inertial measurement unit (IMU) 9
 Information Sharing 161
 Inspection Capabilities for Enhanced Ship Safety (INCASS) 25, 26
 Integrated Instrumentation 111, 112, 130, 131
 Integrated Marine Observing System (IMOS) 85
 Integrated navigation systems (INSS) 165
 Integrated Sensor Suite (ISS) 96
 International Association of Classification Societies (IACS) 5
 International Conference on Collision and Grounding of Ships (ICCGS) 24
 International Maritime (Consultative) Organization (IMO) 4
 International Oceanographic Data and Information Exchange (IODE) 82
 Internet of Things (IoT) 1, 2, 53

Islamic Revolutionary Guard Corps (IRGC) 162

J

Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) 81

K

Karaszkievicz model 152, 153, 157

L

Least-squares complex exponential (LSCE) 60

Light emitting diode (LED) 188

M

Machine learning (ML) 37, 43
 Machinery risk assessment (MRA) 25, 67
 Machine-to-machine communication (M2M) 2
 Man-in-the-middle (MiTM) 162
 Marginal ice zone (MIZ) 31, 36
 Marine Data Center (MDC) 82
 Marine energy converters (MECs) 131
 Marine Renewable Energy 112, 138
 Maritime autonomous surface ships (MASSs) 162
 Maritime Cybersecurity 161
 Moderate-Resolution Imaging Spectroradiometer (MODIS) 5, 8
 Multiscale Wasserstein auxiliary classifier generative adversarial network (MW-ACGAN) 6
 Multi-stage rotational region-based network (MSR2N) 6, 11

N

Nephelometric turbidity units (NTU) 191
 Non-destructive testing (NDT) 37
 Northern Sea Route (NSR) 6, 10, 59
 Numerical simulations 150

O

Open acidification (OA) 91
 Open circuit potential (OCP) 54
 Operating technology (OT) 166
 Operational modal analysis (OMA) 38, 42
 Orthogonal test design 146

P

Pacific Marine Environmental Laboratory (PMEL) 84
 PCBs (Printed Circuit Board) 146
 Polylactic acid (PLA) 185, 187
 Pressure-maintaining trapping instrument (PMTI) 141, 142, 143
 Pressure test process 153
 Principal component analysis (PCA) 38, 46
 Pseudo Simplified (PS) 38, 41

Q

Quadratic function 152

R

Rate of signal energy (RSE) 38, 40
 Relative motion speed 150
 Remote Desktop Protocol (RDP) 165, 167, 175
 Remote procedure call (RPC) 175
 ROV (Remote Operated Vehicle) 142

S

Safety of Life at Sea (SOLAS) 4, 71
 SAR ship detection dataset (SSDD) 6, 9, 11
 Sea ice concentration (SIC) 36
 Sea Surface Salinity (SSS) 84
 Sea Surface Temperature (SST) 84
 Security Risk Analysis 161
 Server message block (SMB) 162
 Shipboard Automated Meteorological and Oceanographic System (SAMOS) 82
 Shipboard Oceanographic and Atmospheric Radiation (SOAR) 36
 Ship Operating Technology 175
 Software development kit (SDK) 118
 Steel-concrete-polymer (SCP) 59
 Stress distribution 151, 152, 153

Structural health monitoring (SHM) 37, 63
 Structural risk assessment (SRA) 25, 67
 Superelastic material 147, 157
 Support vector machine (SVM) 44
 Synthetic aperture radar (SAR) 5, 6, 7, 8, 28, 67

T

Time of flight (TOF) 14
 Trapezoidal thread 143

U

Ultrasonic gauge (UG) 31
 Underwater Video Profiler (UVP) 85, 88
 United States Coast Guard (USCG) 162
 Unmanned surface vehicles (USVs) 65

V

Vessel Monitoring System (VMS) 93
 Vessels of Opportunity (VOO) 79, 80, 86
 Vessel traffic services (VTS) 12
 Voice over Internet Protocol (VoIP) 176
 Voluntary Observing Ships (VOS) 81
 Voyage data recorder (VDR) 162

W

Water leak detection function 145
 Wave attenuation measurement (WAM) 31
 Wave Energy Test Site (WETS) 123
 Wave-in-ice instruments (WIIs) 31
 Wind turbines (WTs) 36
 Wireless sensor network (WSN) 23, 25, 67
 World Meteorological Organization (WMO) 81

Z

Zero resistance ammeter (ZRA) 52, 54
 ZPAs (Zigbee Protocol Analyzers) 23, 25