

Feetnes

- Full Color Book plus DVD
- Over 100 hours Interactive E-lectures, Quiz and Videos in DVD
- DVD has many useful features for teachers to teach with digital resources in classroom



Applied Naval Architecture 2nd Edition



APPLIED NAVAL ARCHITECTURE

2ND EDITION

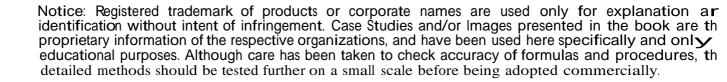
3G E-LFARNING

© 2022 3G E-learning LLC 90 Church Street FL 1 #3514 New York, NY 10008 United States of America www.3ge-learning.com email: info@3ge-learning.com

Authored and Edited by 3G E-learning LLC, USA

ISBN: 978-1-98465-961-3

This book contains information obtained from highly regarded resources. A wide variety of referenc are listed. Reasonable efforts have been made to publish reliable data and information, but the auth editors, and the publisher cannot assume responsibility for the legality of all materials or the consequen of their use. The authors, editors, and the publisher have attempted to trace the copyright holders of *a* material in this publication and express regret to copyright holders if permission to publish has not bee obtained. If any copyright material has not been acknowledged, let us know so we may rectify in a future reprint. Registered trademark of products or corporate names are used only for explanation **a** identification without intent to infringe.



For more information about 3G E-Learning LLC and its products, visit www.3ge-learning.com

TABLE OF CONTENTS

Preface

Chapter 1 Introduction to Ship



±?

-	
Introduction	1
1.1 Naval Architecture	2
1.2 Features of Merchant Ships	8
1.2.1 Dry Cargo Ships	8
1.2.2 Tankers	11
1.2.3 Passenger Ships	14
1.2.4 Specialized Vessels	17
1.2.5 Offshore Vessels	21
1.3 Management of High Speed Craft	25
1.3.1 Types of High-Speed Craft	25
1.3.2 Design and Construction Issues	28
1.4 Role of Warships	29
1.4.1 Types of warship	30
Summary	37
Knowledge Check	38
Review Questions	39
References	40

Chapter 2 Ship Design

41

xv

1

Ib_	
hi] _{ye4} , {ea	

Introduction	41
2.1 The Ship Design Requirements	42
2.1.1 Some Design Features	43
2.1.2 Developing the Design	46
2.2 The Ship Design Process	48
2.3 Design of Merchant Ships	52
2.3.1 General Cargo Ships	52
2.3.2 Container Ships	54

	2.3.3 Roll-on roll-off ships (Ro-Ro ships)	
	2.3.4 Bulk Cargo Carriers	57
	2.3.5 Passenger Ships	58
	2.3.6Tugs	66
	2.4 Design of High speed Craft	68
	2.5 Design of Warship	69 72
	2.5.1 Enemy weapons	74
	Summary	82
	Knowledge Check	84
	Review Questions	85
	References	86
Chapter 3	Ship Measurements and	-
	Calculations	87
	Introduction	87
	3.1 The Concept of Ship's hull	88
	3.1.1 The geometry	88
	3.1.2 Representing the Hull Form	92
	3.1.3 Hull Characteristics	93
	3.2 Displacement and Tonnage	95
	3.2.1 Deadweight	95
	3.2.2 Tonnage	96
	3.3 Regulation	98
	3.3.1 Load Lines	98
	3.4 Approximate Integration	99
	3.4.1 Trapezoidal Rule	100
	3.4.2 Simpson's rules	101
	3.4.3 Other Simpson's rules	108
	3.4.4 Tchebycheff's Rules	1 08
	3.4.5 Polar co-ordinates	109
	Summary	110
	Knowledge Check	111
	References	113
Chapter 4	Flotation and Stability	115
	Introduction	115
	4.1 Equilibrium of A Body Floating In Still Water	116
	4.1.1 Underwater Volume	118
	4.2 Stability at Small Angles	120
	4.2.1 Transverse Metacenter	122
	4.2.2 Transverse Metacenter for Simple	



	4.3
	4.4 Sur
	Kno Rev Ref

Geometrical Forms	123
4.2.3 Metacentric Diagrams	126
4.2.4 Longitudinal Stability	127
1.3 Hydrostatic Curves	129
4.3.1 Fully Submerged Bodies	130
4.3.2 Problems in Trim and Stability	1 3 1
4.3.3 The Inclining Experiment	138
1.4 Launching	1 42
Summary	1 45
Knowledge Check	146
Review Questions	147
References	148

t\Chapter 5 Re

20 Barts

Resistance		149
ntroduction		149
.1Fluid Flow		150
5.2 Types of Resistance		153
5.2.1 Wave-Making Res	sistance	154
5.2.2 Frictional Resistar	nce	159
5.2.3 Eddy Making Resi	istance	162
5.2.4 Appendage Resis	tance	163
5.2.5 Wind Resistance		163
5.3 Calculation of Resistan	nce	164
5.3.1 ITTC method		165
5.3.2 Wetted Surface Ar	rea	167
5.4 Methodical Series		169
5.5 Roughness		172
5.5.1 Form Parameters	and Resistance	173
5.6 Full Scale Trials		176
5.6.1 Effective Power		177
Summary		180
Knowledge Check		181
Review Questions		182
Reference		183

Chapter	6	Pr
---------	---	----

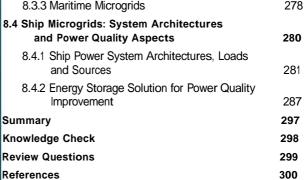
r 6 Prop	ulsion
----------	--------

Introduction	1 85
6.1 General Principles of Propulsion	1 86
6.1.1 Extension of Effective Power Concept	186
6.2 Propulsors	187
6.2.1 Momentum Theory	188

	6.2.2 The Screw Propeller	
	6.3 Propeller Thrust and Torque	
	6.3.1 Blade Element Theory	
	6.3.2 Presentation of Propeller Data	:
	6.3.3 Hull Efficiency Elements	2
	6.4 Cavitation	2
	6.4.1 Comparing Ship and Model under	
	cavitating Condition	2
	6.4.2 Cavitation Number	2
	6.4.3 Occurrence and Effects of Cavilation	2
	6.4.4 The Cavitation Tunnel	2
	6.5 Other Propulsor Types	2:
	6.5.1 controllable Pitch Propeller	2
	6.5.2 Self-pitching Propellers	23
	6.5.3 Surface Piercing PropellerS	21
	6.5.4 Shrouded or ducted propeller	21
	6.5.5 Pump Jets	21
	6.5.6 Contra-rotating propellers (CRPs)	21
	6.5.7 Azimuthing propellers	21
	6.5.8 Vertical axis propeller	22
	6.5.9 Water jet propulsion	22
	6.5.10 Paddle wheels	220
	6.5.11 Wind	221
	Summary	222
	Knowledge check	223
	Review Questions	224
	References	225
Chanter 7	Seakeeping	227
Ontepter		
	Introduction	227
	7.1 Seakeeping Qualities	228 229
	7.2 Ship Motions	229
	7.2.1 Motions in Regular Waves	229 231
	7.2.2 Presentation of Motion Data	232
	7.2.3 Motions in Irregular Seas 7.2.4 Energy Spectra	234
	7.3 Limiting Factors	236
	7.4 Stabilization	238
	7.4.1 Bilge keels	239
	7.4.2 Passive tanks	240
	7.4.3 Active fins	240

	7.4.4 Active tanks		241	
	Summary		243	
	Knowledge Check		244	
No.	Review Questions		245	
	References		246	
		CHECKING STREET		
pter 8	Powering System	ms in Ship	247	
	Introduction		247	
	8.1 Ship Power System	Control: A Technology		
	Assessment		248	
	8.1.1 The Virtual Tes	st Bed	249	
	8.1.2 Main Goals of	the Demonstration	250	
	8.1.3 Definition of th	e Scenario	251	
	8.1.4 Power Genera	tion and Supply on a Ship	253	
	0,00	wer Supply & Shaft Ships Machinery Operation	255	
	8.2 Intelligent Shore-to		200	
	Supply System	-Ship Fower	257	
	8.2.1 Design of the	Cable Lifting Device	260	
	8.2.2 Structural Des	ign of the Cable Lifting Device	e 261	
	8.2.3 Control Circuit	Design of the Cable Lifting		
	Device		264	
	8.2.4 Collaborative N	Motor Control	266	
	8.2.5 Modeling and	Simulation	270	
	8.3 Onboard Integrated	Marine Power Systems	272	
	8.3.1 Modern Marine	e Power Systems	274	
	8.3.2 Future Marine	Power Systems	276	
	8.3.3 Maritime Micro	grids	278	

Ch



Chapter 9 Technological Impact on Ship

9.1 An IoT-Based Ship Berthing Method Using a Set of Ultrasonic Sensors

304

Introduction

1 ANT ALL	9.1.1 Main Architectures of the I	305
	9.1 _{-2 10} T Elements and Technologie 🗲 💶	305
	9.1.3 loT, Cloud, BigData in the Marine	309
	9-1.4 Interrelated Mechanism	311
	9.1 ₋₅ Problem Analysis in Ship Berthing	313
	9.1.6 Proposed System	314
	9.1.7 Implementation and Experiment	321
	9.1.8 Consequences	322
	9.2 Simultaneous Ship Detection and Orientation Estimation	325
	9.2.1 Simultaneous Detection a~d'4II	n <u>328</u>
	9.3 Ship Detection for Optical Remote Sensing Images Based on Visual Attention	334
	9.3.1 Proposed Method	337
	9.3.2 Experiments and Argument	342
	Summary	352
	Knowledge Check	353
	Review Questions	354
	References	355
Oh and an 40	Managamant, CObin Osfalbs	
	Management of Ship Safety	357
	and Services	301
	Introduction	57
	10.1 Ship Safety Management System	3 ⁵⁸
	10.1.1 System of Formal Safety Assessment (FSA)	359
Sand A	10.1.2 Identification of Risks during Lockage of LNG-Fueled Ships 5≫	361
	10.1.3 Risk assessment of Lockage of LNG-fueled ships	363
	10.1.4 Suggestions for Lockage Safety Management of LNG-fueled Ships	368
1	0.2 Ship Management Services	370
	10.2.1 Shipping Operations Manager	371
		272
	10.2.2 Management of Ship's Commercial Activity	372
	10.2.3 Ships Operator	375
	10.2.3 Ships Operator 10.2.4 Cruise Ship Pursers	375 376
	10.2.3 Ships Operator	375

10.3 Control Systems for the Ship in Confined and Open Waters	379
10.3.1 Training Ship	381
10.3.2 Automation of the Ship Motion Control Processes	382
10.3.3 Essential Components Arrangement of the Autonomous Training Ship	389
10.3.4 Motion Results	391
10.4 Manpower Management Service	396
10.4.1. Customer Value	396
10.4.2. People Value-Shore Staff and Seafarers	397
10.4.3 Training for Effective Value Creation	399
10.4.4 Knowledge Management (KM) Strategies	400
10.5 Future in Ship Management	
10.5.1 Average Salary of Cruise Ship Workers	405
10.5.2 Reasons to Work on a Cruise Ship	406
Summary	411
Knowledge Check	
Review Questions	413
References	414
Index	417

#. ;», fi

INDEX

Α

ahead resistance coefficient (ARC) 164 aircraft 67, 74, 76 ami^dships 89, 90, 91, 93, 94, 97, 107, 111 Anchor Handling Tug Supply (AHTS) 17, 21 Artificial intelligence 304 Automation system 304

В

Bernouilli's theorem 150 Boil-off gas (BOG) 362 Bonjean curves 118, 119, 133, 143 boundary layer 158, 159, 160, 163, 172 bow system 156, 157 bulbous bow 175 bulk carrier 9, 10 buoyancy force 117, 121, 125, 130

С

Cable laying vessels 17 cargo carrier 52, 84 cargo handling systems 6 civil engineer 3 Clarke transform 268 Collaborative control method 272 computer designed ships 92 Constant false alarm rate (CFAR) 325 Container ships 9, 10, 38, 54, 56, 84 Control strategy 266, 267, 269, 270, 271, 292, 293 Convolutional neural networks (CNNs) 325 Cost-benefit Assessment 361 Cruise ship industry 357, 411 Cruise ships 66

D

deadweight tonnage (DWT) 10, 13, 38 Design development 46 Diesel-Electric-propulsion 248, 297 Drilling vessels 18 Dry cargo ships 8, 38

Е

effective power 176, 177, 178 Electrical angular velocity 268, 269 Electromagnetic torque 267, 268, 269 Electronic product codes (EPCs) 307 Embedded technology 304 energy spectrum 232, 234, 235

F

Feeling things 307, 352 Ferries 3, 5, 16, 38 floating body 117, 120 Formal Safety Assessment (FSA) 359 frictional resistance 153, 154, 164, 165, 166, 167, 170, 172, 173, 175, 177, 181, 182 Froude number 151, 152, 153, 154, 164

418 Applied Naval Architecture

fully submerged body 130

G

geometric 159 gravity 116, 120, 127, 128, 132, 133, 136, 137, 138, 139, 140, 142, 143, 146

Η

Histogram of oriented gradients (HOG) 325 hydraulically 160 hydrodynamics 150, 179 Hydrofoil craft 69, 71 hydrostatic curves 115, 129, 131 hydrostatic forces 116, 117, 146

I

Integrated Tug Barges (ITB) 12 International Maritime Organization (IMO) 59 International safety management (ISM) 358 Internet of things (IoT) 305, 352

L

Land-based power systems 248, 297 length between perpendiculars (LBP) 88 liquefied natural gas (LNG) 11 liquefied petroleum gas (LPG) 61 Load Line Regulations 98

Μ

maintenance costs 44 Marine industry 247, 272 marine vessels 2,3, 13, 17, 18, 19 mean time between failure (MTBF) 50 merchant ime to repair (MTR) 50 merchant ship 44, 52 Merchant vessels 8, 39, 40 methodical series 149, 169, 170, 171, 176 momentum theory 198, 200, 208

Ν

Naval Architect 3 Naval architecture 2, 5, 7, 303, 352 naval technology 2 Navigation 361,363,368,381,414 Network layer 305,306,315,320,321,352 Non-linear systems 267

0

Object-based image analysis (OBIA) 325 Ocean liners 14 ore/bulk/oil (OBO) 66, 84

p

parallel middle body 157, 175 Passenger ships 66 pipelaying vessel 19, 38 presentation of motion data 231, 245 propeller efficiency 200, 203, 219 propulsor. 186, 189, 217 Pulse generator 269

Q

quasi-propulsive coefficient (QPC) 187

R

refrigeration system 54, 56 repair by replacement (RBR) 50 response amplitude operators (RAOs) 232 Reynolds' numbers 154, 159, 160, 168 rolling 229, 230,231, 238, 239, 240, 244 Roughness 149, 172

S

Safety assessment method 359,360 Safety management system (SMS) 358, 411 Scale-invariant feature transform (SIFT) 325 seakeeping 43, 47, 67, 69, 71, 228, 232, 236, 245 Seakeeping ability 228, 244 Seismic vessels 19 Sensorlayer 305,306,315,321,352 Service-oriented architecture (SOA) 305 ship depth 90, 111 ship motions 232, 233, 238, 245 Ships 3, 8, 10, 14, 15, 26

