

# MARINE 2015

## Computational Methods in Marine Engineering VI

15 - 17 June 2015, Rome, Italy

Edited by: Francesco Salvatore, Riccardo Broglia and Roberto Muscari.





**Computational Methods in  
Marine Engineering VI  
MARINE 2015**

**Rome, Italy  
June 15 – 17, 2015**

A publication of:

**International Center for Numerical  
Methods in Engineering (CIMNE)**  
Barcelona, Spain



Printed by: Artes Gráficas Torres S.L., Huelva 9, 08940 Cornellà de Llobregat,  
Spain

Depósito legal: B-13769-2015

ISBN: 978-84-943928-6-3

## TABLE OF CONTENTS

Preface .....	7
Acknowledgements .....	9
SUMMARY.....	11
Contents .....	13
Invited Sessions .....	21
General Sessions .....	425
Authors Index .....	1161



## PREFACE

This volume contains full-length papers of contributions presented at *MARINE 2015, the Sixth International Conference on Computational Methods in Marine Engineering*, held at Consiglio Nazionale delle Ricerche (CNR), Rome, Italy, 15-17 June 2015.

The conference program includes 6 plenary lectures and 141 contributions articulated in 11 contributed sessions and in 11 invited sessions organised by recognised experts. A total of 95 full-length papers have been submitted by authors and are presented in the volume.

*MARINE 2015* celebrates the first decade of this conference series. Previous editions were held in Oslo, Norway, in June 2005, with following editions every second year, in Barcellona, Spain, June 2007, in Trondheim, Norway, June 2009, in Lisbon, Portugal, September 2011, and finally in Hamburg, Germany, May 2013.

In the wake of previous editions, the mission to provide “*a meeting place for researchers developing computational methods and scientists and engineers focusing on challenging applications in Marine Engineering*” is even more appropriate. In particular, *MARINE 2015* gives special attention to themes related to the “Blue Growth” strategy for the sustainable exploitation of the oceans, with multi-disciplinary sessions dedicated to the greening and safety of marine transport, to the development of marine renewable energy technologies, and to the analysis of the impact of human activities on the marine environment. The state-of-art in numerical methods is addressed in sessions on computational fluid-dynamics, design and optimization, fluid-structure interaction, smooth-particle hydrodynamics, isogeometric methods, high-performance computing.

The *MARINE* Conference series is organized in the framework of the Thematic Conferences of the European Community on Computational Methods in Applied Sciences (ECCOMAS). *MARINE 2015* is also a Special Interest Conference of the International Association for Computational Mechanics (IACM). The conference is jointly organized by INSEAN, the maritime technology research institute of the Italian National Research Council (CNR) and by the International Center for Numerical Methods in Engineering (CIMNE) in co-operation with the Technical University of Catalonia (UPC).

Our sincere appreciation goes to plenary lecturers, invited session organizers and all authors who have contributed to the outstanding scientific quality of the conference as reflected in the proceedings. We would like to thank CNR President, Prof. Luigi Nicolais, for kindly offering facilities to host the conference, and acknowledge the support from the sponsors listed on the next page. Finally, we wish to thank Mr. Alessio Bazzanella and staff from the Congress Department of CIMNE, Barcelona, Spain, for their excellent work in the support of conference organization and for the publication of this volume.

Rome, 15th of June 2015

Francesco Salvatore, Riccardo Brogna, Roberto Muscari (CNR-INSEAN) Editors



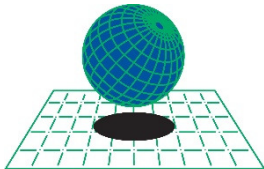


## ACKNOWLEDGEMENTS

The conference organizers acknowledge the support towards the organization of the MARINE 2015 Conference to the following organizations:



INSEAN, CNR, ITALY



**CIMNE**<sup>ES</sup>

International Center for Numerical Methods in Engineering (CIMNE), Spain



European Community on Computational Methods in Applied Sciences (ECCOMAS)



International Association for Computational Mechanics (IACM)



SeaFEM, Spain



CINECA, Italy



## SUMMARY

### INVITED SESSIONS

IS - Computational Methods in Support of Ocean Energy Harvesting .....	23
IS - Computational Modelling and Design of Sailing Boats .....	177
IS - Efficient Algorithms for Design Optimization .....	200
IS - HPC Applications in CFD .....	278
IS - Isogeometric Methods for Marine Engineering .....	290
IS - Numerical methods for predicting manoeuvring in waves .....	306
IS - Numerical Modeling and Characterization of Nets for Marine Applications .....	339
IS - Numerical Modeling Experiments for Offshore Wind-Energy .....	365
IS - Offshore Technology .....	389
IS - Transient and Unsteady Effects in Ship Hydrodynamics .....	401

## **GENERAL SESSIONS**

Coastal Engineering .....	425
FSI, Structures and Materials .....	480
Greening of Marine Transport.....	546
Hydrodynamics and Propulsion.....	613
Marine Renewable energy.....	762
Numerical Methods in CFD .....	826
Offshore Engineering.....	943
Safety .....	1015
Ship design and optimization.....	1051
Smooth Particle Hydrodynamics .....	1104
Underwater Vehicles .....	1128

# CONTENTS

## INVITED SESSIONS

### IS - Computational Methods in Support of Ocean Energy Harvesting

<b>A comparison of numerical modelling techniques for tidal stream turbine analysis</b> .....	23
<i>I. Masters, A.J. Williams, T.N... Croft, M. Togneri, M. Edmunds, E. Zangiabadi and I. Fairley</i>	
<b>Adaptive simulation of unsteady flow past the submerged part of a floating wind turbine platform</b> .....	35
<i>J. Jansson, V. Nava, M. Sanchez, G. Aguirre, R. Vilela de Abreu, J. Hoffman and J.L. Villate</i>	
<b>CFD Analysis of devices in oscillating water column - OWC</b> .....	47
<i>V. Russo, D. Nicolini and T. Crescenzi</i>	
<b>Effect of a negative stiffness mechanism on the performance the WEPTOS rotors</b> .....	58
<i>S. Peretta, P. Ruol, L. Martinelli, A. Tetu and J.P. Kofoed</i>	
<b>Experimental test and numerical shape optimization of a point pivoted absorber for wave energy conversion</b> .....	73
<i>D.P. Coiro, G. Troise, G. Calise and N. Bizzarrini</i>	
<b>Influence of the excitation force estimator methodology within a predictive controller framework on the overall cost of energy minimisation of a wave energy converter.</b> .....	90
<i>F. Ferri, S. Ambühl and J.P. Kofoed</i>	
<b>Numerical Study on Active and Passive Trailing Edge Morphing Applied to a Multi-MW Wind Turbine Section</b> .....	106
<i>A. Castorrini, A. Corsini, M. Boezi and F. Rispoli</i>	
<b>Optimization of the Wavesax device: numerical modelling and ocean wave basin tests</b> .....	119
<i>G. Agate, A. Amicarelli, A. Danelli and M. Peviani</i>	
<b>Performance of a U-OWC – turbine coupled system using different control laws</b> .....	128
<i>F. Arena, V. Laface, G. Malara and F.M. Strati</i>	
<b>Rain erosion numerical modeling applied to multi-MW off-shore wind turbine</b> .....	139
<i>A. Corsini, A. Castorrini, P. Venturini and F. Rispoli</i>	
<b>The use of OpenFOAM as a virtual laboratory to simulate Oscillating Water Column Wave Energy Converters</b> .....	153
<i>I. Simonetti, L. Cappietti, H. El Safti, G. Manfrida, H.G. Matthies and H. Oumeraci</i>	
<b>Traditional turbulence methods and novel visualisation techniques for coastal flow model in order to deploy tidal stream turbines</b> .....	165
<i>I. Masters, E. Zangiabadi, M. Edmunds, I.A. Fairley, M. Togneri, A.J. Williams and T.N. Croft</i>	