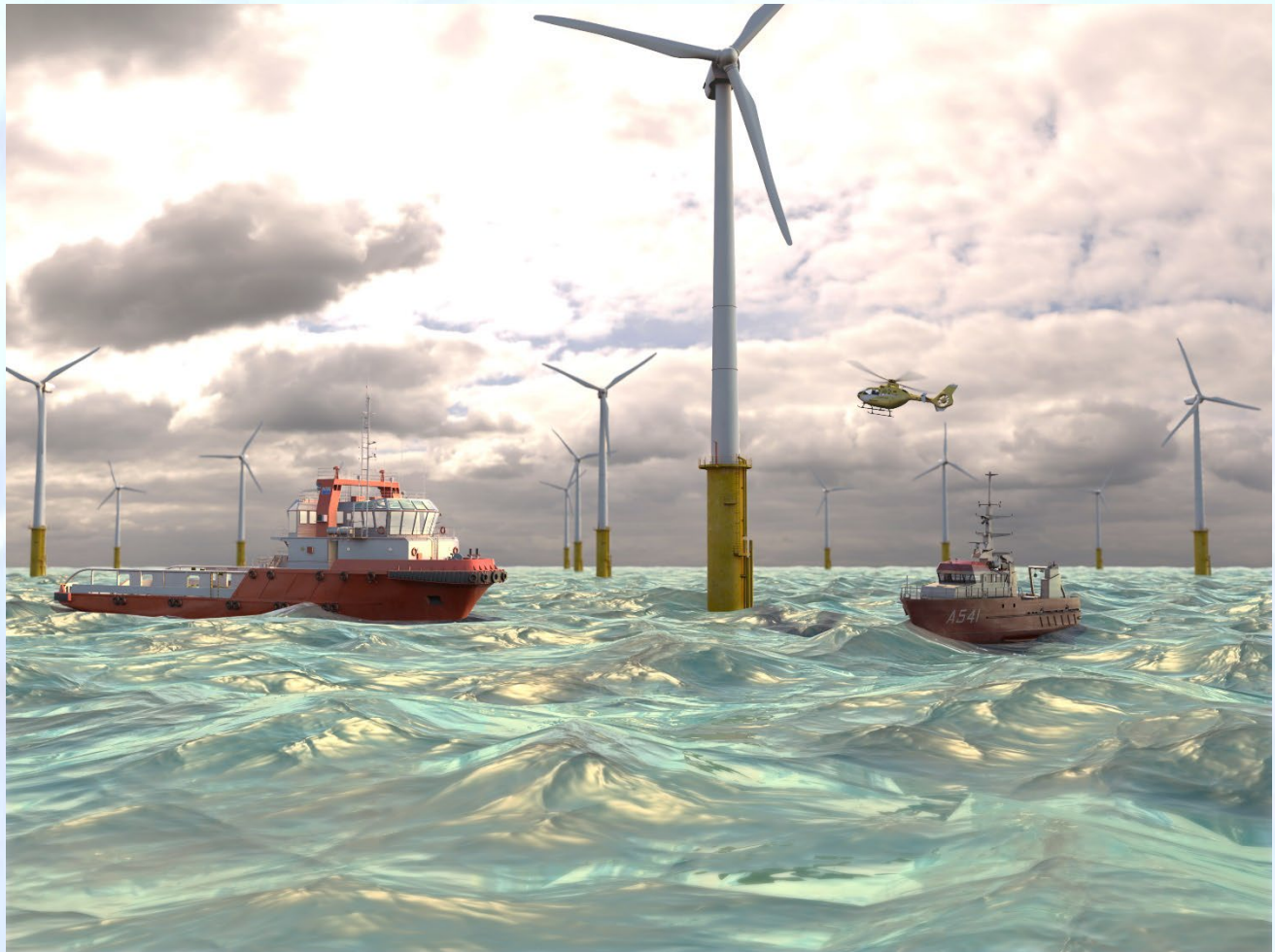


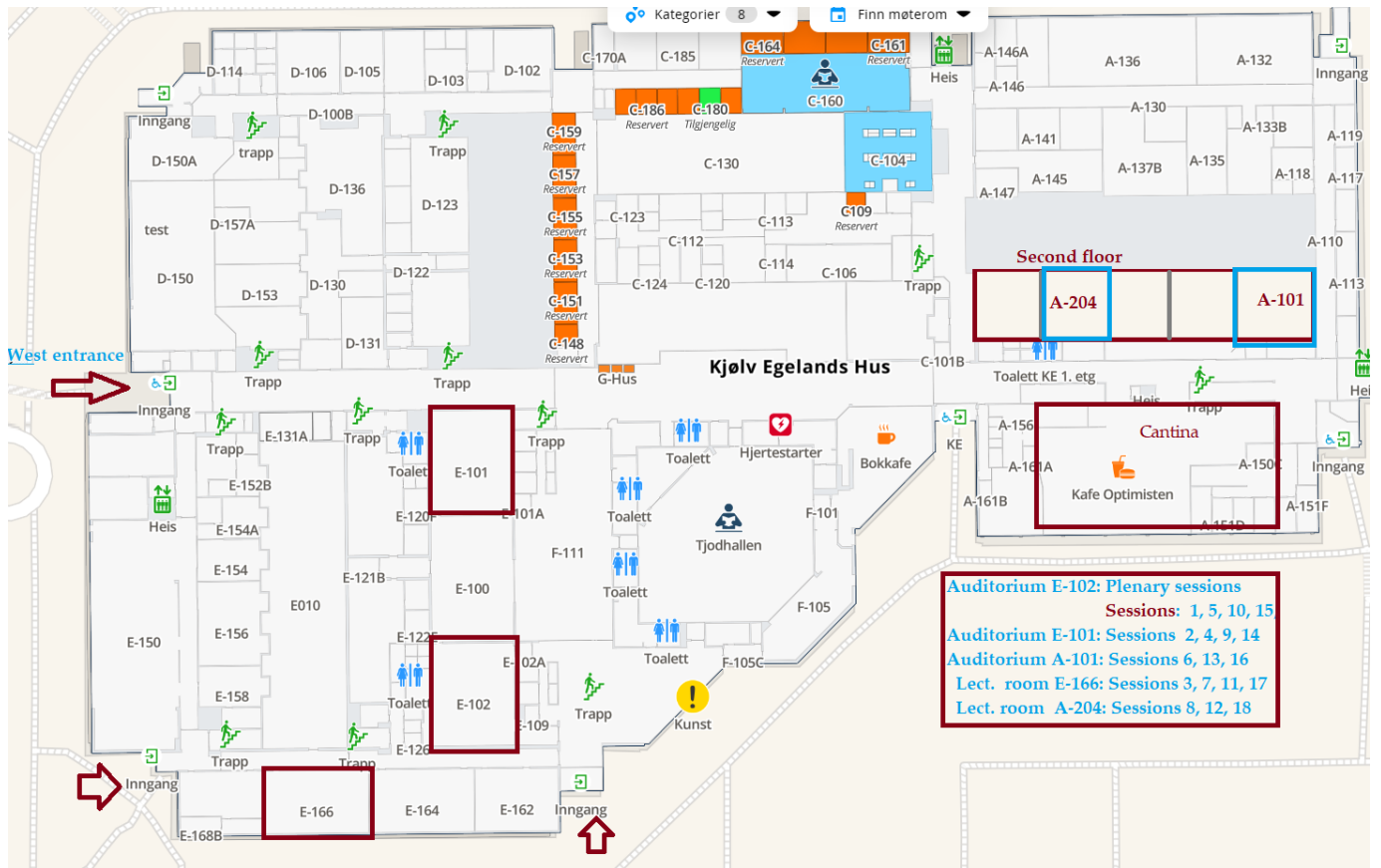
**Fourth Conference of Computational Methods
&
Ocean Technology
(COTech 2023)**

November 30 – December 1, 2023, University of Stavanger, Norway



Final Conference Program

Department of Mechanical and Structural Engineering
and Materials Science, University of Stavanger



Venue

The conference is organized at University of Stavanger, Norway

Address:

Kjølv Egeland's hus, Aud. E-102 ([see map](#))

Entrance West, Kristine Bonnevis vei



COTech 2023 Conference Program

November 30 – December 1, 2023

University of Stavanger, Norway

Program at Glance

Date	Time	Events
Day 1: Nov.30,	08:00 – 08:30	Registration
	08:30 – 09:10	Conference opening
	09:10 – 09:50	Keynote 1: Professor José A.F.O. Correia
	09:50 – 10:30	Keynote 2: Professor Nicholas Fantuzzi
	10:30 – 11:00	Coffee break and group photo program
	11:00 – 12:30	Special Sessions with Three Parallel Sessions (T2-1, T3-1, T7-1)
	12:30 – 13:30	Lunch break
	13:30 – 14:10	Keynote 3 Professor Asfaw Beyene
	14:10 – 14:50	Keynote 4 Professor Jayantha P. Liyanage
	14:50 – 15:10	Coffee break
	15:10 – 17:00	FIVE Parallel Sessions (T1-1, T2-2, T3-2, T4-1, T6-1)
	17:00 – 17:20	Transport to Stavanger Oil Museum
	17:20 – 19:20	Visiting Stavanger Oil Museum
19:30 – 21:30	Conference Dinner	
Day 2: Dec. 1	08:30 – 09:00	Registration
	09:00 – 09:40	Keynote 5 Professor Mohammed Pourkashanian
	09:40 – 10:20	Keynote 6 Professor Odne S. Burheim
	10:20 – 10:40	Coffee break
	10:40 – 12:30	FIVE Parallel Sessions (T2-3, T3-3, T5-1, T6-2, T7-2)
	12:30 – 13:30	Lunch break
	13:30 – 15:00	FIVE Parallel Sessions (T2-4, T2-5, T2-6, T2-7, T5-2)
	15:00 – 15:20	Coffee break
	15:20 – 16:00	Award Ceremony and Conference Closing

Time allocation for presentations:

Keynote speakers: max. **40 min**; Each article: max. **15 min** excl. Q & A.

T1: Wind Engineering and Industrial Aerodynamics
 T2: Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology
 T3: Computational Mechanics, Structural Integrity, and Life Extension of Structures

T4: Cold Climate Region Technology
 T5: Smart Operations and Maintenance
 T6: Additive Manufacturing, Design Optimization and Composites
 T7: Smart Energy Storage, Integration and Utilization



Preface

The COTech (Computational Methods & Ocean Technology) conference started as part of the research and dissemination activities of the Program Area for research "COtech - Computational methods in Offshore Technology" at Faculty of Science and Technology, University of Stavanger (UiS) with its first event in 2017. This Program Area for Research was founded in 2015 with seven professors, four associate professors, two adjunct professors and five research (PhD) students from the Department of Mechanical and Structural Engineering and Materials Science (IMBM), whose expertise and competence lies primarily within use of computational methods such as finite element methods, boundary and volume element methods, computational fluid dynamics and the like in marine and subsea technology, marine operations, design and analysis of mechanical systems, integrity and reliability of offshore structures and mechanical systems, renewable energy and wind engineering. In the ocean-related engineering area in particular, numerical computation approach is nowadays not only serving as a means to cultivate and realize innovative ideas, but also it is becoming the primary choice to solve complex engineering problems for the harsh and unfriendly environment in the Arctic.

Like the previous conference, this year's COtech conference is conducted as part of the dissemination activities of the Institute Strategic Program (ISP) entitled "Computational Methods and Ocean Technology" established under the research activities of the Department of Mechanical and Structural Engineering and Materials Science. This three-year program (2021 - 2023) intends to bring researchers of the department under four selected research areas:

1. *Ocean Energy Conversion* - installations & dynamic analysis of offshore wind turbines, structural health monitoring, corrosion assisted fatigue, ocean wave energy.
2. *Aquaculture Technology* - efficient farming techniques, advanced numerical modeling and computation, fluid-structure interaction, design effective maintenance programs for aquaculture.
3. *Marine and Subsea Technology* - sediment erosion (scour), scour prediction CFD models, structural integrity and fatigue life of offshore structures, adaptive control of ROVs in subsea application, predictive maintenance of subsea structures
4. *Innovative Solutions* - 3D printing based innovative solutions, inspection drones, augmented reality for maintenance training, ...

In addition to the thematic areas covered in the last three conferences, the 4th COtech conference accommodated some of the emerging technologies and applications such as machine learning techniques, additive manufacturing technologies, 3D printing in healthcare technology, smart energy storage and bio-inspired design.

In general, the conference is intended to provide a platform for academics and professionals working within diverse forms of the computational methods, Ocean/Offshore technology and Oil and Gas technologies to come together, present their recent works in the area, exchange ideas, and establish professional networks. It will serve as a forum for multidisciplinary research and bring together enable them to exchange their research experience and disseminate their results within the involved fields.

The conference is organized under 7 thematic areas, which will also serve as conference tracks.

1. *Wind Engineering and Industrial Aerodynamics*
2. *Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology*
3. *Computational Mechanics, Structural Integrity, and Life Extension of Structures*
4. *Cold Climate Region Technology*
5. *Smart Operations and Maintenance*
6. *Additive Manufacturing, Design Optimization and Composites*
7. *Smart Energy Storage, Integration and Utilization*

Among the submitted manuscripts, 63 full papers passed the review process. The review work was conducted according to the review policy of IOP conference series where each paper was reviewed



by at least two reviewers involving both national and international reviewers. Six known experts in the area were invited to present keynote papers from different countries.

The conference committee and editors of this proceeding would like to thank all the reviewers and authors of the papers in this proceeding for their valuable contributions to 4th COtech conference. The financial support from Department of Mechanical and Structural Engineering and Materials Science at University of Stavanger through the ISP program is highly appreciated. Finally, the administrative support provided by Mrs Vanessa Grace Ochon Booc is highly appreciated.

Conference Organizing Committee

Prof. Hirpa G. Lemu
Prof. Dimitrios Pavlou
Prof. Muk Chen Ong
Prof. Jasna B. Jakobsen
Prof. Sudath C. Siriwardane
Prof. Yihan Xing
Assoc. Prof. Ove Mikkelsen

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Prof. Tor H. Hemmingsen
Assoc. Prof. Yanyan Sha
Prof. Yihan Xing
Prof. Yiliu Liu

Invited Keynote Speakers

Prof. Asfaw Beyene, San Diego State University, USA.
Prof. Mohammed Pourkashanian, University of Sheffield, United Kingdom
Prof. Nicholas Fantuzzi, University of Bologna, Italy
Prof. José A.F.O. Correia, University of Porto, Portugal
Prof. Jayantha Prasanna Liyanage, University of Stavanger, Norway
Prof. Odne S. Burheim, Norwegian University of Science and Technology (NTNU), Norway

Additional plenary session speakers

Dr. Dr. Xuanlie ZHAO, Harbin Engineering University, China
(Title of speech: Multi-Body Hydrodynamics and Hybrid Platforms: Insights from Recent Studies)

Dr. Stamatios Avlonitis, DEYATH Mesaria-Thira, Greece
(Title of speech: Reverse Osmosis Technology for Desalination)



Main Conference Program, November 30 and December 1, 2023

DAY 1 Thursday, November 30, 2023	
08:00 -08:30 <i>Location</i>	Registration <i>In front of Auditorium E-102</i>
08:30 – 09:10	Opening plenary <i>Auditorium KE E-102</i> Welcome: Prof. Hirpa G. Lemu, Chairman of Conf. Organizing Committee, Professor Merete Vadla Madla, Vice Rector for Research, Univ. of Stavanger
09:10 – 10:30 <i>Chair:</i> <i>Location</i>	Keynote Speeches I <i>Professor Dimitrios Pavlou, University of Stavanger, Norway</i> <i>Auditorium KE E-102</i>
09:10 – 09:50	Keynote 1: Promoting Multiscale Fatigue to Design Reliable and Sustainable Structures <i>Professor José A.F.O. Correia,</i> University of Porto, Portugal
09:50 – 10:30	Keynote 2: Sustainability and Renewables in Offshore Environment: Recent Modelling Challenges <i>Professor Nicholas Fantuzzi,</i> University of Bologna, Italy
10:30 – 11:00	Coffee break and group photo



Keynote 1

Promoting Multiscale Fatigue to Design Reliable and Sustainable Structures

Professor José A.F.O. Correia, Institute of Science and Innovation in Mechanical and Industrial, Engineering, University of Porto, Portugal

Abstract: This keynote speech describes the author's experience in experimental research, numerical modelling, and developing models for characterising fatigue behaviour in metallic materials. The advances made in material fatigue characterisation range from micro to macro physical scales. In structural fatigue design, the fatigue behaviour of structural components and large-scale engineering structures is often assessed using probabilistic approaches and modelling at various physical scales due to time and cost constraints on test equipment. This is derived from the mechanical properties of normalized small-scale specimens. Design code approaches typically estimate the structural component's life by averaging the lifetime of the most stressed points on the component and adding safety factors to account for dispersion bands, size effects, stress field uncertainties, and different environments. However, this approach may not be accurate enough, leading to designs that are either too conservative or too optimistic. Currently, it is increasingly urgent to model the fatigue properties of small-scale samples for the strength of structural components at various physical scales. This must take into account loading effects, environmental effects, and probabilistic analysis in order to make structures reliable and sustainable. The keynote focuses on the author's experience in characterising the fatigue behaviour of metallic material, including experimental and probabilistic models for fatigue resistance and crack propagation. The author also discusses integrated fatigue approaches for structural components, modelling based on fracture mechanics, and fatigue damage assessment of engineering structures such as bridges, offshore platforms, etc. Additionally, two technical works related to fatigue damage assessment are presented.

Keynote 2

Sustainability and Renewables in Offshore Environment: Recent Modelling Challenges

Professor Nicholas Fantuzzi, University of Bologna, Italy

Abstract: Offshore structures are known to be used for extracting natural gas and oil from the sea bed. However, when the underground source finishes, these structures should be moved to another location or removed if they have reached their design life. Removal operations go under the name of decommissioning which is a multidisciplinary process by which a Company decides on how to shut down the field activities at the end of the structure life: plugging and abandoning the well(s), making the equipment/installation safe, removing some or all the facilities and restoring the area. Decommissioning will occur at different stages of asset lifecycle and has wide relevance in terms of reputation, so it needs to be managed properly as a dedicated business process. Nevertheless, another solution might be considered: change the future working life of these platforms by involving renewable energy and transforming them, for instance, into offshore wind towers. This activity involves retrofitting activities in order to strengthen the original structural elements in order to carry new loads. All the aforementioned operations involve structural modeling which can be carried out at global and local scales. Such degrees of complexity might be time consuming for companies that in general have limited time to make decisions in the initial phases of these operations and want to save money. Therefore, in this talk some modeling aspects about the sustainability of installations for renewables sources are discussed together with recent modelling challenges.



DAY 1 Thursday, November 30, 2023

11:00 – 12:30 Three Parallel Sessions

Session 1: Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology (T2-1)

Session chairs: Professor Yihan Xing, University of Stavanger
Dr. Guang Yin, University of Stavanger

Location: E-102

1	<i>Special Session in Recognition of Outstanding Contribution of Professor Emeritus Ove Tobias Gudmestad in Marine and Offshore Education and Research (30 min.)</i>
2	Multi-Body Hydrodynamics and Hybrid Platforms: Insights from Recent Studies, <u>Xuanlie ZHAO</u>
3	Dynamic Response of a Single Point Mooring Submersible Fish Cages in Waves and Currents, <u>Xueliang Wen, Hui Cheng, Muk Chen Ong</u>
4	A parametric study on the initial transverse stability of suspension ships, <u>Jialin Han, Motohiko Murai</u>

Underlined author names are presenting authors.

Session 2: Computational Mechanics, Structural Integrity & Life Extension of Structures (T3-1)

Session chairs: Professor Dimitrios Pavlou, University of Stavanger, Norway
Professor José A.F.O. Correia, University of Porto, Portugal

Location: E-101

1	<i>Special Session in Recognition of the Outstanding Research Achievements of Professor José A.F.O. Correia in Fatigue and Structural Integrity of Engineering Structures (30 min)</i>
2	Spatial and Temporal Crack Initiation Prediction in Steels Based on Residual Stress Tensor Distribution Monitoring, <u>E Mangiorou, T Damatopoulou, S Angelopoulos, P Vourna, A Ktena and E Hristoforou,</u>
3	Material characterization of EN AC-AI Si12CuNiMg alloy in stress relaxation and creep conditions <u>Goftila G. Sirata, Krzysztof Wacławski</u>
4	An approach for fatigue life assessment of a road bridge based on measured corrosion and actual traffic loading; <u>Nirosha D Adasooriya, Arve Tuvera Cruz, Mehari Tsadik Gebremeskel</u>

Underlined author names are presenting authors.

Session 3: Smart Energy Storage, Integration and Utilization (T7-1)

Session chairs: Professor Mohsen Assadi, University of Stavanger, Norway
Dr. Stamatios Avlonitis, Greece

Location: E-166

1	<i>Special Session: Reverse Osmosis Technology for Desalination Dr. Stamatios Avlonitis, DEYATH Mesaria-Thira, Greece (30 min.)</i>
2	Assessing Impact of Borehole Field Data's Input Parameters on Hybrid Deep Learning Models for Heating and Cooling Forecasting: A Local and Global Explainable AI Analysis, <u>Naveed Ahmed, Mohsen Assadi, Qian Zhang, A A Ahmed</u>
3	Hydrogen Safety Considerations: Mitigating Risks and Securing Operations in Enclosed Spaces, <u>Slawosz Kleszcz, Mohsen Assadi</u>
4	Machine learning for underground gas storage with cushion CO2 using data from reservoir simulation, <u>Johan Olav Helland, Helmer André Friis, Mohsen Assad, Stanislaw Nagy</u>

Underlined author names are presenting authors.

12:30 – 13:30 Lunch break



13:30 – 14:50 Chair Location	Keynote Speeches II <i>Professor Jasna B. Jakobsen, University of Stavanger, Norway</i> Auditorium KE E-102
13:30 – 14:10	Keynote 3: Biomimicry, the case of morphing blades <i>Professor Asfaw Beyene,</i> Department of Mechanical Engineering, San Diego State University, USA
14:10 – 14:50	Keynote 4: Engineering the Future of Critical Assets and Infrastructures under Emerging Uncertain Conditions <i>Professor Jayantha P. Liyanage</i> Faculty of Science and Technology, University of Stavanger, Norway
14:50 – 15:10	Coffee break

Keynote 3

Biomimicry, the case of morphing blades

Professor Asfaw Beyene

Abstract: Designers have shown great ingenuity in the use of biomimicry, adopting and emulating unique biomechanical occurrences honed by millions of years of evolution, as widely observed in nature. Special pads are modeled after the sticky feet of a gecko enabling human climbers to scale vertical surfaces. A kingfisher's beak that allows it to enter and exit water bodies without creating a compression wave inspired the bullet train.

The study of shark skin and its unique composition has led to many scientific breakthroughs in transportation as well as in swimsuits which are now banned from major competitions. By rearranging the mirrors of concentrated solar power plants in a pattern similar to the spirals on the face of a sunflower, engineers reduced the plant footprint by 20% and increased its power output. The baobab tree, the armadillo's impenetrable shell, a bird skull, etc. can be cited as more examples of successful biomimicry that improved efficiency and performance of manufactured devices.

Although in its infancy, the concept of biomimicry has also been embraced in turbomachinery and energy systems by adopting fish locomotion and bird aerodynamics. Fin morphing techniques and wing flexibilities could lead to design concepts which can greatly improve conversion efficiencies in energy systems. Application of whale flippers proposed as a design approach to improve the stall characteristics of wind turbine blades is one such case in point. In this lecture, a work of the author's research team on adaptive turbine blades, spanning over a decade, is summarized, - culminating with the latest lab and simulation outputs. These results show that contrary to contemporary turbine blades, which are rigid chord-wise, flexible turbines with morphing blades better adjust to variable operating conditions, thereby reducing flow separation and improving the power output. Advances in morphing wind turbine blades and potential efficiency gains will be presented.

Keynote 4

Engineering the Future of Critical Assets and Infrastructures under Emerging Uncertain Conditions

Professor Jayantha Prasanna Liyanage

Abstract: Industrial, economic, and societal aspects generate unprecedented demands and challenges towards critical Engineering assets and infrastructures in public and private sectors. They will continuously be exposed to a range of latent and uncertain conditions where engineering and operational boundaries get pushed and



tested in numerous ways. The critical questions under such emerging contexts are; what is this rapidly emerging Engineering future of critical Engineering assets and infrastructures? where are the real pressure points? what does it take to ensure engineering and operational robustness of those Engineering assets and infrastructures?



15:10 – 17:00 FIVE Parallel Sessions

Session 4: Wind Engineering and Industrial aerodynamics (T1-1)

Session chairs: Professor Jasna B. Jakobsen, University of Stavanger, Norway
 Assoc. Professor Knut Erik Giljarhus, University of Stavanger, Norway

Location: E-101

- | | |
|---|---|
| 1 | Wind engineering studies on Lysefjord suspension bridge: Development of work and progress from 2013 to 2023, <u>Jonas T. Snæbjörnsson</u> , <u>Jasna B. Jakobsen</u> |
| 2 | Active damage mitigation of the blade leading edge erosion for a wind turbine during rainfall events, <u>Álvaro Úbeda Ripoll</u> , <u>Zhiyu Jiang</u> , <u>Amrit Shankar Verma</u> , <u>Jing Zhou</u> |
| 3 | Flow Over a Step Cylinder using Partially Averaged Navier-Stokes Equations with Application Towards Subsea Power Cables, <u>Usman Shaukat</u> , <u>A Schnepf</u> , <u>K E T Giljarhus</u> |
| 4 | An image processing approach to reconstruct wind using long-range wind lidars, <u>M Nafisifard</u> , <u>J B Jakobsen</u> , <u>J T Snæbjörnsson</u> , <u>H Ágústsson</u> , <u>Martin S. Grønseth</u> , <u>Ove Undheim</u> |
| 5 | Wind flow measurements and analysis using Lidars: A study on the University of Stavanger Campus, <u>Lennart Vogt</u> , <u>Jasna B. Jakobsen</u> , <u>Jónas T. Snæbjörnsson</u> , <u>Lin Li</u> , <u>Charlotte Obhrai</u> , <u>Swen Roemer</u> |

Underlined author names are presenting authors.

Session 5: Advanced Computational Methods & Applications in Marine, Subsea and

Offshore Technology (T2-2)

Assoc. Professor Xuanlie Zhao, Harbin Engineering University
 Dr. Changqing Jiang, University of Duisburg-Essen, China

Location: E-102

- | | |
|---|--|
| 1 | A novel design of a hybrid glulam-steel substructure for the IEA 15-MW floating wind turbine, <u>Yucong Ma</u> , <u>Hassan Hasan Yousef</u> , <u>Karan Sandipkumar Patel</u> , <u>Yihan Xing</u> |
| 2 | Life Cycle Cost Analysis of a Floating Wind Farm in the Norwegian Sea, <u>Zhiyu Jiang</u> , <u>Fredrik Andersen Bjørni</u> , <u>Sverre Lien</u> , <u>Torjus Aasrum Midtgarden</u> , <u>Laura Castro-Santos</u> |
| 3 | Applying a machine learning method for cumulative fatigue damage estimation of the IEA 15MW wind turbine with monopile support structures, <u>Chao Ren</u> and <u>Yihan Xing</u> |
| 4 | Mooring system design for an integration of an offshore fish cage and a floating offshore wind turbine, <u>Yu Ma</u> |
| 5 | Protection Design Against Anchor Hooking Risks – A Case Study in Brazil
<u>Kun Yang</u> , <u>Per Richard S. Nyström</u> , <u>Stian L. Rasmussen</u> , <u>Zhenguo Tu</u> |

Underlined author names are presenting authors.

Session 6: Computational mechanics, and Structural Integrity and Life Extension of

Structures (T3-2)

Professor Nicholas Fantuzzi, University of Bologna, Italy
 Professor Dimitrios Pavlou, University of Stavanger, Norway

Location: A-101

- | | |
|---|---|
| 1 | Design optimization of small fishing vessel structures: A case study, <u>Gerry Putra</u> , <u>Faiz Rizqillah Akbar</u> , <u>Ardiyansyah Yatim</u> , <u>Y Liu</u> |
| 2 | Combining Machine Learning Methods and Data Augmentation for Misaligned Journal Bearings Design, <u>Konstantinos Arvanitis</u> , <u>PANTELIS NIKOLAKOPOULOS</u> |
| 3 | Reliability Local Fatigue Design Challenges of Transition Pieces from Decommissioned Platforms for Offshore Wind Energy, <u>Paulo Mendes</u> , <u>Carlos Souto</u> , <u>Taemin Heo</u> , <u>Abilio de Jesus</u> , <u>Nicholas Fantuzzi</u> , <u>Lance Manuel</u> , <u>José A.F.O. Correia</u> |
| 4 | W-beam Guardrail Crash Analysis and Evaluation using Finite Element Method, <u>Yemsrach Solomon LERABO</u> , <u>Haileleoul Sahle HABTE</u> |
| 5 | Numerical analysis of centrifugal water pump impeller under varying loads, <u>Leta Yadeta Tesfaye</u> , <u>Addisu K/Mariam Tadese</u> , <u>Hirpa G. Lemu</u> |

Underlined author names are presenting authors.



<p>Session 7: Cold Climate Region Technology (T4-1) Session chairs: Professor Ove T. Gudmestad, University of Stavanger, Norway Dr. Marek Jan Janocha, University of Stavanger, Norway</p> <p><i>Location: E-166</i></p>	
1	Availability of fresh water in Cold climate regions, <i><u>Mu Dah Awong</u>, Ove Tobias Gudmestad</i>
2	Transitioning towards renewable energy and sustainable storage solutions at remote communities in the Arctic, <i><u>Milla Regine Antonsen Hjallar</u>, Elena Dis Vioisdottir, Ove Tobias Gudmestad</i>
3	Impact of and solutions to effects of climate changes for Longyearbyen, Svalbard, Norway, <i><u>Susanna Nemeth Winther</u>, Ove Tobias Gudmestad</i>
4	Review of icing and ice-structure interaction models and mitigation methods for offshore wind in cold climate regions, <i><u>Yingjie Gu</u>, Marek Jan Janocha, Muk Chen Ong, Atle Blomgren</i>
Underlined author names are presenting authors.	
<p>Session 8: Additive Manufacturing Technologies, Design Optimization & Composites (T6-1) Session chairs: Professor Andrés G. Granada, IQS, Barcelona, Spain Dr. Mesay A Tolcha, Jimma University, Ethiopia</p> <p><i>Location: A-204</i></p>	
1	Open material database for tensile test properties of additive manufacturing materials, <i><u>Andrés-Amadir García-Granada</u>, H. Rostro-González, Josep-Maria Puigoriol-Forcada, Guillermo Reyes-Pozo</i>
2	Comparative study of influence of international standards on structural performance of 3D printed long fiber composite structures, <i><u>Adugna D. Akessa</u>, Yosef Wakjira Adugna, Wakshum M Tucho</i>
3	Bio-Inspired Design Trends for Sustainable Energy Structures, <i><u>Yohannes Regassa</u>, Tamana Dabasa, Genetu Amare, Hirpa G. Lemu,</i>
4	Process parameter modelling and optimization techniques applied to fused deposition modelling: A review, <i><u>Temesgen Batu</u>, Hailu Shimels, Hirpa G. Lemu</i>
5	Fracture toughness analysis of woven sisal-glass fibers hybrid composite, <i><u>Oda Kerre Gudeta</u>, Mesay A Tolcha, T D Badasa, E G Koricho</i>
Underlined author names are presenting authors.	
17:00 – 17:20 Transport to Norwegian Oil Museum	
17:20 – 19:20	Visit to Stavanger Oil Museum
19:30 – 21:30	Conference dinner, Bølgen & Moi



DAY 2	Friday, December 1, 2023
08:30 – 09:00	Registration
09:00 – 09:40	Keynote Speeches III <i>Chair:</i> Professor Mohsen Assadi, University of Stavanger, Norway <i>Location:</i> Auditorium KE E-102
09:00 – 09:40	Keynote 5: The Role of Low/zero Carbon Fuels in the Energy Transitions to Net Zero <i>Professor Mohammed Pourkashanian,</i> Managing Director of the Translational Energy Research Centre and the Sustainable Aviation Fuels Innovation Centre University of Sheffield, United Kingdom
09:40 – 10:20	Keynote 6: Lithium ion Batteries, the Basics and Some Trends Ahead <i>Professor Odne S. Burheim</i> Department of Energy and Process Engineering, NTNU, Norway
10:20 – 10:40	Coffee break

Keynote 5:

The Role of Low/zero Carbon Fuels in the Energy Transitions to Net Zero

Professor Mohammed Pourkashanian

Abstract: The energy transition to net zero is one of the most challenging issues facing industrialised societies today as it will require widespread changes to both energy supply and demand. Wide range of low and zero carbon fuels tailored to different energy sectors are essential parts of achieving net zero target. Low/zero carbon fuels—in particular, green/blue hydrogen and Sustainable Aviation fuels offer a variety of potential solutions. Hydrogen can be used as a fuel on its own to decarbonise industry, heat and transport, or use as a feedstock to produce alternative sustainable fuels (e-fuels) with a higher energy density and can be more easily transported and stored. In addition, during the initial transition stage these fuels can be blended with fossil fuels to reduce overall emissions followed by replace fossil fuels entirely, without requiring expensive changes to energy systems transportation and storage infrastructure.

The presentation will explore the role of low/zero carbon fuels such as hydrogen and e-fuels on energy transition focusing on technical challenges and opportunities on production and utilisation. We will also examine role of hydrogen as a feedstock to produce sustainable fuels to decarbonise “hard-to-decarbonise” sector such as aviation. The presentation will suggestion on what form is appropriate for what use and how to initiate the production and deployment of these sustainable fuels.

Keynote 6:

Lithium ion Batteries, the Basics and Some Trends Ahead

Professor Odne S. Burheim

Abstract: Production of Lithium ion Batteries (LIB) has doubled about every 3rd year for more than a decade, and is forecasted to continue doubling at the same interval for at least another decade. LIB is a general term covering a family of different materials put together in different formats of batteries. LIB functionality follows some basic principals in terms of the electrodes reactions, where a transition metal (Fe, Co, Mn, Ni) reacts in the cathode and Li reacts in the cathode by exchanging electrons to electric devices outside the LIB. Design of commercial cells depend on capacity of the cell, termed in Ah (amount of charge) or Wh (amount of energy), and the main difference lies in the assembling process.

Modern production of batteries has eventually come into a transition phase, where the major challenges ahead appear to be focusing on quality, yield, scrap rates, and circularity. Conventional battery production is currently



well established in Asia, and it is a relatively new and emerging process in Europe and North America. As this is an exponentially growing market (doubling every 3rd year), a field with much room for disruption, and a high quality, and high value market; battery production as an area is experiencing lots of interest from political points, financial points and academic points. The presentation will give a brief introduction to the basics of LIB concepts, technological opportunities, and motivation behind political and financial interests.



10:40 – 12:30 FIVE Parallel Sessions

Session 9: Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology (T2-3)

Session chairs: Prof. Muk Chen Ong, University of Stavanger
Dr. Naiquan Ye, SINTEF Ocean AS

Location: E-101

1	Two-body dynamic simulations of a combined semi-submersible floating offshore wind turbine and torus wave energy converter, <u>Vitor De Santis Tavares</u> , <u>Chern Fong Lee</u> , <u>Muk Chen Ong</u>
2	Turbulent flow over a dimple, <u>Jianxun Zhu</u> , <u>Cai Tian</u> , <u>Lars Erik Holmedal</u>
3	Numerical Planar Motion Mechanism Tests of an autonomous underwater helicopter, <u>Guang Yin</u> , <u>Zhikun Wang</u> , <u>Muk Chen Ong</u>
4	Dynamic Analysis of a Floating Dock under Accidental Conditions, <u>Xueliang Wen</u> , <u>Alejandro Garcia Conde</u> , <u>Jianan Zhang</u> , <u>Muk Chen Ong</u>
5	Optimised On-bottom Stability Analysis of Shallow Water Cables and Pipelines using SIMLA DROPS, <u>Per Richard S. Nyström</u> , <u>Kun Yang</u> , <u>Stian Laland Rasmussen</u> , <u>Zhenguo Tu</u>

Underlined author names are presenting authors.

Session 10: Computational Mechanics, and Structural Integrity and Life Extension of Structures (T3-3)

Session chairs: Professor Sudath C. Siriwardane, University of Stavanger, Norway
Adj. Professor Gerhard Ersdal, University of Stavanger, Norway

Location: E-102

1	Effect analysis of wooden fence width on wave transmission by SWASH model, <u>Tri Mai</u> , <u>Anh Ngo</u> , <u>Tung Dao</u> , <u>Hien Hau Pham</u> , <u>Liu Yili</u>
2	Reuse of structural steel components from decommissioned offshore structures for new building: A case study, <u>Lars Vegar Valen</u> , <u>Sigmund Røland</u> , <u>Sudath C Siriwardane</u> , <u>Fredrik Bjørheim</u>
3	Non-linear buckling analysis of ship hull stiffened panels, <u>Enes Hacıhamud</u> , <u>Kjetil Dahl</u> , <u>Ole Gabrielsen</u> , <u>Hirpa Lemu</u> , <u>Sudath C Siriwardane</u>
4	Experimental assessment of hole drilling repair performance for tubular joint under fatigue loading, <u>Simen Riise</u> , <u>Mostafa Atteya</u> , <u>Gerhard Ersdal</u> , <u>Ove Mikkelsen</u>
5	Statistical evaluation of tubular joint SCFs from test data and finite element analyses, <u>Gerhard Ersdal</u> , <u>Mostafa Atteya</u> , <u>Ove Mikkelsen</u>

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Session 11: Smart Operations and Maintenance (T5-1)

Session chairs: Assoc. Professor Idriss El-Thalji, University of Stavanger, Norway
Professor Jayantha P. Liyanage, University of Stavanger, Norway

Location: E-166

1	Dealing with Abnormalities and Deviations to enhance Resilience in Engineering Assets: A critical review from Human Factors and Decision-making Perspectives under Complex Operational Contexts, <u>Mohammad Bakhshandeh</u> , <u>Jayantha P Liyanage</u>
2	Service and inventory model for maintenance workshop in the short cycle operation region: Agent-based Simulation Approach, <u>Majid Shalfawi</u> , <u>Idriss El-Thalji</u> , <u>A Turkyilmaz</u>
3	Internal Clearance Behaviour in Healthy and Faulty Bearings, <u>Idriss El-Thalji</u> , <u>Yasmine Khattab</u>
4	Reliability and resilience analysis of green hydrogen production: Common changes and particular concerns in offshore industries, <u>Farhana Yasmine Tuhi</u> , <u>Yiliu Liu</u>

Underlined author names are presenting authors.



Session 12: Additive Manufacturing Technologies, Design Optimization & Composites (T6-2)

Session chairs: Professor Asfaw Beyene, San Diego State University, USA
Dr. Wakshum M. Tucho, University of Stavanger, Norway

Location: A-204

1	Utilizing Multiple Criteria Decision-making Optimization Methods for Electro-Discharge Machining Processes, <u>Mesay A. Tolcha</u> , <u>Hirpa G. Lemu</u>
2	Triply periodic minimal surfaces (TPMS) based functionally graded biomimetic scaffold fabrication via Stereolithography, <u>Yosef W Adugna</u> , <u>Hirpa G Lemu</u> , <u>Hanne R Hagland</u>
3	Comparative analysis of artificial neural network model and analysis of variance for predicting defect formation in plastic injection moulding processes, <u>Naol D. Dejene</u> , <u>Desalegn Wolla</u>
4	Literature review on thin-walled and cellular structure designs for energy absorption, <u>Tamana Dabasa</u> , <u>Yohannes Regassa</u> , <u>Hirpa G. Lemu</u>
5	Assessment of awareness levels towards additive manufacturing best practices in transforming traditional manufacturing: A case study in Ethiopian context, <u>Tekalign Lemma</u> , <u>Hirpa G. Lemu</u> , <u>Endalkachew M. Gutema</u>
6	Additive manufacturing and its impacts on supply chain performance: a case study in Ethiopia footwear industries, <u>Tekalign Lema</u> , <u>Endalkachew M. Gutema</u> , <u>Hirpa G. Lemu</u>

Underlined author names are presenting authors.

Session 13: Smart Energy Storage, Integration and Utilization (T7-2)

Session chairs: Prof. Mohammed Pourkashanian, University of Sheffield, United Kingdom
Prof. Mohsen Assadi, University of Stavanger, Norway

Location: A-101

1	Artificial Neural Network Model for Optimizing CO ₂ Heat Pump Systems for Domestic Hot Water, Heating, and Cooling, <u>Fredrik Skaug Fadnes</u> , <u>Mohsen Assadi</u> , <u>Reyhaneh Banihabib</u>
2	Day-ahead optimal scheduling of micro gas turbine-based microgrid considering electricity and heating energy, <u>Qian Zhang</u> , <u>Mohsen Assadi</u>
3	Numerical Modeling of a High Temperature Borehole Thermal Energy Storage System: Norway Case Study, <u>Abdelazim Abbas Ahmed</u> , <u>Mohsen Assadi</u> , <u>Raoof Gholami</u> , <u>Naveed Ahmed</u>
4	Development of a surrogate model of a trans-critical CO ₂ heat pump for use in operations optimization using an artificial neural network, <u>Thor Alexis Sazon</u> , <u>Qian zhang</u> , <u>Homam Nikpey</u>
5	Numerical investigation on pillow plate heat exchangers: Effects of nanofluid and geometry, <u>Ali Karimi</u>
6	Review of recent advancement in performance, and thermal energy storage studies on indirect solar dryers for agricultural products, <u>Gadisa D. Shekata</u> , <u>Getachew S. Tibba</u> , <u>Aklilu T. Baheta</u>

Underlined author names are presenting authors.

12:30 – 13:30

Lunch break



13:30 – 15:00 FIVE Parallel Sessions

Session 14: Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology (T2-4)

Session chairs: Dr. Xueliang Wen, University of Stavanger, Norway
Dr. Chao Ren, University of Stavanger, Norway

Location: E-101

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|---|---|
| 1 | Research on dynamic responses of mooring line system of floating offshore structures in Vietnam sea conditions using random model, <u>Hien Hau Pham</u> , <u>Tri Mai</u> , <u>Yiliu Liu</u> |
| 2 | Numerical study on the de-ballasting operation of a floating dock with a malfunctioning pump, <u>Jianan Zhang</u> , <u>Xueliang Wen</u> and <u>Muk Chen Ong</u> |
| 3 | Dynamic response of a floating dock under corrosion-induced accidents, <u>Terry Zahi</u> , <u>Xueliang Wen</u> , <u>Muk Chen Ong</u> |
| 4 | Numerical study on the lifting operation of a gravity-type fish cage, <u>André Gjerde</u> , <u>X. Wen</u> , <u>M.C. Ong</u> |
| 5 | Calculation and prediction of suspended span caused by erosion of deep water submarine pipelines. <u>Xu Jia</u> , <u>Kankan Ni</u> , <u>Yancheng Li</u> , <u>Lusheng Jia</u> |

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Session 15: Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology (T2-5)

Session chairs: Prof. Henry Hooi Siang Kang, University of Technology Malaysia
Dr. Aleksander Kniat, Gdansk University of Technology

Location: E-102

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| 1 | Assessment of a novel PTO system for swell energy converters using digital twin modelling, <u>Chao Ren</u> , <u>Yihan Xing</u> , <u>Lyder Moen</u> |
| 2 | Fixed Type-Oscillating Water Column Front Wall Angle Variation and Impact on Chamber Performance: CFD Numerical Wave Tank Assessment, <u>A.H Samitha Weerakoon</u> , <u>Thilan De Silva</u> , <u>Mohsen Assadi</u> |
| 3 | Effect of a rotational damper on a moored and articulated multibody offshore system in waves, <u>Qi Zhang</u> , <u>Ould el Moctar</u> , <u>Changqing Jiang</u> |
| 4 | Numerical analysis of semiconductor-based energy conversion technologies for offshore applications, <u>Tae Young Kim</u> , <u>Taeho Choi</u> , <u>Jung Hwan Lee</u> |
| 5 | Numerical investigation of VIMEC oscillator hydrodynamic performance using overset mesh approach, <u>Olexandr S. Mikhno</u> , <u>Muk Chen Ong</u> , <u>Marek Jan Janocha</u> |

Session 16: Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology (T2-6)

Session chairs: Assoc. Prof. Zhiyu Jiang, University of Agder, Norway
Dr. Marek Jan Janocha, University of Stavanger, Norway

Location: A-101

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| 1 | Feasibility of fiber optic sensors in measurements inside floating dock, <u>Aleksander Kniat</u> , <u>Michał Wójcik</u> |
| 2 | A space-time symmetry preserving discretization scheme for initial value problems <u>Alexander Rothkopf</u> , <u>Jan Nordström</u> |
| 3 | MATT'S PATROLL: A Generalized Framework to Track Marine Litter Path, Fare, and Toll, <u>Jazzie Jao</u> , <u>Edgar Vallar</u> , <u>Marlon Era</u> , <u>Marc Jeff Lanada</u> , <u>Jezzel Jao</u> |
| 4 | Selecting the inlet configuration for gas-liquid cylindrical cyclone separator, <u>Van Sy Le</u> , <u>Thi Lan Nguyen</u> |
| 5 | Optimization of bend stiffeners of a suspended inter-array power cable between two floating Offshore wind turbines, <u>Dan Liu</u> , <u>Izwan Ahmad</u> , <u>Marek Jan Janocha</u> , <u>Per Nyström</u> , <u>Muk Chen Ong</u> |

Underlined author names are presenting authors.



<p>Session 17: Smart Operations and Maintenance (T5-2) Session chairs: Professor Yiliu Liu, NTNU, Norway Assoc. Professor Idriss El-Thalji, University of Stavanger, Norway</p> <p><i>Location: E-166</i></p>	
1	Quantifying Benefits of Cloud Services Using Simulation Modelling Approach, <u>Abdulrahman Al-Ani</u> , <u>Idriss El-Thalji</u>
2	Ship Emission Projections Using Machine Learning for Sustainable Shipping in the Strait of Malacca and Singapore, <u>Ki Hong Ten</u> , <u>Hooi-Siang Kang</u> , <u>Chee Hoo Kok</u> , <u>Chee-Loon Siow</u> , <u>Kuan Yew Wong</u> , <u>Choon Hee Ong</u> , <u>Yiliu Liu</u>
3	Systems Dynamic Model of Wear Evolution for Sheaves used in Oil and Gas Hoisting Operations, <u>Soumya Barua</u> , <u>Idriss El-Thalji</u>
4	Optimization of the Waste Collection Arc Routing Problem using the Physics-based Electromagnetism-Like Algorithm, <u>Jazzie Jao</u> , <u>Edgar Vallar</u>
5	Microeconomic and Macroeconomic Analyses of the Potential Geographic Business Expansion of a Publicly Listed Philippine Company Engaged in Manufacturing of Compostable Additives <u>Jezzel Jao</u> , <u>Jazzie Jao</u> , <u>Edgar Vallar</u> , <u>Marlon Era</u>
Underlined author names are presenting authors.	
<p>Session 18: Advanced Computational Methods & Applications in Marine, Subsea and Offshore Technology (T2-7) Session chairs: Professor Lars Erik Holmedal, Norwegian University of Science Technology Professor Muk Chen Ong, University of Stavanger</p> <p><i>Location: A-204</i></p>	
1	Numerical investigation on unidirectional oscillatory flow past a circular cylinder at low Reynolds number and high Keulegan–Carpenter number, <u>Zhishuo Zhang</u> , <u>Jianxun Zhu</u> , <u>Cai Tian</u> and <u>Lars Erik Holmedal</u>
2	Oscillatory flow over cylinders, <u>Xinru Wang</u> , <u>Jianxun Zhu</u> , <u>Lars Erik Holmedal</u>
3	Flow over step cylinders, <u>Jianxun Zhu</u> , <u>Cai Tian</u> , <u>Lars Erik Holmedal</u>
4	Turbulent flow over a dimple, <u>Jianxun Zhu</u> , <u>Cai Tian</u> , <u>Lars Erik Holmedal</u>
5	Insights into the Three-dimensional Effect of Flow past an Inclined Circular Cylinder using Large Eddy Simulations, <u>Guang Yin</u> , <u>Gen Li</u> , <u>Marek Jan Janocha</u> , <u>Muk Chen Ong</u>
Underlined author names are presenting authors.	
15:00 – 15:20 Coffee break	
15:20 – 16:00 Award Ceremony and Conference Closing (Location: E-102)	

Conference Organizer

Department of Mechanical and Structural Engineering and Materials Science



Bachelor studies within

- Mechanical Engineering
- Structural Engineering

MSc studies within

- Engineering Structures and Materials
- Industrial Asset Management
- Marine- and Offshore Technology

PhD-studies within

- Offshore Technology

