

# Second Conference of Computational Methods in Offshore Technology and First Conference of Oil and Gas Technology in Cold Climate

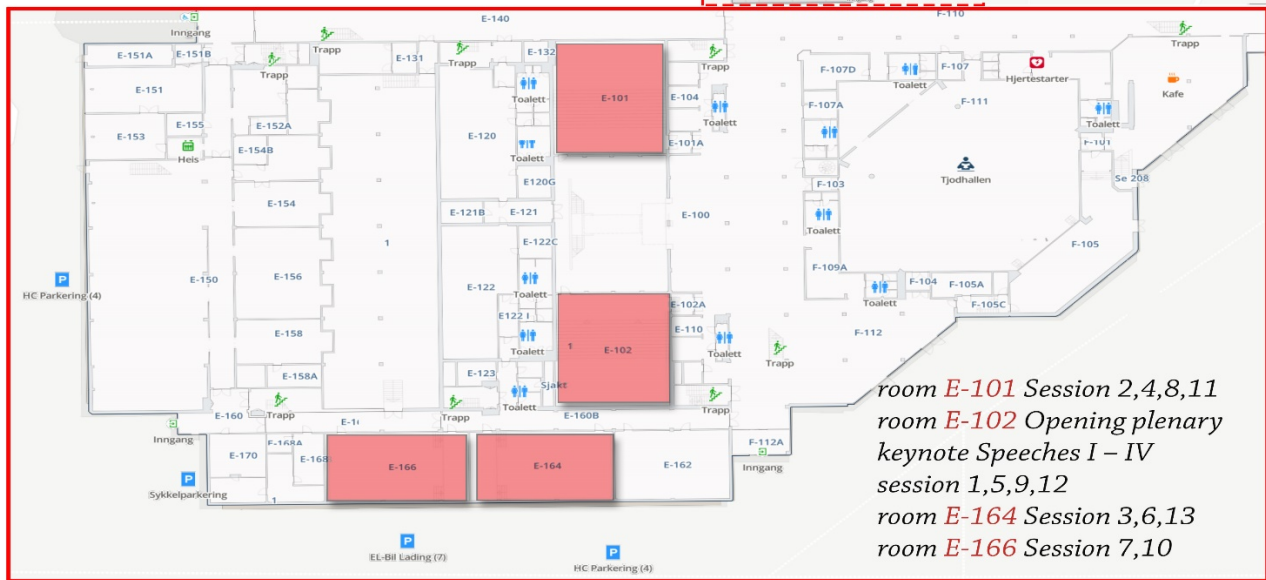
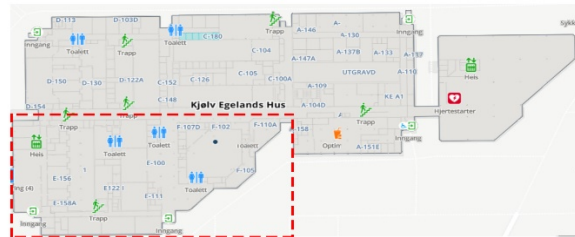
**(COTech & OGTech 2019)**

*November 27 – 29, 2019, University of Stavanger, Norway*



## Final Program

# CO Tech & OG Tech 2019



room **E-101** Session 2,4,8,11  
 room **E-102** Opening plenary  
 keynote Speeches I – IV  
 session 1,5,9,12  
 room **E-164** Session 3,6,13  
 room **E-166** Session 7,10

Opening Plenary	Day 1	8:45 – 9:20
Keynote Speech I	Day 1	9:20 – 10:40
Keynote Speech II	Day 1	11:00 – 12:20
Keynote Speech III	Day 2	8:40 – 10:00
Keynote Speech IV	Day 2	10:20 – 11:40
1 Computational mechanics and Design Optimization I	Day 1	13:20 – 14:50
2 Structural Integrity Management and Life Extension of Structures 1	Day 1	13:20 – 14:50
3 Oil & Gas Field Development in the Cold Climate Region 1	Day 1	13:20 – 14:50
4 Computational Mechanics and Design Optimization 2	Day 1	15:10 – 16:40
5 Structural Integrity Management and Life Extension of Structures 2	Day 1	15:10 – 16:40
6 Industrial Engineering in Industry 4.0	Day 1	15:10 – 16:40
7 Energy Resources Development in the Arctic	Day 1	15:10 – 16:40
8 Wind Engineering and Renewable Energy	Day 2	13:00 – 14:30
9 Advanced Computational Methods & Applications in Marine & Offshore Technology	Day 2	13:00 – 14:30
10 Technologies in the Upstream Sector in Oil- and Gas Industry with Emphasis on the High North 1	Day 2	13:00 – 14:30
11 Computational Mechanics and Design Optimization 3	Day 2	14:50 – 16:20
12 Technologies in the Upstream Sector in Oil- and Gas Industry with Emphasis on the High North 2	Day 2	14:50 – 16:20
13 Oil & Gas Field Development in the Cold Climate Region 2	Day 2	14:50 – 16:20





# Program for COTech & OGTech 2019 Conference

November 27 – 29, 2019  
University of Stavanger, Norway

Program at glance		
Date	Time	Events
<b>Day 0:</b> Nov. 27	International & national participants arrive	
	13:00 – 16:00	Student presentations (Prof. A Zolotukhin and Prof. D Pavlou)
	13:00 – 18:00	Registration (Optional)
<b>Day 1:</b> Nov. 28,	08:00 – 08:45	Registration
	08:45 – 09:20	Conference opening
	09:20 – 10:00	<b>Keynote 1</b> Professor Jørgen Amdahl
	10:00 – 10:40	<b>Keynote 2</b> Professor Hojjat Adeli
	10:40 – 11:00	Coffee break
	11:00 – 11:40	<b>Keynote 3</b> Professor Dimitris A. Saravanos
	11:40 – 12:20	<b>Keynote 4</b> Professor Anatoly B. Zolotukhin
	12:20 – 13:20	Lunch break
	13:20 – 14:50	THREE Parallel Sessions
	14:50 – 15:10	Coffee break
	15:10 – 16:40	FOUR Parallel Sessions
	17:00 – 19:30	Visiting Stavanger Oil Museum
	19:30 – 21:30	Conference Dinner
	<b>Day 2:</b> Nov. 29	08:00 – 08:40
08:40 – 09:20		<b>Keynote 5</b> Professor dr. sc. Hrvoje Jasak
09:20 – 10:00		<b>Keynote 6</b> Professor Jakob Mann
10:00 – 10:20		Coffee break
10:20 – 11:00		<b>Keynote 7</b> Professor Svein Sævik
11:00 – 11:40		<b>Keynote 8</b> Arne Dugstad
11:40- 12:00		<b>Special session: Double degree MSc program UiS - Gubkin</b>
12:00 – 13:00		Lunch break
13:00 – 14:30		THREE Parallel Sessions
14:30 – 14:50		Coffee break
14:50 – 16:20		THREE Parallel Sessions
16:20 – 16:30		<b>Conference Closing</b>

**Time allocation:** Keynote: max. 40 min; Each article: 15 min including Q & A



## Preface

This conference is organized as a joint event of the COTech (Computational Methods in Offshore Technology) and OGTech (Oil and Gas Technology) conferences. The COTech 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). This Program Area for Research was founded in 2015 with seven professor, 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 offshore-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.

The OGTech conference is organized as part of a collaborative project called UTFORSK between a team of researchers from University of Stavanger and Gubkin Russian University of Oil and Gas. The overall aim of the project is to make the team stronger and more sustainable. Among others, the project focuses on building a bridge of collaboration in research and education between the two countries, Norway and Russia, that share the Arctic region and to strengthen the research aspects of the Offshore Technology field in Arctic environment. By facilitating mobility of researchers and staff in both directions, the project aims to provide a common and successful learning environment for young researchers (Masters and PhDs) to make sure that students have skills and knowledge required in order to face the challenges that the Offshore industry meets in the North - such as environmental aspects and Offshore Technology within subsea/ marine structures in cold climate.

In general, the conference is intended to provide a platform for academics and professionals working within both the Offshore 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 a multidisciplinary research and brings together Norwegian and invited foreign researchers to enable them exchange their research experience and disseminate their results within the involved fields. The conference is organized under 8 thematic areas, which will also serve as conference sessions.

1. *Wind Engineering and Renewable Energy*
2. *Advanced Computational Methods and Applications in Marine Technology*
3. *Computational Mechanics and Design Optimization*
4. *Structural Integrity Management and Life Extension of Structures*
5. *Oil & Gas Field Development in the Cold Climate Region*
6. *Energy Resources Development in the Arctic*
7. *Technologies in the Upstream Sector in Oil- and Gas Industry with Emphasis on the High North*
8. *Industrial Engineering in Industry 4.0*

Among the submitted manuscripts, 66 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. Eight 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 COTech & OGTech 2019 conference. The financial support from Department of Mechanical and Structural Engineering and Materials Science at University of Stavanger as well as the project funding from Diku (Norwegian Agency for International Cooperation and Quality Enhancement in Higher Education) through the UTFORSK project are highly appreciated.

Stavanger, November 27, 2019  
*Hirpa G. Lemu, Prof.*  
Chairman of the Organizing Committee



## Conference Organizing Committee

Prof. Hirpa G. Lemu  
Prof. Emeritus Ivar Langen  
Prof. Emeritus Bjørn H. Hjertager  
Prof. Emeritus Ove Tobias Gudmestad  
Prof. Anatoly Zolotukhin  
Prof. Dimitrios Pavlou  
Prof. Muk Chen Ong,  
Assoc. Prof. Ove Mikkelsen  
Mrs. Vlada Streletskaya

## Topic Area Coordinators

Prof. Jasna B. Jakobsen  
Prof. Muk Chen Ong  
Prof. Dimitrios Pavlou  
Adjunct Prof. Gerhard Ersdal  
Prof. Emeritus Ove T. Gudmestad  
Prof. Anatoly Zolotukhin  
Prof. Tor Henning Hemmingsen  
Assoc. Prof. Idris El-Thalji

## Invited Keynote Speakers

**Prof. Jørgen Amdahl**, Norwegian University of Science and Technology, NTNU, Norway  
**Chief Scientist Arne Dugstad**, Institute for Energy Technology (IFE), Norway  
**Prof. dr. sc. Hrvoje Jasak**, University of Zagreb, Croatia  
**Prof. Dimitris A Saravanos**, University of Patras, Greece  
**Prof. Svein Sævik**, Norwegian University of Science and Technology, NTNU, Norway.  
**Prof. Jakob Mann**, DTU Wind Energy, Denmark  
**Prof. Anatoly Zolotukhin**, Gubkin Russian State University (NRU) of Oil and Gas, Russia  
**Prof. Hojjat Adeli**, The Ohio State University, USA



## Technical Committee Members and Reviewers

1. Ass. Prof. Mustafa Serkan Abdüsselam, Giresun University, Turkey
2. Prof. Henning Agerskov, Technical University of Denmark (DTU), Denmark
3. Assoc. Professor Paul Akangah, North Carolina A&T State University, USA
4. Dr. José António Correia, University of Porto, Portugal
5. Prof. Sergey Arsenyev-Obraztsov, Gubkin University, Russia
6. Prof. Ivar Austvoll, University of Stavanger, Norway
7. Assoc. Prof. Vladimir P. Balitskiy, Gubkin Oil & Gas University, Russia
8. Prof. Abbas Barabady, The Arctic University of Norway (UiT), Norway
9. Prof. Kostas Belibassakis, National Technical Univ. of Athens, Greece
10. Prof. André De Boer, University of Twente, The Netherlands
11. Prof. Robert Brown, Memorial University of Newfoundland, Canada
12. Prof. Hermes Carvalho, Federal University of Minas Gerais, Brazil
13. Ass. Prof. José Miguel Castro, University of Porto, Portugal
14. Dr. Etienne Cheynet, University of Stavanger, Norway
15. Dr. Nianzhong Chen, University of Newcastle, UK
16. Dr. José António Correia, University of Porto, Portugal
17. Prof. Sreekanta Das, University of Windsor, Canada
18. Mr. Stanislav Duplinsky, Subsea 7, Norway
19. Assoc. Prof. David Fuhrman, Technical University of Denmark (DTU), Denmark
20. Prof. Alexander Ermakov, Gubkin University, Russia
21. Adjunct Prof. Gerhard Ersdal, University of Stavanger, Norway
22. Prof. Tiago Fazer-Ferradosa, University of Porto
23. Dr. Stephen Fox, VTT Technical Research Centre of Finland, Finland
24. Prof. Koh Chan Ghee, National Univ. of Singapore (NUS), Singapore
25. Assoc. Prof. Knut Erik Giljarhus, University of Stavanger, Norway
26. Adj. Prof. Torfinn Havn, University of Stavanger, Norway
27. Prof. Emeritus Bjørn Hjertager, University of Stavanger, Norway
28. Prof. Lars Erik Holmedal, Norwegian Univ. of Sci. and Technology (NTNU), Norway
29. Adj. Assoc. Prof. David Häger, University of Stavanger, Norway
30. Prof. Jasna Jakobsen, University of Stavanger, Norway
31. Prof. Hrvoje Jasak, University of Zagreb, Croatia
32. Assoc. Prof. Tore M. Jonassen, Oslo University College, Norway
33. Adjunct Prof. Daniel Karunakaran, University of Stavanger, Norway
34. Prof. Uday Kumar, University of Luleå, Sweden
35. Prof. Emeritus Ivar Langen, University of Stavanger, Norway
36. Dr. Gunnar Lian, Equinor, Norway
37. Prof. Jayantha Prasanna Liyanage, University of Stavanger, Norway
38. Dr. Inge Lotsberg, DNV GL Oslo, Norway
39. Assoc. Prof. Lin Li, University of Stavanger, Norway
40. Dr. Pavel Liferov, Statoil AS, Norway
41. Dr. Yuzhu Li, Technical University of Denmark, Denmark
42. Dr. Shengnan Liu, Subsea 7, Norway
43. Assoc. Prof. STILIANOS MARKOLEFAS, University of Athens, Greece
44. Prof. Tore Markeset, University of Stavanger, Norway
45. Assoc. Prof. Ove Mikkelsen, University of Stavanger, Norway
46. Dr. Per Olav Moslett, DNV, Norway



47. Prof. Mohamad Mustafa, The Arctic University of Norway (UiT), Norway
48. Prof. Håkan Nilsson, Chalmers University of Technology, Sweden
49. Prof. Ove Njå, University of Stavanger, Norway
50. Assoc. Prof. Pantelis Nikolakopoulos, University of Patras, Greece
51. Assoc. Prof. Charlotte Obrai, University of Stavanger, Norway
52. Dr. Piotr Omenzetter, University of Aberdeen, UK
53. Dr. Theodosios Papatthasiou, Brunel University, London, UK
54. Dr. Luca A. Piciaccia, VEAS, Norway
55. Prof. Demosthenes Polyzos, University of Patras, Greece
56. Prof. Jose Victor Ramos, University of Porto
57. Prof. Paulo Rosa-Santos, University of Porto, Portugal
58. Prof. Raviliy Safieva, Gubkin Oil & Gas University, Moscow, Russia
59. Assoc. Prof. Hilde Sandhåland, Western Norway University of Applied Sciences, Norway
60. Prof. John V Sharp, Brunel University London, UK
61. Prof. Jonas T. Snærbjörnsson, Rykjavik University, Iceland
62. Assoc. Prof. Sudath Siriwardane, University of Stavanger, Norway
63. Assoc. Prof. Yanyan Sha, University of Stavanger, Norway
64. Assoc. Prof. Hodjat Shiri, Memorial Univ. of Newfoundland, Canada
65. Dr. Srinivas Sriramula, University of Aberdeen, UK
66. Prof. Francisco Taveira-Pinto, University of Porto, Portugal
67. Prof. Michalis Vrahopoulos, University of Athens, Greece
68. Dr. Jungao Wang, University of Stavanger, Norway
69. Prof. Yihan Xing, University of Stavanger, Norway
70. Prof. Qian Xudong, National University of Singapore (NUS), Singapore
71. Dr. Guang Yin, University of Stavanger, Norway
72. Prof. Stefanos Zaoutsos, University of Thessaly, Greece
73. Prof. Anatoly B. Zolotukhin, Gubkin University, Russia
74. Assoc. Prof. Sigmund Kyrre Ås, Norwegian University of Science and Technology (NTNU), Norway



## Main Conference Program, November 28 and 29, 2019

DAY 1	
Thursday, November 28, 2019	
08:00 -08:45 <i>Location</i>	Registration <i>In front of Auditorium E-102</i>
<b>08:45 – 09:20</b>	<b>Opening plenary</b> Øystein Lund Bø, Dean of Faculty of Science and Technology, UiS Professor Hirpa G. Lemu, Chairman of Conference Organizing Committee Professor Anatoly Zolotukhin and Professor Dimitrios Pavlou, Organizers of OGTech 2019
<b>09:20 – 10:40</b> <i>Chair:</i> <i>Location</i>	<b>Keynote Speeches I</b> <b><i>Professor Emeritus Ove T Gudmestad, University of Stavanger</i></b> <i>Auditorium KE E-102</i>
09:20 – 10:00	<b>Keynote 1: Impact from Ice Floes and Icebergs on Ships and Offshore Structures in Polar Regions</b> <i>Professor Jørgen Amdahl, Norwegian University of Science and Technology, NTNU, Norway</i>
10:00 – 10:40	<b>Keynote 2: Advances in Structural Health Monitoring</b> <i>Professor Hojjat Adeli, The Ohio State University, USA</i>
10:40 – 11:00	Coffee break
<b>11:00 – 12:20</b> <i>Chair</i> <i>Location</i>	<b>Keynote Speeches II</b> <b><i>Professor Alexander Ermakov, Gubkin University of Oil and Gas, Russia</i></b> <i>Auditorium KE E-102</i>
11:00 – 11:40	<b>Keynote 3: Damping in Composite Materials, Laminates and Wind Turbine Blade Structures</b> <i>Professor Dimitris A Saravanos, University of Patras, Greece</i>
11:40 – 12:20	<b>Keynote 4: Innovation Technologies in Offshore Field Development with the Emphasis on the Arctic</b> <i>Professor Anatoly B Zolotukhin, Gubkin University of Oil and Gas, Russia</i>
12:20 – 13:20	Lunch break





### Keynote 1

*Impact from Ice Floes and Icebergs on Ships and Offshore Structures in Polar Regions*

**Professor Jørgen Amdahl**, Norwegian University of Science and Technology, NTNU, Norway

**Abstract:** Oil activity, shipping and cruise traffic in Arctic regions increase, partly sparked by global warming. This instigates safety concerns with respect to environmental pollution, fatalities and economic loss. With large distances to infrastructure it may be challenging to assist in case of critical events. Structural damage due to impacts from ice floes and icebergs may become fatal if excessive flooding and loss of stability occur. Ships and oil rigs operating in permanent ice cover will need to be ice-strengthened. Lightly ice-strengthened or non-ice strengthened structure may operate close to the ice edge or may need to move into light ice-conditions, e.g. during search and rescue operations. Traditionally, the design against ice loads has been based on ultimate limit state (ULS) principles; i.e. the structure shall crush the ice with minor deformations. However, for extreme ice events or for insufficient resistance, the structure may undergo large permanent deformations. Such events must be dealt with in the Accidental Limit State (ALS) format, which is not well developed for ice loads. The presentation will review the principles for ULS design and ALS design and show how they may differ substantially. Material modeling of the ice for nonlinear finite element analysis (NLFEA) of ice-structure interaction is reviewed. Aspects of local and global shape of the ice feature are discussed in view of external mechanics (demand for energy dissipation) and internal mechanics (local damage). Simplified methods for structural damage assessment are reviewed for ice loads that may move both transverse to and along the shell plating. Application examples of the ALS principles will be presented.

### Keynote 2

*Advances in Structural Health Monitoring*

**Professor Hojjat Adeli**, The Ohio State University, USA

**Abstract:** Structural Health Monitoring (SHM) has been at the forefront of structural engineering research in the past two decades. Together with active/semi-active vibration control technology, they make the smart structure technology. SHM approaches can be divided into vibration-based and imaging-based techniques, the latter using machine vision technology. For vibration-based SHM, the author has advanced a multi-paradigm approach through adroit integration of a signal processing technique, chaos and fractality analysis, and machine learning (ML) techniques. ML is a key and increasingly pervasive technology in the 21st century. It is going to impact the way people live and work in a significant way. Machine learning algorithms developed by the author and his associates are briefly described with applications for health monitoring of structures. Models are presented for locating, detecting, and quantifying damage in smart highrise building structures.



## Day 1 Keynote Speeches II

(E-102)

**Chair: Professor Alexander Ermakov, Gubkin University of Oil and Gas, Russia**

### Keynote 3

*Damping in Composite Materials, Laminates and Wind Turbine Blade Structures*

**Professor Dimitris A Saravanos**, University of Patras, Greece

**Abstract:** Damping is among the properties of polymer-matrix composites which have received moderate attention and is less understood. The damping of composite materials is always available due to the polymer matrix, is highly anisotropic and tailorable, yet antagonistic to stiffness and strength. Therefore, the prediction of structural damping in off-shore composite wind-turbine blades is challenging, and requires development of robust multi-scale analytical capabilities. The presentation will review past and on-going analytical, numerical and experimental research conducted on this subject. Mechanics for predicting the damping of composite plies and multi-ply laminates are summarized, and damping characterization methods are proposed. The equivalent damping properties at blade cross-sections are outlined, and ultimately the prediction of structural damping in composite blades using reduced-order beam finite elements is presented. Large displacements and geometric nonlinearity are finally included in the prediction of damping of large flexible off-shore wind turbine blades. Numerical results are presented and correlated with measured data

### Keynote 4

*Innovation Technologies in Offshore Field Development with the Emphasis on the Arctic*

**Professor Anatoly B Zolotukhin**, Gubkin University of Oil and Gas, Russia

**Abstract:** Development of oil and gas fields located on the Arctic shelf is characterized by complex natural and climatic conditions, an incomplete and heterogeneous database, large investments, high economic, environmental and operational risks. All this should be thoroughly evaluated and must be taken into account when deciding on the development of the field and the choice of concept. Several modern approaches in development of hydrocarbon resources are considered in the presentation. Those include exploration potential and challenges in arctic waters, innovations in drilling, reservoir and production engineering, transportation of hydrocarbons, smart well concept deployment, evaluation of technical accessibility of the northern seas and a multi-criteria evaluation of the effectiveness of field development concept. Important issues and challenges of machine learning and specialist training are also discussed in the presentation.



<b>DAY 1</b>		<b>Thursday, November 28, 2019</b>	
<b>13:20 – 14:50</b>		<b>Three Parallel Sessions</b>	
<b>Session 1: Computational Mechanics and Design Optimization 1</b>			
Session chairs		Professor Alexander Ermakov, Gubkin University of Oil and Gas, Russia Professor Stefanos Zaoutsos, University of Thessally, Larissa, Greece	
Location		E-101	
1	Optimal sea floor placement of the oil/gas production equipment, <i>S S Arsenyev-Obratsov, A I Ermolaev and A M Kuvichko</i>		
2	Optimal thermobaric parameters determination of natural gas dehydration in LNG production, <i>E B Fedorova, V B Mel'nikov, E B Gafarova and V A Fedorova</i>		
3	Assessment of jacket-type platform stress state in corrosive environment: Case study, <i>I Starokon and A Ermakov</i>		
4	Contact stresses associated with the wedge-lock mechanism in a prototype subsea pipeline recovery tool, <i>Yihan Xing, N B Eriksson, Muck C Ong and C Knutsen</i>		
5	Flexural dynamic behavior of submerged cylindrical structures under wave loads, <i>T Giotis, D Pavlou and K A Belibassakis</i>		
6	Machine learning in reservoir permeability prediction and modelling of fluid flow in porous media, <i>A B Zolotukhin and A T Gayubov</i>		
<b>Session 2: Structural Integrity Management and Life Extension of Structures 1</b>			
Session chairs		Adjunct Professor Gerhard Ersdal, University of Stavanger, Norway Assoc. Professor Ove Mikkelsen, University of Stavanger, Norway	
Location		E-102	
1	Time-variant rule-based reliability of corroded structures by Monte Carlo simulation, <i>K M Neumann, B Leira, O T Vårdal and S Ehlers</i>		
2	Synthesis and characterization of fly ash and slag based geopolymer concrete, <i>Børge Kallesten, Samdar Kakay and Kidane Gebremariam</i>		
3	Predictive maintenance (PdM) analysis matrix: A tool to determine technical specifications for PdM ready-equipment, <i>Idris El-Thalji</i>		
4	An efficient approach for ship collision design of reinforced concrete pontoon walls, <i>Y Sha, J Amdahl and K Yang</i>		
5	A web based solution to track trawl vessel activities over pipelines in Norwegian Continental Shelf, <i>M Farmanbar, A Palanisamy, A B Høydal, A Keprate and G Haug</i>		
<b>Session 3: Oil &amp; Gas Field Development in the Cold Climate Region 1</b>			
Session chairs		Professor Jørgen Amdahl, NTNU, Norway Ove T Gudmestad, University of Stavanger, Norway	
Location		E-164	
1	Choice of fuel system for the offshore support fleet, <i>M L Eliassen and O T Gudmestad</i>		
2	The influence of the composition of water on the results of accelerated aging resistance testing of low voltage subsea cables insulation, <i>R Erfurth1 and O T Gudmestad</i>		
3	Rationale for development of design basis for Barents Sea field developments, <i>Ove T Gudmestad</i>		
4	Development of a method for evaluation of measures used for winterization of offshore facilities and units, <i>S R Jacobsen, S Vidval, K G Dørum, O T Gudmestad and H S Wiencke</i>		
<b>14:50 – 15:10</b>		<b>Coffee break</b>	



<b>DAY 1</b>		<b>Thursday, November 28, 2019</b>
<b>15:10 – 16:40</b>		<b>Four Parallel Sessions</b>
<p><b>Session 4: Computational Mechanics and Design Optimization 2</b>            Session chairs Professor Tiago Fazeres-Ferradosa, University of Porto, Portugal            Professor Dimitrios G Pavlou, University of Stavanger, Norway            Location E-101</p>		
1	Fretting fatigue and wear of mechanical joints: Literature study <i>Øyvind Karlsen and Hirpa G Lemu</i>	
2	Numerical analysis of the influence of friction conditions on the pile-up effect in Vickers hardness measurements, <i>Thomas Trzepiecinski and Hirpa G Lemu</i>	
3	Implementation of linear, double-linear, and nonlinear fatigue damage accumulation rules for fatigue life prediction of offshore drilling top-drive tie-rods, <i>Jesse E Inoma, Dimitrios G Pavlou and J Zec</i>	
4	Numerical study on the ventilation performance of a livestock house built in porous panels in Cold Regions, <i>Yihan Xu, M Y Mustafa, R K Calay and B R Sørensen</i>	
5	Brief review on the limit state function of dynamic scour protections, <i>Tiago Fazeres-Ferradosa, M Welzel, F Taveira-Pinto, P Rosa-Santos and J Chambel</i>	
6	Fatigue design challenges: Recent linear and nonlinear models, <i>Dimitrios G Pavlou</i>	
<p><b>Session 5: Structural Integrity Management and Life Extension of Structures 2</b>            Session chairs Narve Oma, Chief Engineer, Petroleum Safety Authority Norway            Associate Professor Sudath Siriwardane, University of Stavanger, Norway            Location E-102</p>		
1	Investigation of updating methods for probability-informed inspection planning for offshore structures, <i>Gerhard Ersdal and N Oma</i>	
2	Inspection planning for fatigue cracks in offshore structures by Monte Carlo simulations, <i>H Neeraas, G Ersdal, N Oma and N-Ch Hellevig</i>	
3	Acceptable Fatigue Crack Occurrence Rate, <i>O T Vårdal and T Moan</i>	
4	State-of-the-art of crack propagation modelling in tubular joints, <i>Mostafa Atteya, O Mikkelsen and H G Lemu</i>	
5	Buckling capacity of simulated patch corroded tubular columns – laboratory tests <i>T Vo, K Hestholm, G Ersdal, N Oma and M Sivertsvik</i>	
<p><b>Session 6: Industrial Engineering in Industry 4.0</b>            Session chairs Professor Rafiq Jamalov, ASOIU, Azarbaijan            Assoc. Professor Idris El-Thalji, University of Stavanger, Norway            Location E-164</p>		
1	A summary of adapting Industry 4.0 vision into engineering education in Azerbaijan, <i>A Ahadov, E S Asgarov and Idris El-Thalji</i>	
2	Scalability and compatibility analyses of airborne wind technology for maritime transport, <i>DA Domínguez Santana and Idris El-Thalji</i>	
3	Context analysis of Ofshore Fish Farming, <i>Idris El-Thalji</i>	
4	Feasibility study for utilization of solar energy in the Arctic areas, <i>S Tamrakar, M Mustafa and R Riise</i>	
5		



<p><b>Session 7: Energy Resources Development in the Arctic</b>          Session chairs Professor Anatoly Zolotukhin, Gubkin University of Oil and Gas, Russia          Professor Emeritus Ivar Langen, University of Stavanger  <i>Location E-166</i></p>	
1	<p>The Barents Sea of the Norwegian Continental Shelf: drilling through carbonates, modelling, risk management and well planning,  <i>M A Mosesyan, A Hartwig, K M Edin, A S Rabey and L M Surguchev</i></p>
2	<p>Application of multicriteria fuzzy clusterization approach to assess the arctic seas oil and gas field development prospects,  <i>K N Pivovarov, A B Zolotukhin and V V Streletskaya</i></p>
3	<p>Problem and models of multicriteria decision making and risk assessment of the arctic offshore oil and gas field development,  <i>Anatoly B Zolotuhin and Yu P Stepin</i></p>
4	<p>Remote inspection by the magnetic tomography method (MTM) to prevent the risks imposed by exploitation of Arctic offshore pipelines,  <i>S S Kamaeva, I S Kolesnikov, N A Eremin and L A Khusnutdinov</i></p>
5	<p>Digital transformation of gas production,  <i>A N Dmitrievskiy, N A Eremin and V E Stolyarov</i></p>

<b>17:00 – 19:30</b>	Visit to Stavanger Oil Museum and book presentation by Prof. Arnfinn Nergaard
<b>19:30 – 21:30</b>	Conference dinner, Bølgen & Moi



<b>DAY 2</b>	<b>Friday, November 29, 2019</b>
08:00 – 08:40	Registration
<b>08:40 – 10:00</b>	<b>Keynote Speeches III</b> <i>Chair: Professor Emeritus Bjørn H. Hjertager, University of Stavanger, Norway</i> <i>Location Auditorium KE E-102</i>
08:40 – 09:20	<b>Keynote 5: Multi-Scale Simulation of Extreme Wave Events</b> <i>Professor dr. sc. Hrvoje Jasak, University of Zagreb, Croatia</i>
09:15 – 10:00	<b>Keynote 6: Turbulent Loads on Wind Turbines Anticipated by Forward-looking Doppler Lidars.</b> <i>Professor Jakob Mann, DTU Wind Energy, Denmark</i>
10:00 – 11:20	Coffee break
<b>10:20 – 11:40</b>	<b>Keynote Speeches IV</b> <i>Chair Professor Emeritus Ivar Langen, University of Stavanger, Norway</i> <i>Location Auditorium KE E-102</i>
10:20 – 11:00	<b>Keynote 7: The use of Curved Sandwich Beam Based Finite Elements in Stress Analysis of Slender Structures with Complex Cross-sections</b> <i>Professor Svein Sævik, Norwegian University of Science and Technology, NTNU, Norway</i>
11:00 – 11:40	<b>Keynote 8: Transport and injection of CO<sub>2</sub> - Technological Challenges</b> <i>Arne Dugstad, Chief Scientist, Institute for Energy Technology (IFE), Norway</i>
11:40 – 12:00	<b>Special session on Double MSc Degree Programme UiS – Gubkin Collaboration</b> <i>Professor Emeritus Ove T Gudmestad and Professor Anatoly Zolotukhin</i>
12:00 – 13:00	Lunch break



## Keynote 5

### *Multi-Scale Simulation of Extreme Wave Events*

**Professor dr. sc. Hrvoje Jasak**, University of Zagreb, Croatia

**Abstract:** CFD simulations of wave and current loading on off-shore objects may be the most reliable source of extreme structural loading on off-shore structures. Under such conditions, experimental methods suffer from scaling law limitations and full-scale data on actual loads are rarely, if ever, available. On the CFD modelling side, it is extremely hard to prescribe initial conditions that correspond to highest structural load, as they involve freak waves, non-linearity of the flow model, breaking waves, green water and potential structural response, such as springing and whipping of ships. The challenge in performing meaningful simulation of extreme loads requires a multi-scale approach. Here, the significant wave may be screened or manufactured based on the analysis of extreme condition. Once identified, the wave field needs to be reliably advected to the structure and ultimately its interaction with the structure needs to be captured. In this presentation, a multi-scale approach to extreme wave loads shall be presented, with the focus on computationally difficult aspects, such as green water and compressibility in wave impact. Practical simulations of extreme loads using OpenFOAM's Naval Hydro Pack shall be shown as illustration of the methodology.

## Keynote 6

### *Turbulent Loads on Wind Turbines Anticipated by Forward-looking Doppler Lidars.*

**Professor Jakob Mann**, DTU Wind Energy, Denmark

**Abstract:** Reducing loads on today's wind turbines with rotor diameters exceeding 200 m is important in order to minimize the cost of the energy harvesting turbines. Doppler lidars that measure the wind remotely are currently used to assess wind resources and may be mounted on the wind turbine nacelles to measure the wind direction and steer the turbine into the wind or to measure power curve of the turbine. Current research is investigating how to best use lidars to alleviate loads by forestalling turbulent gusts. Both experiments and modeling show that the more beam directions used by the nacelle-mounted lidars the higher the coherence between the lidar-derived wind and the wind seen by the turbine rotor. However, in normal cases, not much is gained by going beyond four to six beams. In cases where the inflow contains wakes from other turbines many more beam directions may be necessary.



**Keynote 7**

*The use of Curved Sandwich Beam Based Finite Elements in Stress Analysis of Slender Structures with Complex Cross-sections*

**Professor Svein Sævik**, Norwegian University of Science and Technology, NTNU, Norway

**Abstract:** The presentation addresses the use of curved sandwich beam based finite elements in stress analysis of dynamic flexible pipes, umbilicals and power cables. First, an introduction into the basic theory of curved beams, differential geometry, the kinematics of associated hybrid mixed contact elements and alternative models for describing the friction behavior between the relevant interfaces are given. This is followed by describing how the basic equations are applied to develop tailor-made finite elements. Then example applications are presented where the results from numerical studies are compared to monitored data obtained by full scale testing of both flexible pipe and umbilical cross-sections. Thereafter, the phenomenon of local buckling of tensile armor wires in deep water flexible pipes is discussed by comparing numerical results to both analytical equations and experimental results. Finally, the conclusions and direction of future research is presented.

**Keynote 8**

*Transport and injection of CO<sub>2</sub> - Technological Challenges*

**Arne Dugstad, Chief Scientist**, Institute for Energy Technology (IFE), Norway

**Abstract:** Extensive Carbon Capture and Storage (CCS) will require transport and injection of large quantities of liquid and supercritical CO<sub>2</sub>. The CO<sub>2</sub> stream will contain impurities (i.e. H<sub>2</sub>O, CH<sub>4</sub>, Ar, O<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub>, H<sub>2</sub>S, CO) that might affect the flow properties and the corrosion of pipeline and tubing material. Several tentative CO<sub>2</sub> specifications have been suggested in the literature, but due to lack of data there are currently no commonly agreed specifications for safe CO<sub>2</sub> transport. The lack of data is reflected in the ISO standard for CO<sub>2</sub> transport (issued 2016) that does not recommend specific CO<sub>2</sub> compositions, but states that “*The most up to date research should be consulted during pipeline design*”. The paper discusses state of the art, current challenges and recent research performed in the dense phase CO<sub>2</sub> laboratory at IFE





13:00 – 14:30 Three Parallel Sessions	
<p><b>Session 8: Wind Engineering and Renewable Energy</b>            Session chairs Professor Jasna B. Jakobsen, University of Stavanger, Norway            Professor Jonas T Snæbjörnsson, Reykjavik University, Iceland  <i>Location E-101</i></p>	
1	The performance of structured and unstructured grids on wind simulations around a high-rise building, <i>T-O Hågbo, K E T Giljarhus, S Qu and B H Hjertager</i>
2	Mooring systems analysis of floating wind turbines in Italian seas, <i>P Re, G Passoni, O T Gudmestad</i>
3	CFD simulations of a suspension bridge deck for different deck shapes with railings and vortex mitigating devices, <i>Ibuki Kusano, J B Jakobsen and J T Snæbjörnsson</i>
4	Testing of a new transport and installation method for offshore wind turbines, <i>J Haugvaldstad and O T Gudmestad</i>
5	The Influence of an unstable turbulent wind spectrum on the Loads and motions on floating Offshore Wind Turbines, <i>J M Knight and Charlotte Obhrai</i>
<p><b>Session 9: Advanced Computational Methods &amp; Applications in Marine &amp; Offshore Technology</b>            Session chairs Professor Muk Chen Ong, University of Stavanger, Norway            Associate Professor Knut Erik Giljarhus, University of Stavanger, Norway  <i>Location E-102</i></p>	
1	Assessment of wave runup and wave rundown based on observed long-term wave conditions, <i>Dag Myrhaug and T Sunde</i>
2	Investigation of transitional turbulence models for CFD simulation of the drag crisis for flow over a sphere, <i>S M Nakhostin and K E T Giljarhus</i>
3	Effects of an inserted circular cylinder on a steady lid-driven rectangular cavity flow, <i>J Zhu, L E Holmedal and D Myrhaug</i>
4	Numerical study on aerodynamic drag reduction and energy harvest for electric vehicle: a concept to extend driving range, <i>Alemayehu W Huluka and C H Kim</i>
5	Numerical simulation of flow around two 5:1 rectangular cylinders at a high Reynolds Number, <i>G Yin, T Monaci and M C Ong</i>
<p><b>Session 10: Technologies in the Upstream Sector in Oil- and Gas Industry with Emphasis on the High North 1</b>            Session chairs Professor Tor Henning Hemmingsen, University of Stavanger            Adjunct Professor Torfinn Havn, University of Stavanger  <i>Location E-166</i></p>	
1	Proposals on 3D parallel edge-preserving filtration for x-ray tomographic digital images of porous medium core plugs, <i>S S Arsenyev-Obratsov, E A Volkov and G O Plusch</i>
2	Field development optimization of waterflooding process using data assimilation methods, <i>R Guliev and A Zolotukhin</i>
3	Coupling well hydrodynamic tests data with results of digital simulation for better identification of reservoir properties, <i>Maria Khaydina and A Latysheva</i>
4	Integration of expert and data-driven workflows to manage reservoir and well life cycle in Arctic conditions using innovative SICLO methodology, <i>M Antonic, M Solesa, A B Zolotukhin, D Rakic and M Aleksic</i>



5	Work on structural integrity for semi submersibles exposed to bergy bits – integrated analysis of ice structure impacts, <i>W Lu, Z Yu, M Van D Berg, R Lubbad, E Kim, J Amdahl, L G Bjørheim, <u>Morten A Langøy</u> and S Løset</i>
14:30 – 14:50 Coffee break	
<b>14:50 – 16:20 Three Parallel Sessions</b>	
<b>Session 11: Computational Mechanics and Design Optimization 3</b>	
Session chairs Professor Andrés A Garcia-Granada, Universitat Ramon Llull, Spain Professor José António Correia, University of Porto, Portugal	
Location <i>E-101</i>	
1	Topology optimization through stiffness/weight ratio analysis for a three-point bending test of additive manufactured parts, <i>A A Garcia-Granada, J Catafal-Pedragosa and H G Lemu</i>
2	Optimization of well gas rates for offshore gas-condensate field, <i>A I Ermolaev, A A Nekrassov and I A Trubacheva</i>
3	Numerical simulation of FDM manufactured parts by adopting approaches in composite material simulation, <i>A D Akessa, A W Gebisa and H G Lemu</i>
4	Mechanical behavior of aluminum honeycomb sandwich structures under extreme low temperature conditions, <i>Stefanos P Zaoutsos</i>
5	The correlation and determination matrices associated with the burst design of a subsea carbon-fibre-epoxy composite flow-line, <i>Y Xing, W Xu, V Buratti</i>
6	Strength analysis of 3D printed carbon fibre reinforced thermoplastic using experimental and numerical methods, <i>Fitawi Ghebretinsae, Ove Mikkelsen and Adugna D Akessa</i>
<b>Session 12: Technologies in the Upstream Sector in Oil- and Gas Industry with Emphasis on the High North 2</b>	
Session chairs Professor Tor Henning Hemmingsen, University of Stavanger, Norway Professor Malcolm Kelland, University of Stavanger, Norway	
Location <i>E-102</i>	
1	Challenges with gas hydrate formation, <i>Malcolm A Kelland</i>
2	Comparative study of wax inhibitor performance for pour-point reduction of oil from Sirikit Oilfield in Thailand, <i>Kreangkrai Maneeintr, K Jongkittinarukorn and T Boonpramote</i>
3	About a method of acoustic impact on high viscosity oil fields, <i>Z N Alisheva, N A Eremin and G P Metaksa</i>
4	Study on application of colloidal particles of metal oxides to increase the oil recovery factor, <i>V I Lesin and N A Eremin</i>
5	Applying of the associative polymer solutions to enhance oil recovery, <i>R Zh Abirov and N A Eremin</i>
6	Castor oil as a biodegradable source to synthesis kinetic/anti-agglomerant methane hydrate inhibitors, <i>Abdolreza Farhadian and Mikhail A. Varfolomeev</i>



<b>Session 13:</b> Oil & Gas Field Development in the Cold Climate Region 2 Session chairs <b>Professor Emeritus Ove T Gudmestad, University of Stavanger, Norway</b> <b>Professor Anatoly Zolotukhin, Gubkin University of Oil and Gas, Russia</b> <i>Location E-164</i>	
1	Evaluation of ballast failures during operations of semi-submersible rigs, <i>N Unegbu and O T Gudmestad</i>
2	Survival in cold waters - learnings from participation in cold water exercises - a regulatory perspective related to the Norwegian offshore industry, <i>J E Jensen, K E Solberg and O T Gudmestad</i>
3	Pipeline shore crossing approaches in Arctic conditions, <i>L Kurbonshoeva, O T Gudmestad and A Zolotukhin</i>
4	Features of geotechnical surveys and leg penetration analysis for drilling platforms in the Arctic seas, <i>Ivan Marchenko</i>

<b>16:20 – 16:30</b>	<b>Conference closing</b>



**2<sup>nd</sup> Conference of Computational Methods in Offshore Technology  
(COTech 2019)**  
**1<sup>st</sup> Conference of Oil and Gas Technology in Cold Climate  
(OGTech 2019)**

---

November 27, 2019

*Student presentations*

**Oral Session**

1. *Ramil Guliev*: Field development optimization of water flooding process using data assimilation methods.
2. *Joakim Fischer*: Structural response of a composite multicopter drone for offshore structure inspection
3. *Abdumalik Gayubov*: Machine learning in reservoir permeability prediction and modelling of fluid flow in porous media.
4. *Vasilina Solou*: A review assessment of current ROV's technology
5. *Ivan Marchenko*: Features of geotechnical surveys and leg penetration analysis for drilling platforms in the Arctic seas.
6. *Yulia Zaripova*: A green and high cloud point kinetic methane hydrate and corrosion inhibitor based on sulfonated chitosan.
7. *Lesana Kurbonshoeva*: Pipeline shore crossing approaches in Arctic conditions.
8. *Vlada Streletskaya*: Application of multicriteria fuzzy clusterization approach to assess the arctic seas oil and gas field development prospects.
9. *Mariya Chudakova (Lazebnaya)*: Monitoring of natural fluid seeps along the Eastern coast of Sakhalin Island based on optical and SAR satellite imagery.

**Poster Session**

1. *Irina Trubacheva*: Optimization of well gas rates for offshore gas-condensate field.
2. *Grigory Plyushch*: Proposals on 3D parallel edge-preserving filtration for x-ray tomographic digital images of porous medium core plugs.



Special Events



# ARCTIC OFFSHORE FIELD DEVELOPMENT

Gubkin University and  
University of Stavanger

Collected by  
Ove Tobias Gudmestad and Anatoly Borisovich Zolotukhin  
with the assistance of Lesana Kurbonsheva

Moscow/Stavanger, August 2019



## Special Events

50 years of subsea success in Norway

KRISTIN ØYE GJERDE  
ARNFINN NERGAARD

**GETTING DOWN TO IT**  
50 YEARS OF SUBSEA SUCCESS IN NORWAY

NORSK OLEUMUSEUM

KRISTIN ØYE GJERDE  
ARNFINN NERGAARD | **GETTING DOWN TO IT**  
50 YEARS OF SUBSEA SUCCESS IN NORWAY



## Sponsors

**EDR<sup>™</sup> MEDES0**

SYSTEMS

STRUCTURES

OPTICS

EMBEDDED SOFTWARE

FLUIDS

DIGITAL TWIN

ELECTRONICS

MATERIALS

# Digital Labs

Solutions for predicting the future

▣ For just one new pump design Grundfos was able to cut 30 percent in overall development time and achieve significant savings in physical prototyping costs.

— JACOB VERNERSEN, GRUNDFOS

f t in  
Follow us on our social platforms!  
[edrmedeso.com](http://edrmedeso.com)



## Sponsors







## Sponsors

### 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



