

SFI OFFSHORE MECHATRONICS

ANNUAL REPORT 2018



TABLE OF CONTENTS

Summary	3
History	3
Organisation	3
The Research	3
International Cooperation	4
Recruitment	4
Communication and Dissemination activities	4
Vision and Objectives	5
Vision	5
Mission Statement	5
Grand Challenges	5
Research Plan / Strategy	7
Recruitment	7
The Research Plan	7
Organisation	12
Centre Management	12
Organisation Map	12
Work Packages WP1 – WP6	13
Steering Board	20
Partners	21
Cooperation Between the Centre's Partners	22
Scientific Activities and Results	26
International Cooperation	29
International Advisory Board	29
NorTex Data Science Cluster	29
Other Activities	29
Recruitment	30
Communication and Dissemination Activities	32
Dissemination Activities	34
Other	37

ANNUAL REPORT 2018

Summary

HISTORY

SFI Offshore Mechatronics has its origins from the Agder cooperation within the field of Mechatronics, initiated by University of Agder with partners from the local industry related to offshore engineering. This cooperation has been active for several years, and has its origin in the establishment of Master and PhD education to produce needed candidates for the regional and national labour market. Since then, the cooperation has developed to include R&D projects and mobility between industry companies and UiA. During the project period new links between the industry partners and the other universities and research institute partners (NTNU, Aalborg University, RWTH Aachen and NORCE) have been formed.

ORGANISATION

SFI Offshore Mechatronics is hosted by UiA, Faculty of Engineering and Science. UiA is responsible for three work-packages, NTNU for two, University of Aalborg for one and NORCE for one work package. In addition, NTNU Aalesund and RWTH Aachen participate in different WPs. GCE NODE heads a non-scientific work package for technology vision. The industrial partners are ABB, Bosch Rexroth, Cameron, Klueber Lubrication, Egde consulting, Lundin, MacGregor, MHWirth, National Oilwell Varco, Skeie Technology and Stepchange. SFI Offshore Mechatronics Steering board consists of 7 partners, where the industry partners hold majority. The Centre Director heads the daily operations, assisted by an administrative manager. The international Advisory Board gives strategic and scientific advice and consists of international experts in the fields of research.

THE RESEARCH

The main goal is to develop new concepts for autonomous systems where the construction, engineering and design, invite autonomy to minimize the number of manual processes, as well as to reduce risk and cost related to offshore engineering and operations. The research shall result in enabling technologies, equipment, processes and solutions for autonomy and monitoring of heavy machinery, and for handling and analysing large data flows under demanding conditions. The research is carried out in six work packages: WP1 Drives, WP2 Motion Compensation, WP3 Robotics and Autonomy, WP4 Modelling and Simulation, WP5 Monitoring Techniques and WP6 Data Analytics, IT Integration and Big Data.

Vision and Objectives

INTERNATIONAL COOPERATION

International cooperation and network is very important in SFI Offshore Mechatronics. There are both international research partners and industry partners in the Centre. The researchers in the Centre have extensive international networks in addition to the actual international universities in the partnership.

RECRUITMENT

By the end of 2018 22 PhDs and 1 Post.doc are employed in the Centre. In addition, there are 2 associated UiA funded PhDs included in the centre. Some of these have been recruited from industry partners. This has been a positive experience since the candidates bring valuable industry insight into the research.

COMMUNICATION AND DISSEMINATION ACTIVITIES

The main platform for presenting results is the SFI Offshore Mechatronics Annual Conference. This took place in Grimstad, May 2018. Over 80 participants got presentations of results and group meetings over two days. SFI Offshore Mechatronics has a web page, a Facebook profile, is on Twitter and LinkedIn. The Centre has an open and including attitude, and several high-school classes have visited, a lot of presentations in regional, national and international fora have been given, as well as participation on other relevant arenas.

VISION

The SFI Offshore Mechatronics will become the international knowledge and research hub for the next generation of advanced offshore mechatronic systems for autonomous operation and condition monitoring of offshore engineering systems under the control of land-based operation centres, to ensure safe and efficient operation in deeper water and in harsh environments.

The centre shall contribute significantly to growth and innovation in the industry, creating jobs and business with potential both within the target sector, and beyond, such as maritime industry, with a net positive impact on society.

MISSION STATEMENT

By 2023, SFI Offshore Mechatronics shall have succeeded in becoming an internationally renowned research-based innovation centre reaching national, international and long-term targets.

National target – develop new concepts for autonomous systems where the construction, engineering and design, invite autonomy to minimize the number of manual processes, as well as to reduce risk and cost related to offshore operations. International target – support the industry partners to strengthen the global position by developing the most efficient and safe future offshore operations.

Long-term target – enable technologies, equipment, processes and solutions for autonomy and monitoring of heavy machinery, and for handling and analysing large data flows under demanding conditions.

GRAND CHALLENGES

The grand challenges are:





Research Plan/Strategy

RECRUITMENT

In 2018 22 PhD students and two Post.Docs worked in the centre. They were employed at University of Agder, Aalborg University, NTNU and RWTH Aachen.

THE RESEARCH PLAN

The research themes of all the positions have been defined in close cooperation with the partner companies. This is to ensure relevance for the industry partners. Several of the candidates are recruited from the industry partners. The 8 year research plan for the SFI (2015-2023) is presented as follows:



WORK-PACKAGE 1: DRIVES

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WORK-PACKAGE 2: MOTION COMPENSATION

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WORK-PACKAGE 3: ROBOTICS AND AUTONOMY

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WORK-PACKAGE 4: MODELLING AND SIMULATION

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WORK-PACKAGE 5: MONITORING TECHNIQUES

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WORK-PACKAGE 6: DATA ANALYTICS, IT INTEGRATION AND BIG DATA

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The working titles of the positions

- **WP1.2** Using digital hydraulic in secondary control of motor drive.
- **WP1.3** Using digital hydraulic in secondary control of cylinder drive.
- **WP1.4** Electrical and electrohydraulic linear actuators.
- WP1.5 Cylinder direct drive.
- WP2.1 Computer vision and 3D sensors for topside automation of offshore drilling.
- **WP2.2** High-performance control for motion compensation.
- **WP2.3** Nonlinear friction compensation in motion compensation systems with significant elasticity.
- **WP2.4** Vision systems for offshore crane control in ship-to-ship operations.
- WP2.5 Real-time multiple DOF motion compensation using an industrial robot, sensor fusion and conformal geometric algebra.

- WP2.6 Real-time teleoperation and model-based control of cranes with loads.
- **WP3.1** Development of offshore 3D sensor package.
- WP3.2 Autonomy systems foundation development.
- **WP3.3** Handling of sensor fusion, pointclouds and 3D maps.
- WP3.4 Implementation of situational awareness/human factors concepts for operators using virtual arena.
- WP3.5 Reliable Communication in 5G.
- **WP3.6** Instrumentation and real-time control of long-reach, light-weight arm intended for use offshore (associated PhD position).
- **WP3.7** Coupled dynamics between vessel and crane (associated PhD position).

- **WP3.8** Formal Methods in Robotics (integrated MSc / PhD position).
- **WP4.1** Integrated simulation of multiphysical systems in offshore operations.
- WP4.2 Component-based simulation systems for drilling automation and crane systems.
- **WP4.3** Protocols and standard for integration of simulation models and co-simulation.
- WP4.4 Modelling and simulation of cable and pulley systems in offshore cranes.
- WP5.1 Tapered big bearings.
- WP5.2 Large diameter steel ropes.
- WP5.3 Fibre ropes.
- WP5.4 Condition-based lifetime prediction as result of calculated component loads.

- **WP5.5** Modelling the fatigue damage mechanism in welded joints (associated PhD position).
- WP6.1 Distributed in-network intelligence across multiple components.
- **WP6.2** Coordinated multi-variable data acquisition, intelligent data reduction, as well as automatic data quality verification and validation.

Organisation

Work Packages WP1 – WP6

CENTRE MANAGEMENT

The SFI Offshore Mechatronics centre is hosted by UiA and the management is led by Centre Director, Professor Geir Hovland with assistance from Administrative Manager Anne-Line Aagedal. In addition, UiA provides necessary resources from the Faculty and Central Management.



Geir Hovland and Anne-Line Aagedal.



WP-leaders: Olav Egeland, Torben Ole Andersen, Thomas Meyer, Anne Grete Ellingsen, Geir Hovland, Baltasar Beferull-Lozano and Morten Kjeld Ebbesen.

WP1



ORGANISATION MAP



12 ANNUAL REPORT 2018







WP2.2

NTNU

Torstein Myhre









Dirk Abel RWTH Aachen Sup. WP2.6

UiA

WP2.7

TBA, NTNU

UiA Sup. WP2.5



WP2.4

Alexander M.

Sjøberg, NTNU



WP2.5

WP2.6 Sondre S. Tørdal Philip Schubert RWTH Aachen

WP2.8

TBA, NTNU



WP2.1

NTNU

Geir O. Tysse

WP3 LEADER Geir Hovland, UiA Supervisor WP3.1 and WP3.2, Co-supervisor WP3.6, WP3.7

WP2.3

NTNU

Andrej Cibicik









Olav Egeland NTNU Zhang Sup. WP3.3

Houxiang NTNU Aalesund UiA Sup. WP3.4

Morten Ottestad

Knut Berg

Kaldestad

Sup. WPs

UiA Technician

Ilya Tyapin UiA Sup. WP3.6

Jing Zhou UiA Sup. WP3.7



Frank Y. Li

Sup. WP 3.5

UiA







Charlotte Skourup ABB Co.Sup WP3.4

UiA

David Anisi ABB Co.Sup WP3.2



WP3.1

UiA

Joacim

Dybedal



WP3.2

Aalerud

Atle

UiA



WP3.3

Aksel

Sveier

NTNU



WP3.4

NTNU

Thiago G.

Monteiro

Aalesund



WP3.5

UiA

Thilina N.





WP3.6 WP3.9 WP3.7 WP3.8 Dipendra Ronny Yvonne TBA Weerasinghe Subedi Landsverk Murray, UiA UIA UiA











WP4.2

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16 ANNUAL REPORT 2018



Christian Holden, NTNU Sup. WP4.1 &

Houxiang Zhang NTNU Aalesund Sup. WP4.3

WP2 LEADER

Olav Egeland, NTNU Supervisor WP2.1-2.4



Geir Hovland UiA Co-Sup. WP4.3



WP4.1 WP4.2 Savin Viswanathan Njål Tengesdal NTNU NTNU

WP4.3

Lars Ivar Hatledal NTNU Aalesund

WP4.4 WP4.5 Gaute Fotland TBA

Arne Styve

NTNU

NTNU

Aalesund

Co-sup. WP4.3

Bjørn Haugen

Co-sup. WP4.4

NTNU

NTNU

WP5 Thomas J.J. Meyer NORCE ······ Subtask 5.1 Subtask 5.2 ig tapered rolle «Big steel ropes Tor Inge Waag



UiA

WP5 LEADER

Hansen

Subtask 5.3

Big fiber ropes





WP5.3 Geir Grasmo Shaun UiA Falconer Sup. WP5.3

Ellen Nordgård-



WP5.4 Lothar Wöll Aachen IME

lan K. Jennions Cranfield U.

> Tom Lassen Task leader, UiA



WP5.5 Zbigniew Mikulski UiA



Kjell Gunnar WP51 Robbersmyr Martin Hemmer Sup. WP5.1 UiA

UiA



Subtask 5.4

"Winch Lifetim



"Welded i

17



WP2 LEADER Baltasar Beferull-Lozano, UIA Supervisor WP6.1 - WP6.2





Jing Zhou

Co. Sup. WP6.2

UiA

Daniel Romero UiA Co. Sup. WP6.1

Linga Cenkeramaddi UiA Co. Sup.



UiA



WP6.2 **Emilio Ruiz Moreno** UiA

WP6.3 TBA



WP7 TECHNOLOGY VISION

The purpose of WP7 is to ensure input to the work packages during the 8-year period of the SFI Offshore Mechatronics project. The objective of WP7 is to provide biyearly updates and strategic input on market, technology development and business framework.

WP7 will create an open arena for future trends, barriers and opportunities. WP7 held a work-shop in October 2018 and will continue working with form and content in 2019.



Steering Board

The Steering board (2017-2019) consists of 7 members, and 2 deputy members: Leif Haukom (GCE NODE), Charlotte Skourup (ABB), Arild Strand (Bosch Rexroth), Morten Halvorsen (NOV), Thor Arne Håverstad (Teknova), Torben Ole Andersen (Aalborg University) and Michael Rygaard Hansen (UiA), Eivind Gimming Stensland (Deputy, MacGregor) and Torgeir Welo (Deputy, NTNU).

The majority of the SFI Offshore Mechatronics Steering Board members are from the Industry Partners. The Steering board is appointed for 2 years. It is the General Assembly which appoints the Steering board.



Thor Arne

Håverstad

Teknova



NOV

Leif Haukom GCE NODE Chairman

Skourup ABB Deputy Chairman

Geir Grasmo

UiA

Morten



Halvorsen

Torben Ole Andersen AAU



Torgeir Welo **Eivind Gimming** NTNU

The Centre has one General Assembly every year, where all partners meet and work-plans for the following year are presented and discussed.

The General Assembly was held on November 15, 2018, where the budget for next three years and the WP annual work plans were presented and approved.

KEY NUMBERS 2016

Stensland

MacGregor

Steering board meetings	4
WP leader meetings	10
Workshops	3
Reference Group Meetings	21
Conferences	1
General Assembly	1

Partners



Partners gathering on the SFI OM annual conference.















Norway

Lundin



Cooperation Between the Centre's Partners

The project started April 1, 2015. To get a best possible start with the goal of involving industry partners and make the SFI project relevant for all partners, there were 3 workshops in the beginning of the period. As a result, the themes and the scientific focus areas are defined and therefore relevant for all partners. In this Project it was important to align the research with the industry partners which were faced with a difficult situation caused by low oil prices and a significant reduction in orders. Several of the partners had to reduce the number of employees in 2015 and 2016.

There are 6 scientific work-packages in SFI Offshore Mechatronics. For each WP there is a reference group. Effort has been put in to get relevant people from the partners to participate in the WPs. This is an important action, to get the SFI activities and results communicated to industrial partners.

In addition to participating in reference group meetings, there are other initiatives to share knowledge between researchers and industry partners.

The management team in MacGregor Norway visited the motion-lab in Grimstad and got a demonstration by PhD candidate Sondre Sanden Tørdal's robot technology. Sondre handed in his thesis in 2018 and have now joined the R&D team at MacGregor Norway to continue development of the technology. The leader for the R&D department in the offshore division at MacGregor and Tørdal's new colleague is Eivind Gimming Stensland. He is currently in the management board in the SFI Offshore Mechatronics centre and has watched Tørdal during the entire project period. He is impressed by what Tørdal has developed and is very satisfied that he now joins MacGregor to develop the product further. Gimming Stensland tells that the technology is very relevant as part of MacGregor's digitization process.



In December 2018, members of the international knowledge and research hub SFI Offshore Mechatronics have visited the Rexroth cylinder factory in Boxtel, the Netherlands, to learn all about condition monitoring features in Rexroth hydraulic and electro-mechanic cylinders.



The industry and researchers are together working on leveraging the research produced in the centre and in 2018 the centre further increased the focus on innovation. One initiative introduced in 2018 was The SFI Offshore Mechatronics innovation award, awarded to researchers submitting declarations of invention (DOFI) for ideas generated in their projects. The first innovation award for SFI Offshore Mechatronics was given to Thomas Meyer, Rune Schlanbusch, Joachim Dybedal and Atle Aalerud.



On November 29th UiA Nyskaping arranged a Patenting vs. Publication workshop where many of the WP leaders and PhD students were present. Bergen Teknologioverføring presented relevant topics such as the patenting process, company formation and business models.





In addition, the centre has started the process of mapping new potential innovations. This has been done through interviews with PhD candidates structured through a "Research impact Canvas" developed by Innoventus sør. Innvoentus Sør has facilitated the interviews and the centre leader has also been present. Both the industry and research partners have found the results interesting and the centre will continue this work into 2019.

Scientific Activities and Results



Inside the driller's cabin, from left to right: Joacim Dybedal, Atle Aalerud and Kai Erik Nilsen.

During the summer 2018 SFI Offshore Mechatronics conducted outdoor testing in the testing tower at MHWirth. The goal of the tests was to test the multiple sensor packages in a more realistic environment compared to the lab at the University, as well as to generate a large dataset which could be used by the other partners in the project. Initially, the dataset will be used for sensor calibration and human motion detection



PhD researchers: (from left to right) Alexander Meyer Sjøberg, Geir Ole Tysse, Aksel Sveier and Andrej Cibicik.

In 2018 the construction of the new crane laboratory at NTNU, Trondheim was finalized. The laboratory features a down-scaled version of a knuckle boom crane, which will be used for testing and developing control and estimation algorithms for offshore operations. The PhD candidate Andrej Cibicik (NTNU), who is responsible for the design and assembly of the laboratory, thinks that the research results will provide significant value for the industry.

N R C E

NORCE and the University of Agder published an Advanced Maintenance Activies report for 2016-2017. SFI Offshore Mechatronics WP5 has been a significant contributor to the report, both in terms of researchers as well as equipment.



March 22nd SFI Offshore Mechatronics organised the workshop "The Ardor/ Ignis Hackaton" at in Kristiansand with participants from UiA, ABB and other guests from abroad. The teacher, Lior Yaffe from Israel, went through some of the key features of the Ardor/Ignis blockchain technology. Perhaps the most interesting feature for the participants was development of server side AddOns using IntelliJ IDEA, a Java-based integrated development environment for developing computer software. In addition, node is was used to interface functionality with an Ardor node. The entire day was filmed with HD video and several YouTube micro-learning clips were made available to the public based on this workshop.





Other conferences researchers in the SFI participated on in 2018 were Global Fluid Power Society PhD Symposium (GFPS2018) in Samara, Russia, FPMC2018 - ASME Symposium on Fluid Power and Motion Control, Bath, UK, 26th Mediterranean Conference on Control and Automation, 2018. Zadar, Croatia, Conference on Modelling, Identification and Control of Nonlinear Systems MICNON 2018, Guadalajara, Jalisco, Mexico, IFAC OOGP2018, Esbjerg, Denmark., 59th International Conference of Scandinavian Simulation Society, SIMS 2018, Oslo, September 26-28 and The 13th World Congress on Engineering Asset Management (WCEAM-2018), Stavanger, Norway.



In 2018 SFI Offshore Mechatronics got its first level 2 paper accepted: Sondre Sanden Tørdal and Geir Hovland, "Shipto-Ship State Observer using Sensor Fusion and the Extended Kalman Filter", ASME Journal of Offshore Mechanics and Arctic Engineering.



During the year the WPs have presented papers and participated in several IEEE conferences: IEEE Wireless Communications and Networking Conference (WCNC), Barcelona, IEEE/ ASME Intl. Conf. on Mechatronic Systems and Applications (MESA2018), Oulu, Finland, IEEE Int. Conf. Acoust., Speech, Sig. Process, Calgary, Canada, IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC), 2018. Kalamata Greece, IEEE GlobalSIP 2018. Anaheim California, IEE American Control Conference (ACC). Milwaukee, USA and International Conference on Control, Decision and Information Technologies (CoDIT), Thessaloniki, Greece. The paper "Visual Marker Guided Point Cloud Registration in a Large Multi-Sensor Industrial Robot Cell" by Erind Ujkani, Joacim Dybedal, Atle Aalerud, Knut Berg Kaldestad and Geir Hovland received the Best Applications Paper Award at the IEEE/ASME International Conference on Mechatronic and Embedded Systems and Applications (MESA) in Oulu, Finland, July 2-4.



International Cooperation

INTERNATIONAL ADVISORY BOARD

The SFI International Advisory Board (IAB) was established in the beginning of 2016:

- Professor Rolf Johannsson, Lund University, Sweden
- · Professor Ian Jennions, Cranfield University, UK
- Professor Iraj Ershagi, University of Southern California, USA

INTERNATIONAL COOPERATION AMONGST PHD STUDENTS



For two weeks the PhD candidates Sondre Sanden Tørdal (UiA) and Philipp Schubert (RWTH Achen) worked together in UiAs Motion Lab at Campus Grimstad. The solution the PhD candidates are developing can very likely become integrated in a future product for one or more of the partner companies in the research centre SFI Offshore Mechatronics. The plan, as a first step, a joint publication based on this work – and see possibilities for future collaboration afterwards.

NORTEX DATA SCIENCE CLUSTER

SFI Offshore Mechatronics participate in "NorTex Data Science Cluster" funded by INTPART. This is a collaboration project initiated by IRIS, UiA, GCE NODE, Rice University and UT Austin. The project will finance several activities to stimulate and promote research collaboration between Norwegian and US partners, not limited to the mentioned partners, but will include other academic institutions or industrial companies relevant for the proposed Data Science Cluster.



Professor **Frank Yong Li** spent parts of 2017-2018 at Rice University on sabbatical leave from the University of Agder working on wireless communication research. Prof. Li is the main supervisor of the project WP3.5 in SFI Offshore Mechatronics.

OTHER ACTIVITIES

October 15th WP7 organized a workshop on AI+Safety where Simen Eldevik from DNVGL presented his research. After that there was a discussion on barriers of AI for the offshore industry.

On October 25th the WP6 Leader prof. Baltasar Beferull Lozano organized a workshop on the fundamentals of Graph Signal Processing, together with his colleagues Dr. Daniel Romero and Dr. Luis Miguel Lopez Ramos. Several participants from industry attended, in addition to researchers from UiA.

SFI Offshore Mechatronics WP3 researchers were co-organizers and had a presentation at the conference NFA Autonomy in March. The presentation is available at: nfea.no/arrangementer/autonomikonferansen-2018



PhDs and Post.Docs in SFI Offshore Mechatronics

Recruitment

The following researchers and technicians were hired in SFI Offshore Mechatronics in 2015-2018.

NAME	POSTITION / INSTITUTION	PERIOD
Torstein Myhre	Post.Doc, NTNU	2015-2017
Geir Olav Tysse	PhD, NTNU	2015-2018
Sondre Sanden Tørdal	PhD, UiA	2015-2018
Achim Felderman	PhD, RWTH Aachen	2015-2017
Atle Aalerud	PhD, UiA	2016-2019
Andrej Cibicik	PhD, NTNU	2016-2019
Joacim Dybedal	PhD, UiA	2016-2019
Shaun Falconer	PhD, UiA	2016-2019
Daniel Hagen	PhD, UiA	2016-2019
Martin Hemmer	PhD, UiA	2016-2019
Sondre Nordås	PhD, UiA	2016-2019
Aleksander Meyer Sjøberg	PhD, NTNU	2016-2019
Aksel Sveier	PhD, NTNU	2016-2019
Thilina Weerashinge	PhD, UiA	2016-2019
Philipp Schubert	PhD, RWTH Aachen	2016-2019
Lothar Wöll	PhD, RWTH Aachen	2016-2019
Zbigniew Mikulski	PhD, UiA (associated)	2016-2019

PhD, Aalborg	2017-2019
PhD, NTNU Aalesund	2017-2021
PhD, NTNU	2017-2020
PhD, NTNU	2017-2020
PhD, NTNU Aalesund	2017-2020
PhD, NTNU	2017-2020
Post.Doc, UiA	2016-2018
PhD, Aalborg	2018-2021
PhD, UiA	2018-2021
PhD, UiA (associated)	2018-2021
	 PhD, Aalborg PhD, NTNU Aalesund PhD, NTNU PhD, NTNU PhD, NTNU Aalesund PhD, NTNU Post.Doc, UiA PhD, Aalborg PhD, UiA (associated)

The centre management and the WP-leaders are actively working on recruitment of female PhD candidates from the master programs at UiA, AAU, NTNU and RWTH Aachen. In general, there are few female master students in the relevant disciplines. The few potential candidates have been actively contacted and motivated to apply for the upcoming positions. The first female PhD candidate in the centre started in 2018, though as an associated PhD financed by UiA. The centre management is also actively looking for female supervisors to join the individual work-packages.

Communication and Dissemination Activities

SFI Offshore Mechatronics has a web page for news and general information about the project: sfi.mechatronics.no/

The web site is both for partners and the general public. All information about the organization, activities and results that are not sensitive is published here. From the web site there is generated a monthly newsletter, with over 350 subscribers.

The project is also on Twitter (@sfimechatronics), on Facebook (facebook.com/ SFIOffshoreMechatronics) and LinkedIn, (.linkedin.com/groups/2556388) with almost 500 followers.



The SFI Offshore Mechatronics centre wants to contribute in recruiting students to engineering and science. During the year we had visits from the regional high schools to give insight in what we do through tutorial sessions and demonstrations in the Mechatronics lab.



Dissemination Activities

PUBLICATIONS

JOURNAL PAPERS

Søren Ketelsen, Lasse Schmidt, Viktor Hristov Donkov and Torben Ole Andersen, **Energy Saving Potential in Knuckle Boom Cranes Using a Novel Pump Controlled Cylinder Drive.** Modelling, Identification and Control, Vol 39, number 2, 2018, pp 73-89, doi 10.4173/mic.2018.2.3

Kleppe, Adam Leon; Tingelstad, Lars; Egeland, Olav. **Coarse Alignment for Model Fitting of Point Clouds using a Curvature-Based Descriptor.** IEEE Transactions Science and Engineering.

Tysse, Geir Ole; Egeland, Olav. **Dynamic model for a heavy crane on a ship moving in waves. Modeling, Identification and Control,** Vol. 39, No. 2, pp. 45-60. J4: Tingelstad, Lars; Egeland, Olav. (2018) Motor Parameterization. Advances in Applied Clifford Algebras. May 2018, 28:34

L. Wöll, G. Jacobs and A. Kramer – 2018 – Lifetime Calculation of Irregularly Oscillating Bearings in Offshore Winches, Modeling, Identification and Control, Vol. 39, No. 2, pp. 61-72.

Jan Kucera and Geir Hovland, Tail Removal Block Validation: **Implementation and Analysis, Modeling, Identification and Control**, Vol. 39, No. 3, pp. 151-156.

Sondre S. Tørdal, Jan T. Olsen and Geir Hovland, **The Norwegian Motion-Laboratory. Modelling, Identification and Control,** Vol 39, number 3, 2018, pp 191-208, doi 10.4173/mic.2018.3.5

Sondre Sanden Tørdal and Geir Hovland, **Ship-to-Ship State Observer using Sensor Fusion and the Extended Kalman Filter, ASME Journal of Offshore Mechanics and Arctic Engineering,** 2018 (Level 2).

Z. Mikulski and T. Lassen, **Fatigue crack initiation and subsequent crack growth in fillet welded steel joints**, International Journal of Fatigue, 2018 (Level 2).

Martin Hemmer, Huynh Van Khang, Kjell G. Robbersmyr, Tor I. Waag and Thomas J. J. Meyer, **Fault Classification of Axial and Radial Roller Bearings Using Transfer Learning through a Pretrained Convolutional Neural Network.** Designs 2018, 2(4), 56; https://doi.org/10.3390/designs2040056;

PUBLISHED CONFERENCE PAPERS

Daniel Hagen, Damiano Padovani, and Morten Kjeld Ebbesen, **Study of a Self-Contained Electro-Hydraulic Cylinder Drive,** 2018 Global Fluid Power Society PhD Symposium (GFPS2018) in Samara, Russia, July 18-20, 2018. Viktor Hristov Donkov, Torben Ole Andersen, Henrik Clemmensen Pedersen and Morten Kjeld Ebbesen, **Application of Model Predictive Control in Discrete Displacement Cylinders to Drive a Knuckle Boom Crane**, 2018 Global Fluid Power Society PhD Symposium (GFPS2018) in Samara, Russia, July 18-20, 2018.

Sondre Nordås, Morten Kjeld Ebbesen and Torben Ole **Andersen, Analysis of Valve Accuracy and Repeatability in High Efficient Digital Displacement Motors,** FPMC2018 – ASME Symposium on Fluid Power and Motion Control, Bath, UK, September 12-14, 2018.

Cibicik, Andreij; Myhre, Torstein Anderssen; Egeland, Olav. (2018) **Modeling and Control of a Bifilar Crane Payload.** IEEE American Control Conference (ACC). Milwaukee, USA

Cibicik, Andrej; Egeland, Olav. (2018) **Estimation of dynamic interface forces between an offshore crane and a vessel**, 2018 IEEE 5th International Conference on Control, Decision and Information Technologies (CoDIT), Thessaloniki, Greece.

Sjøberg, Alexander M.; Egeland, Olav. (2018) **Kinematic Feedback Control Using Dual Quaternions.** 26th Mediterranean Conference on Control and Automation, 2018. Zadar, Croatia

Schubert, Philipp; Abel, Dirk. **Roboterbasierter Teststand zur assistierten Teleoperation teilautonomer Offshore Kräne.** Abstract accepted by VDI Automation 2018

Aksel Sveier, Torstein A. Myhre and Olav Egeland, **Pose Estimation with Dual Quaternions and Iterative Closest Point** – IEEE 2018 Annual American Control Conference (ACC) Milwaukee, USA

Aksel Sveier and Olav Egeland, **Pose Estimation using Dual Quaternions and Moving Horizon Estimation** – 2nd IFAC Conference on Modelling, Identification and Control of Nonlinear Systems MICNON 2018: Guadalajara, Jalisco, Mexico, 20–22 June 2018.

T. N. Weerasinghe, I. A. M. Balapuwaduge and F. Y. Li, **Per-user availability for ultra-reliable communication in 5G: Concept and analysis,** 2018 IEEE Wireless Communications and Networking Conference (WCNC), Barcelona, 2018, pp. 1-6.

Atle Aalerud, Joacim Dybedal and Geir Hovland, **Scalability of GPU-Processed 3D Distance Maps for Industrial Environments,** IEEE/ASME Intl. Conf. on Mechatronic Systems and Applications (MESA2018), Oulu, Finland. Erind Ujkani, Joacim Dybedal, Atle Aalerud, Knut Berg Kaldestad and Geir Hovland, Visual Marker Guided Point Cloud Registration in a Large Multi-Sensor Industrial Robot Cell, IEEE/ASME Intl. Conf. on Mechatronic Systems and Applications (MESA2018), Oulu, Finland.

Atle Aalerud, Joacim Dybedal and Geir Hovland, **Industrial Environment Mapping Using Distributed Static 3D Sensor Nodes**, IEEE/ASME Intl. Conf. on Mechatronic Systems and Applications (MESA2018), Oulu, Finland.

Njål Tengesdal, Torstein Thode Kristoffersen, Christian Holden – **Applied Nonlinear Compressor Control with Gain Scheduling and State Estimation,** IFAC OOGP2018, Esbjerg, Denmark.

Lars Ivar Hatledal, Houxiang Zhang . **A Software Package for working with Functional Mock-up Units on the Java Virtual Machine.** Abstract accepted, full paper submission by 16. April. 59th International Conference of Scandinavian Simulation Society, SIMS 2018, Oslo, September 26-28.

Shaun Falconer, Ellen Nordgård-Hansen and Geir Grasmo: **Temperature measurements as a method for monitoring ropes,** The 13th World Congress on Engineering Asset Management (WCEAM-2018), Stavanger, Norway.

Martin Hemmer, Kjell G. Robbersmyr, Tor I. Waag and Thomas J. J. Meyer, **Rib-Roller Wear in Tapered Rolling Element Bearings: Analysis and Development of Test Rig for Condition Monitoring,** The 13th World Congress on Engineering Asset Management (WCEAM-2018), Stavanger, Norway.

Tor I. Waag and M. Hemmer, **Observation and Processing of Instantaneous Frequency Variations during Bearing Tests,** The 13th World Congress on Engineering Asset Management (WCEAM-2018), Stavanger, Norway.

L. Wöll, G. Jacobs and A. Kramer – 2018 – **Lifetime Prediction as Result of Calculated Component Loads from Available System Data**, The 13th World Congress on Engineering Asset Management (WCEAM-2018), Stavanger, Norway.

T. Weerasinghe, D. Romero, C. Asenio-Marco, B. Beferull-Lozano, **Fast distributed subspace projection via graph filters,** in Proc. IEEE Int. Conf. Acoust., Speech, Sig. Process., (Calgary, Canada), 2018.

L. Ben Saad, B. Beferull-Lozano, **Stochastic Graph Filtering under Asymmetric Links in Wireless Sensor Networks,** IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC), 2018. Kalamata, Greece.

L. M. Lopez-Ramos, D. Romero, B. Zaman, B. Beferull-Lozano. **Dynamic network identification from non-stationary vector autoregressive time series**, IEEE GlobalSIP 2018. Anaheim, California, USA.

S. Mollaebrahim, C. Asensio-Marco, D. Romero, B. Beferull-Lozano. **Decentralized subspace projection in Large Networks,** IEEE GlobalSIP 2018. Anaheim, California, USA.

OTHER

Bachelor and Master Thesis Projects, Spring 2018 Erlend Erdal Christiansen **Digital Twin Crane**

Halvard Yri Adriaenssens, Bård Barstad, Fredrik Kartevoll **Autonomous transatlantic solar powered vessel**

Benjamin Benjaminsen 3D Scanner for small objects

Sondre Bø, Didrik Efjestad Fjereide, Rayan Sohaib Saeed **Automated guided vacuum cleaner**

Karoline Frisvoll, Eirik Fuskeland, Kristian Henriksen **Autonomous stair robot for elderly and disabled people**

Andre Aaneland, Tonje Kristina Bakke, Christopher Bjørnarå **Autonomous inspection for fish farming**

Andreas Brobakken, Jan Peder Nilsen, Mats Olsen Autonomous Coffee Making/Delivery Mechatronics System

Kristian Høvik Eide, Ellen Marie Jonassen Design and Control of Coupled Tank Systems

Rune Steffensen, Mathias Askildsen, Ståle Jacobsen, Sondre Mathias Pedersen **Design of a component feeding system for a robot**

Zygimantas Osinskas, Georgis Micael Tesfaghiorghis, Jørgen Anker Olsen Implement a self-contained cylinder on a crane boom

Ola Christoffer Våge, Simon Hus, Jørgen Benum, Jan Petter Ottesen **Drone-based filming of experiments in Motion Lab**

Albert Buldenko, Henning Lindheim, Jakob Einarssønn Lunde, Eligijus Sukarevicius Autonomous robot for cleaning of aquaponics fish farming tank and associated piping

Johan Norland Construct and program a rotating platform for ABB YuMi

Thomas Ånensen SLAM for an Ackermann steered mobile robot in repeating environments

Jan Thomas Olsen

Real-Time Control, Stabilization and Montoring of Suspended Load attached to a Moving Base Robot

Lisa Ann Williams Modelling, Simulation and Control of Offshore Cranes

Terje Molnes Control system which requires minimum of teaching and involvement of crew

Daniel Coward **Wireless sensor technology implementation on drilling equipment**

Mathias Timenes
Autonomous inspection robot for fish farming

Jan Fredrik Røsjordet Design of Parallel Kinematic Machine

Hamza Albaidaq, Olav Palmer Taksdal Bjørnarå Design a self-contained cylinder using digital hydraulics

Sølve Eggebø, Jan Størbu Design and test the control system for a self-contained cylinder

Kai Egil Berntsen, André Bleie Bertheussen **Automatic generation of robot path**

Jørn Folmar Nilsen, Emil Mühlbradt Sveen Chemical Flow Controlling System

Maxime Marien, Kjell Erik Wiig Secondary control of a digital hydraulic motor for winch applications

Jakub Mateusz Frasik, Svenn Inge Lund Gabrielsen Real-Time Helicopter Flight Control: Modeling, Identification and Control

Vegard Tveit Optimization of 3D sensor placement in a rig

Kjetil Andreas Fjeld, Lars Ilje Tveit Real-time simulation of electrohydraulic winch for HIL

Daniel Årrestad Stave Condition Monitoring and Prognostics of Steel Wire Ropes

Yvonne Murray Formal Methods in Robotics

Christian Black Jørgensen Development of Position Controller for Pump Controlled Cylinder

Nikolaj Grønkjær, Lasse Nielsen, Frederik, Nielsen Prototype Development, Thermohydraulic Modeling & Validation of Novel Drive Concept

Torbjørn Moi Inverse Digital Twin Methods for Knuckle Boom Crane

Elias Bragstad Hagen
Automatic Robot Welding of Customized Ship Hulls

Kia Brekke Cloud Based Software for Digital Twin Structural Modeling and Monitoring

Odd Harald Sjursen Sande Cloud Based Software for Digital Twin Structural Modeling and Monitoring

Simen Norderud Jensen Cloud Based Software for Digital Twin Structural Modeling and Monitoring

Christian Johansen Cloud Based Software for Digital Twin Structural Modeling and Monitoring

Andreas Børhaug Cloud Based Software for Digital Twin Structural Modeling and Monitoring

Aksel Øvern Industry 4.0 - Digital Twins and OPC UA Hans Bratland Østerdal and Sondre Alexander Vadheim Development of an Automated Bin Picking System for Cluttered Environments

Håkon Hystad Tracking a Moving Object with an Industrial Manipulator using a Particle Filter

Njål Haagensli Munthe-Kaas Estimating the Design Parameters of a Highly Skewed Ship Propeller by Automated 3D-scanning

Janosch Matthias Mellinger Time-optimal control of offshore cranes using a modelpredictive approach

Andreas Klein

Robot assisted generation of optimal reference trajectories for crane-based offshore operations

Byung Kyo Yung

An MINLP Approach Integrating Predictive Method for Optimal Load Sharing in Generating Machines

Elene Marie Espeland Online Modelling of Fuel Efficiency Curves in Generating Machines

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