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Annual Report 2020

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 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 a strong relation between the industry partners and the other universities and research institute partners (NTNU, Aalborg University, RWTH Aachen and NORCE) have been formed.

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 will 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 seven work packages: WP1 Drives, WP2 Motion Compensation, WP3 Robotics and Autonomy, WP4 Modelling and Simulation, WP5 Monitoring Techniques, WP6 Data Analytics, IT Integration and Big Data and WP7 Technology Vision.

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 Consulting and Stepchange. The 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.
SCIENTIFIC ACTIVITIES AND RESULTS
Each PhD defense is a milestone in the SFI Offshore Mechatronics centre. In 2020 seven PhD fellows defended their thesis. In 2020 a large share of the scientific publications was at the highest level (Level2 in Norway). Out of 19 journal papers 6 (32%) were published at the highest level.

INTERNATIONAL COOPERATION
The SFI Offshore Mechatronics center is distributed with industry and research partners across four countries (Norway, Denmark, The Netherlands and Germany). In addition to this, the researchers in the centre utilize their extensive international networks. Due to COVID-19, the opportunities to travel and accommodate guest researchers have been limited in 2020.

RECRUITMENT
In 2020 five new PhD students and three new Post.Doc positions were hired. By the end of 2020 all final PhD and Post.Doc positions have been filled. During the project period a total of 40 researcher and technicians have been recruited. Unfortunately, it was not possible to recruit any female PhD students or Post.Doc positions in 2020.

COMMUNICATION AND DISSEMINATION ACTIVITIES
The main event for communication and dissemination in the project is the SFI Offshore Mechatronics Annual Conference. In 2020, the conference was planned on May 12-13, however due to the situation with COVID-19 it was postponed and eventually cancelled. To compensate for the cancellation of the annual conference short bi-weekly webinars were introduced targeting attendees from both industry and the research partners.

VISION and Objectives

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:

Towards Autonomous Offshore Operations

TOWARDS AUTONOMOUS OFFSHORE OPERATIONS

- New Drilling Processes & Principles
- Fully Electrical Offshore Installations
- Double Performance/ Half Price
- Autonomous Smart Systems
- Reduced Cost of Operations
- Decision Support/ Analytics from Big Data
- Energy Efficient/ Green Solutions

SFI WORK PACKAGES
Research Plan/Strategy

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. Since there are several companies in the centre which operate in the same business segment, it has been decided that the researchers focus on enabling technologies and technological building blocks, rather than working too closely with product specific development.

The research themes of all the positions have been defined in close cooperation with the partner companies. The work program of each work-package is approved annually by the General Assembly.

The research is carried out in seven work packages:
- Work-Package 1: Drives
- Work-Package 2: Motion Compensation
- Work-Package 3: Robotics And Autonomy
- Work-Package 4: Modelling And Simulation
- Work-Package 5: Monitoring Techniques
- Work-Package 6: Data Analytics, It Integration And Big Data
- Work-Package 7: Technology Vision
### WORK-PACKAGE 1: DRIVES

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- WP1.2 Sondre Nordås (PhD, UiA)
- WP1.4 Daniel Hagen (PhD, UiA)
- WP1.5 Søren Ketelsen (PhD, Aalborg)
- WP1.6 Wei Zhao (PhD, UiA)
- WP1.7, Thomas Farsakoglou (PhD, Aalborg)
- WP1.8, New Position (Post.Doc, Aalborg)

### WORK-PACKAGE 2: MOTION COMPENSATION

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- WP2.1 Geir Ole Tysse, (PhD, NTNU)
- WP2.2 Torstein Myhre, (Post.Doc, NTNU)
- WP2.3 Andrej Cibicik, (PhD, NTNU)
- WP2.4 Alexander Meyer Sjøberg, (PhD, NTNU)
- WP2.5 Sondre Sanden Tørdal (PhD, UiA)

### WORK-PACKAGE 3: ROBOTICS AND AUTONOMY

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- Joaism Dybedal, (PhD, UiA)
- Atle Aalerud, (PhD, UiA)
- Aksel Sveier, (PhD, NTNU)
- Thilina Nuwan Weerasinghe (PhD, UiA)

### WORK-PACKAGE 4: MODELLING AND SIMULATION

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- WP4.1 Savin Viswanathan (PhD, NTNU)
- WP4.2 Njål Tangen是真的 (PhD, NTNU)
- WP4.3 Lars Ivar Hatteland (PhD, NTNU)
- WP4.4 Gaute Folland (PhD, UiA)

### WORK-PACKAGE 5: MONITORING TECHNIQUES

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- WP5.1 Martin Hammer, (PhD, UiA)
- WP5.2 Rune Schlams - NORCE
- WP5.3 Shaan Feldman (PhD, UiA)
- WP5.4 Ashwin Feldermand and Uthar Woh, (PhD, IME - Aachen)
- Zbigniew Mikulski, (PhD, UiA)

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

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- WP6.1 Luis M. Lopez-Ramos (Post.Doc, UiA)
- WP6.2 Emilio Ruíz Moreno, (PhD, UiA)
- WP6.3 Kevin Roy, (PhD, UiA)
- WP6.4 Luis M. Lopez-Ramos, (Post.Doc, UiA)
- WP6.5 Jose Amendola, (PhD, UiA)

### WORK-PACKAGE 7: TECHNOLOGY VISION

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- WP7.1 Markus Kristiansen (PhD, UiA)
- WP7.2 Emilio Ruíz Moreno, (PhD, UiA)
- WP7.3 Kevin Roy, (PhD, UiA)
- WP7.4 Luis M. Lopez-Ramos, (Post.Doc, UiA)
- WP7.5 Jose Amendola, (PhD, UiA)
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.

WP1.6 Energy efficient mobile hydraulic systems with focus on rotary actuation.

WP1.7 Energy efficient mobile hydraulic systems with focus on linear actuation.

WP1.8 Energy efficient mobile hydraulic systems with focus on digital valve technology.

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.

WP2.7 Vision systems for supervision of offshore drilling operations.

WP2.8 Fusion of vision, Lidar and IMU data for 3D tracking of objects in offshore crane operations.

WP3.1 Development of offshore 3D sensor package.

WP3.2 Autonomy systems foundation development.

WP3.3 Handling of sensor fusion, point-clouds and 3D maps.


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).

WP3.9/WP6.5 Sensor fusion for perception, collision avoidance and navigation towards autonomous systems.

WP4.1 Integrated simulation of multi-physical 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.

WP4.5 Modelling and simulation of the motion of ships, cranes and drilling systems in waves.

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).

WP5.6 Monitoring of Hydraulic Cylinders.

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.

WP6.3 Design of soft-sensors based on novel context-aware data fusion techniques.

WP6.4 Optimization of energy consumption and emission reduction for O&G production platforms.

WP6.5/WP3.9 Sensor fusion for perception, collision avoidance and navigation towards autonomous systems.

WP7.1 The management of digital business model innovation.
**Organisation**

**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 and Innovation Manager Asle Pedersen. In addition, UiA provides necessary resources from the Faculty and Central Management.

**ORGANISATION MAP**

**Work Packages WP1 – WP7**

WP1 leaders: Olav Egeland, Torben Ole Andersen, Thomas Meyer, Anne Grete Ellingsen (replaced by Marianne Engvoll in 2019), Geir Hovland, Baltasar Beferull-Lozano and Morten Kjeld Ebbesen.

WP1
- WP1 LEADER 1 Morten Kjeld Ebbesen, UiA
  Co-sup. WP1.2, co-sup. WP1.3, and sup. WP1.4
- WP1 LEADER 2 Torben Ole Andersen, AAU
  Sup. WP1.2, sup. WP1.3, and co-sup WP1.4

WP1.2 Sondre Nordás, UiA
WP1.3 Viktor Hristov Donkov, AAU
WP1.4 Daniel Hagen, UiA
WP1.5 Søren Ketelsen, AAU
WP1.6 Wei Zhao, UiA
WP1.7 Thomas Farsakoglou, AAU
WP1.8 New position, AAU
Ian K. Jennions
Cranfield U.

Christian Holden, NTNU
Sup. WP4.1 & WP4.2

Houxiang Zhang
NTNU Aalesund
Sup. WP4.3

Terje Rølvåg
NTNU
Sup. WP4.4

Geir Hovland
NTNU
Co-Sup. WP4.3

Bjørn Haugen
NTNU
Co-sup. WP4.4

Arne Støy
NTNU Aalesund
Co-sup. WP4.3

Subtask 5.1
«Big tapered roller bearings»

Subtask 5.2
«Big steel ropes»

Subtask 5.3
«Big fiber ropes»

Subtask 5.4
“Winch Lifetime predictions”

Subtask 5.5
“Welded joints fatigue predictions”

Tor Inge Waag
Task leader, NORCE

Rune Schlanbusch
Task leader, NORCE

Ellen Nordgård-Hansen
Task leader, NORCE

Achim Feldermann
Task leader, Aachen IME

Tom Lassen
Task leader, UiA

Kjell Gunnar Robbersmyr
UiA
Sup. WPS.1

WPS.1
Martin Hemmer
UiA

WPS.3
Shaun Falconer
UiA

Geir Grasmo
UiA
Sup. WPS.3

Mohammed Yusuf
Aachen IME

Zbigniew Mikulski
UiA

WPS.5
Vignesh Shanbhag
NORCE

WP4 LEADER
Olav Egeland, NTNU
Supervisor WP2.1-2.4

WP5 LEADER
Thomas J.J. Meyer
NORCE

Houxiang Zhang
NTNU Aalesund
Sup. WP4.3

Terje Rølvåg
NTNU
Sup. WP4.4

Geir Hovland
NTNU
Co-Sup. WP4.3

Bjørn Haugen
NTNU
Co-sup. WP4.4

Arne Støy
NTNU Aalesund
Co-sup. WP4.3

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Task leader, NORCE

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Task leader, NORCE

Ellen Nordgård-Hansen
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Achim Feldermann
Task leader, Aachen IME

Tom Lassen
Task leader, UiA

Kjell Gunnar Robbersmyr
UiA
Sup. WPS.1

WPS.1
Martin Hemmer
UiA

WPS.3
Shaun Falconer
UiA

Geir Grasmo
UiA
Sup. WPS.3

Mohammed Yusuf
Aachen IME

Zbigniew Mikulski
UiA

WPS.5
Vignesh Shanbhag
NORCE
Steering Board

The Steering board (2019-2020) consists of 7 members, and 2 deputy members: Leif Haukom (GCE NODE), Morten Halvorsen (NOV), Sjur Henning Hollekim (MHWirth), Øyvind Mydland (Stepchange), Houxiang Zhang (NTNU), Philipp Schubert (RWTH Aachen) and Geir Grasmo (UiA), Elvind Gimming Stensland (Deputy, MacGregor) and Thor Arne Håverstad (Deputy, Norce).

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.

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 11, 2020, where the budget for next three years and the WP annual work plans were presented and approved.

**KEY NUMBERS 2019**

- Steering Board Meetings: 4
- WP leader meetings: 10
- Workshops/Webinars: 6
- Reference Group Meetings: 6
- Conferences: 0
- General Assembly: 1
“Leif has been a tremendous asset for the SFI. Based on his long and strong track-record in the industry, Leif has chaired the SFI in a brilliant way since its inception. We thank him for his efforts in leading the SFI Offshore Mechatronics,” says Tom Fidjeland, CEO of GCE NODE.

Leif Haukom chaired the SFI’s Board of Directors on behalf of GCE NODE. A few years into retirement, Haukom has now decided to leave this position. Tom Fidjeland, CEO of GCE NODE, was elected as the new Chairperson of the Board in the General Assembly on November 11.

“From the companies’ point of view there has traditionally been a gap between academic research and industrial needs. As a result of the companies’ involvement, research in the SFI centre has been more focused,” says Haukom.

Some of the PhD fellows were recruited from the industry partners and return to their company after completion of their thesis. These candidates bring valuable industry insight into the research and then valuable research experience back into the companies.

In addition to this, several of the graduated PhD fellows have been hired by the industry partners. Recruitment, bachelor and master theses, and various forms of mobility contribute to maintaining a strong relation between the academic and industrial partners.

“A valuable outcome of the SFI centre is achieved when PhD fellows complete their research, get hired by the industry and utilize their new knowledge to develop better products for the companies,” says Haukom.

“Building on the idea of co-creation of knowledge, which is the vision of the University of Agder, the industry and all the research partners have come close in the SFI centre. Both parties will for years to come continue to gain from the technological knowledge and personal relationships established through the centre,” says Haukom.

**The new Board of Directors (2021-2023):**

- Tom Fidjeland (GCE NODE), new member of the board and new chairperson
- Morten Halvorsen (NOV), re-elected member of the board and new deputy chairperson
- Sjur Henning Hollekim (MHWirth), re-elected member of the board
- Jisha Panikar (Klüber Lubrication), new member of the board
- Olav Egeland (NTNU), new member of the board
- Torben Ole Andersen (Aalborg University), new member of the board
- Geir Grasmo (UiA, in 2021) and Jorunn Gislefoss (UiA, in 2022), re-elected
- Anstein Jorud (Cameron), new deputy member of the board
- Thomas Meyer (NORCE), new deputy member of the board
**Innovation**

Research based innovation is a demanding interplay with equally important contributions from the industry partners and the academic partners. The main mode of innovation in SFI Offshore Mechatronics is utilization of research results and knowledge created in the centre by the industry partners to make new or improved processes or products.

The path from a TRL3-4 (Technology Readiness Level) up to TRL7-9 which is expected for a company to make large investments into new concepts and technology is known to be challenging. To reach a higher TRL level we encourage the companies to establish industry-driven spin-off projects.

An innovation usually evolves over an extended period, involving a lot of people and results from multiple research projects. To single out the contributing factors to an innovation can be difficult, however in some cases new innovations can be tracked and linked back to the research efforts and spin-off projects.

We try to keep track of spin-off projects from the centre and in 2020 a total of 8 spin-off projects were created. Some projects are direct spin-offs from the centre and initiated in collaboration with the academic partners. Other projects are indirect spin-offs initiated independently by the industry partners.

From time to time the researchers in the centre come up with new innovative ideas and this is handled according to procedures outlined in the consortium agreement such as reporting an Invention Disclosure (DOFI). The first patent filed based on an invention from the centre was published in June 2020.

The patent pending concept is related to improvements in the performance of spinning LiDARs and the inventors are PhD fellows Atle Aalerud and Joacim Dybedal. A spin-off project to commercialize the invention has been created in a partnership between UiA and Innoventus Sør and with funding from the Research Council of Norway, in the FORNY program.

An example of a direct spin-off project in 2020 is “Increasing Operational Efficiency by Retrofitting Sensor-Based Anti-Swing Technology on Offshore Cranes” initiated by MacGregor in collaboration with University of Agder. The project is funded by the Research Council of Norway Maroff-2 program. Research from the project will greatly support a newsolution innovation from MacGregor in collaboration with Kongsberg Maritime called Motion Compensated Pile Gripper. The scientific challenges related to the innovation is close to the research in the SFI Offshore Mechatronics such as wave compensation and control systems. The motion compensated pile gripper will be used for installation of offshore wind towers foundations.

**Related research:**
- Real-Time Motion Compensation in Ship-to-Ship Load Handling (Sondre Sanden Tørdal WP2.5)
- Quaternions and Dual Quaternions for State and Parameter Estimation (Axel Sveier WP3.3)
- High-Performance Control for Motion Compensation (Torstein Myhre WP2.2)
- Integrated simulation of multi-physical systems in offshore operations (Savin Viswanathan, WP4.1)
- Modeling and simulation of the motion of ships, cranes and drilling systems in waves (Savin Viswanathan, WP4.5)
- Protocols and standards for integration of simulation models and co-simulation (Lars Ivar Hatledal, WP4.3)

**Motion Compensated Pile Gripper**

Static pile gripper frames are well known in the industry and are traditionally used for jack-up vessels. With the Offshore Wind market trends, wind farms being installed further offshore and the requirement of handling much larger monopiles, legacy jack-up vessels are not capable of handling the job. Therefore, the market demanded for an innovative approach for installing monopiles by means of a floating vessel, with the pile gripper frame capable of compensating for the vessel motions. One example of this is the use of next generation wind foundation installation vessels as OHT Alfa Lift, combined with a 3000 t crane from Liebherr and MacGregor motion compensated pile gripper. It is the combination of multiple innovative elements that makes the solution unique and new compared to existing solutions, but certainly the integration to the vessel control system is the way to increase efficiency, operability and safety of the overall installation operation.
Scientific Activities and Results

Each PhD defense is a milestone in the SFI Offshore Mechatronics centre. In 2020 seven PhD fellows defended their thesis:


Daniel Hagen (UiA), PhD defended on September 2, 2020. Title of Thesis: Improving Energy Efficiency and Motion Control in Load-Carrying Applications using Self-Contained Cylinders.

In 2020 a large share of the scientific publications was at the highest level (Level2). Out of 19 journal papers 6 (32%) were published in the highest ranked journals.
The SFI Offshore Mechatronics centre is distributed with industry and research partners across four countries (Norway, Denmark, The Netherlands and Germany). In addition to this the researchers in the centre utilize their extensive international networks.

The centre has a small international advisory board. It consists of the following persons: Professor Rolf Johannsson, Lund University, Sweden, Professor Ian Jennions, Cranfield University, UK and Professor Iraj Ershagi, University of Southern California, USA. This board was more active in the early stages of the centre.

Due to COVID-19, in 2020 the opportunities to travel and accommodate guest researchers have been limited. However, most of the PhD defenses have international opponents. The written examination reports serve as valuable feedback on the relevance, quality and impact of the research in the centre. The following are a few excerpts of some very positive feedback:

- Dr. Isabelle Fantoni, France: “The contributions of the thesis are substantial with a thorough theoretical foundation and are also well documented experimentally.”
- Prof. Lorenzo Marconi, Italy: “The thesis is extremely rigorous from a mathematical viewpoint and definitely provides an elegant and powerful framework by contributing with new knowledge to the state of the art.”
- Prof. Joris de Schutter, Belgium: “The contribution is original and the development of the theoretical framework and the presentation in the thesis is of high quality.”
- Prof. Oliver Sawodny, Germany: “The candidate made important achievements in modelling of ship crane and load dynamics, in combination with the wave excitation.”
- Prof. Demba Diallo, France: “A significant contribution of the candidate is the development of a test rig for replicating the scoring on roller end and the analysis of the observed arc-shaped scoring through an analytical model.”
- Prof. Svante Gunnarsson, Sweden: “Throughout the thesis the candidate combines solid theoretical work with extensive experiments, and this combination gives a strong support for the industrial relevance of the results.”
- Prof. Heikki Handroos, Finland: “The author’s clearly novel individual contribution in the overall study is the proposed new version of the partial stroke displacement control strategy.”
Recruitment

In 2020 five new PhD students and three new Post.Doc positions were hired. By the end of 2020 all final PhD and Post.Doc positions have been filled. During the project period a total of 40 researcher and technicians have been recruited. The following researchers and technicians were hired in SFI Offshore Mechatronics in 2015-2020. Unfortunately, it was not possible to recruit any female PhD students or Post.Doc positions in 2020.

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<td>Torstein Myhre</td>
<td>Post.Doc, NTNU</td>
<td>2015-2017</td>
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<tr>
<td>Geir Olav Tysse</td>
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<tr>
<td>Sondre Sanden Tørdal</td>
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<td>Achim Felderman</td>
<td>PhD, RWTH Aachen</td>
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<tr>
<td>Atle Aalerud</td>
<td>PhD, UiA</td>
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<td>Andrej Cibicik</td>
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<td>Joacim Dybedal</td>
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<td>Shaun Falconer</td>
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<td>Martin Hemmer</td>
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<td>Aleksander Meyer Sjøberg</td>
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<td>Thilina Nuwan Weerasinghe</td>
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<td>Philipp Schubert</td>
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<td>Lothar Wöll</td>
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<td>Zbigniew Mikulski</td>
<td>PhD, UiA (associated)</td>
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<td>Viktor H. Donkov</td>
<td>PhD, Aalborg</td>
<td>2017-2019</td>
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<td>Thiago G. Monteiro</td>
<td>PhD, NTNU Aalesund</td>
<td>2017-2021</td>
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<td>Savin Viswanathan</td>
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<td>Njål Tengesdal</td>
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<td>Lars Ivar Hatledal</td>
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<td>Gaute Fotland</td>
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<td>2017-2020</td>
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<td>Luis Miguel Lopez Ramos</td>
<td>Post.Doc, UiA</td>
<td>2016-2018</td>
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<td>Søren Ketelsen</td>
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<td>Emilio Ramiz Moreno</td>
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<td>Yvonne Murray</td>
<td>PhD, UiA (associated)</td>
<td>2018-2021</td>
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<td>Hans Kristian Holen</td>
<td>PhD, NTNU</td>
<td>2019-2022</td>
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<td>Dipendra Subedi</td>
<td>PhD, UiA (associated)</td>
<td>2019-2022</td>
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<td>Ronny Landsverk</td>
<td>PhD, UiA (associated)</td>
<td>2019-2022</td>
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<tr>
<td>Vignesh Shanbhag</td>
<td>Post.doc NORCE</td>
<td>2019-2021</td>
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<tr>
<td>Mohammed Yusuf</td>
<td>PhD, RWTH Aachen</td>
<td>2019-2023</td>
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<td>Alexander Meyer Sjøberg</td>
<td>Post.doc NTNU</td>
<td>2020-2022</td>
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<td>Kevin Roy</td>
<td>PhD, UiA</td>
<td>2020-2023</td>
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<tr>
<td>Marius Kristiansen</td>
<td>PhD, UiA</td>
<td>2020-2023</td>
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<td>Wei Zhao</td>
<td>PhD, UiA</td>
<td>2020-2023</td>
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<tr>
<td>José Amendola</td>
<td>PhD, UiA</td>
<td>2021-2023</td>
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<tr>
<td>Savin Viswanathan</td>
<td>Post.doc NTNU</td>
<td>2021-2023</td>
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<tr>
<td>Tomas Farsakoglou</td>
<td>PhD, AAU</td>
<td>2021-2023</td>
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</table>
The main event for communication and dissemination in the project is the SFI Offshore Mechatronics Annual Conference. In 2020, the conference was planned on May 12-13, however due to the situation with COVID-19 it was postponed and eventually cancelled.

To compensate for the cancellation of the annual conference short bi-weekly webinars were introduced targeting attendees from both industry and the research partners. The topics of the webinars are various technical subjects with both internal and external presenters. The work-packages also invite people from the industry partners to reference group meetings which is a good opportunity to disseminate results to participate in discussions and to get valuable feedback from an industrial perspective.

SFI Offshore Mechatronics is committed to follow the FAIR principles for scientific data management and stewardship. The FAIR principles provide guidelines to improve the Findability, Accessibility, Interoperability, and Reuse of digital assets.

Github (https://github.com/SFI-Mechatronics) is used to host both public and private repositories with source code related to the research in the centre. In 2020 we also started using Dataverse.no to publish datasets. Dataverse.no is hosted by University of Tromsø and is based on The Dataverse Project, developed by the Dataverse Team at the Institute for Quantitative Social Science (IQSS) at Harvard University.

To publish datasets related to our centre, a sub-repository under the UiA Open Research Data repository (https://dataverse.no/dataverse/mechatronics) has been reserved. Each dataset published to Dataverse gets a unique DOI identifier which can be referenced in scientific publications. We expect that publishing datasets to Dataverse.no will improve external reuse of the data but also internally between researchers.

SFI Offshore Mechatronics has a web page (sfi.mechatronics.no) for news and general information about the Project. 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.
Dissemination Activities

PUBLICATIONS

JOURNAL PAPERS

Aksel Sveier and Olav Egeland, Dual Quaternion Particle Filtering for Pose Estimation, IEEE Transactions on Control Systems Technology, 2020, (Level 2).


Geir Ole Tysse, Andrej Cibicik and Olav Egeland, Vision-based control of a knuckle boom crane with online cable length estimation, IEEE/ASME Transactions on Mechatronics (Level 2).


Zbigniew Mikulsik and Tom Lassen, Crack growth in fillet welded steel joints subjected to membrane and bending loading modes, Engineering Fracture Mechanics, Volume 235, August 2020, 107190

CONFERENCE PAPERS:


Lars Ivar Hatledal, Houxiang Zhang and Frederic Collonval, Enabling Python Driven Co-Simulation Models With PythonFMU, ECMS 2020 Proceedings.


Student Projects

UiA
Mehdi Esmaeil
Fault Detection during Drilling using Artificial Intelligence and Model-based Control

Christopher Bjørnarå
Pipe joint position identification

Ilja Boginskiis and Abker Ibrahim Hmdoun
Modeling and Control of Dynamics between Crane and Vessel

Rabah Saleh Hagag and Martin Sirevåg
Formal verification of ABB robotic system

Kjetil Godtfredsen and Erlend Haugan Salmon
3R Long-reach flexible robot

Eilef Lundevold, Gøran Brovig Olsen and Arne Edvard Taanevig
Link Arm for Knuckle Boom Crane

NTNU:

Frode Bergli
Vision Based Tracking of Target Ship in Offshore Crane Operations

Markus Bjønnes and Marius Nilsen
Development of a system for the robotic assembly of mechatronic products using constraint-based robot control

Charlotte Heggem and Nina Marie Wahl
Development of a System for Visual-SLAM and Mobile Manipulation using an Industrial Mobile Manipulator

Espen Lunden
Force Control and Constraint-based Task Specification in Robotic Assembly

Kristian Sørebø
Low-cost Navigation and Collision Avoidance System

Villarreal Lozano Carolina
Digital Twin for Structural Monitoring and Predictive Maintenance of a Maritime Crane (NTNU Aalesund)

RWTH Aachen:

Lifan Li
Robust Load Stabilization for Crane-Based Offshore Loading Processes using a Data-Driven Approach

Laura Mathilde Wolff
Flatness Based Model Predictive Control of an Offshore Crane

Christina Raphaella Ionescu
Robust Model Predictive Control for Offshore Cranes using Sliding Modes and Databased Error Forecasting