

MASTER STUDENT THESES

CLUSTER ON INDUSTRIAL ASSET MANAGEMENT

Contents

Development of Testing Metrics for a Decision Model for the Replacement of Medical Equipment at a Large County Health System	3
Cyber Security in Organizations	3
Asset Management Practices in Norwegian Industrial Sectors.....	3
Digitalization of Offshore Wind Farm Systems	4
Assessment method for review of existing maintenance strategies based on reliability, availability, risk, and cost parameters	4
How to develop a performance management system to analyse working hours at VSAT installations?	4
Lean and TPM Practices in an Industrial Context.....	5
Vedlikeholdsstudie av fiskal instrumentering I Statoil	5
Emergency Release of Mooring Lines in the Barents Sea	5
A Risk Analysis and the Insurance Policies for the Cruise Ships in the Arctic	5
Effects of nonlinearities in the Equation of motion for one degree of freedom systems	6
Evaluation of Ballast Failures during operations of Semi-submersible rigs	6
A Full-Scale Study on Traffic Induced Vibrations of a Suspension Bridge	6
Analysis and the possibility of application of the technologies of capture and storage of carbon dioxide used in Norway for Russian offshore.....	7
Combined oilfield development in the Pechora Sea by using IRGBS "Prirazlomnaya" as a hub	7
Operational limits for a stimulation vessel in the Northern Caspian Sea conditions	7
Underwater robotics in the future of arctic oil and gas operations	8
Conceptual design of oil and gas transportation system in the Barents and Kara Seas	8
Mooring Analysis of a Closed Fish Cage	9
Optimization of the upper completion assembly by using redundant pump exemplified by the well in the Prirazlomnoye field, Pechora Sea	9
Analysis of drilling wastes disposal methods effectiveness in Russian arctic offshore fields.....	9
Design, installation and operation of high voltage cables at sea.....	10
Mooring systems analysis for floating wind turbines in the Italian seas	10
Decision Analysis in Contract Type Selection for an Offshore Field Development.....	10
Offshore Exploratory Drilling Campaigns During Low Oil Price Period: Maximizing Value Creation from Flexibility.....	11
Use of Probability Management in E&P Portfolio Analysis.....	11
Investigation of Corrosion in Geothermal Wells - A Qualitative Risk Assessment.....	11
Applications of Artificial Intelligence in Petroleum Engineering.....	12
Impact of Well Configuration on CO2 Injection for Energy Exploitation in Geothermal/Geopressured Reservoirs	12

Flow-Rate Out Measurement from Well During Drilling.....	12
Automatic collection and storage of smart city data with semantic data model discovery and sample data analysis.....	12
Capacity of a bolted T-stub connection between different materials subjected to tension and thermal load	13
Evaluation of a nonlinear cumulative creep damage model for design applications	13
Model of optimizing test frequencies and ensuring compliance of safety integrity level requirement of emergency shutdown systems based on condition monitoring: A case study at GASSCO	13
General model for RCA in Manufacturing Industry. Case study from Kverneland Group	14
Cost-effective model for self-assessment of maintenance management: An update to the “Maintenance Baseline Study” early developed by Norwegian Petroleum Directorate.	14
Logistics in AkerBP; Criteria For Maximizing Flow.....	14
Using Drone Technology with Photogrammetry for Surveying within Civil Engineering.....	14
What critical factors will affect the start-up and further operation of a science center in Egersund, and how may this be profitable in a five-year perspective?	15
Remote Management: Increased Management Efficiency as a Means to Increased Commitment in Remote Field Personnel	15
Integrated Governance System for a Service Provider: Process orientation and Interoperability with clients, business partners and suppliers	15
Konsekvensene av økt digitalisering blant framtidens byggetreprenører.....	16

Development of Testing Metrics for a Decision Model for the Replacement of Medical Equipment at a Large County Health System

Author: Brett Kenneth Bloch

Supervisor: Professor Jayantha Prasanna Liyanage

Abstract: The medical revolution that has occurred in the last one-hundred years has truly been remarkable. With this amazing growth as well as the continued development come many aches and pains that are exhibited in any rapidly developing technology sector. A major concern is focused on the maintenance and replacement of these technologies. When is the right time to continue to hold onto existing technologies and products and when is it right to cut your losses and invest in new devices? This is a question that plagues hospitals and clinics worldwide. And it can be a costly question to answer. This thesis seeks to formulate and test several metrics to indicate the proper points of replacement for a large fleet of medical equipment.

Cyber Security in Organizations

Author: Fritzvold, Einar

Supervisor: Professor Jayantha Prasanna Liyanage

Abstract: The cyber threat towards digital systems and organizations are increasing. WannaCry is one of the latest large-scale cyberattacks which has had a global impact. The digitalization is transforming organizations to innovate and utilize new digital technology and infrastructure. This is raising the connectivity and dependency on digital systems. Organizations, authorities, individuals, and operations are susceptible to cyber risk. Threat actors are becoming more organized, sophisticated, and cyber-crime has been commercialized. Easy access to malicious tools is one of the drivers for the increased threat. Organizations must know how to face this new cyber threat and understand how it affects their systems and operations. The purpose of this thesis is to compare cyber security solutions and capabilities of three different organizations in the Norway. The main objective is to find industry similarities, key issues and challenges related to cyber security, and find areas of improvement.

Asset Management Practices in Norwegian Industrial Sectors

Author: Gulliksen, Mats Tronstad

Supervisor: Professor Jayantha Prasanna Liyanage

Abstract: Several industrial sectors in Norway have been subjected to challenging industrial conditions in recent years, due to factors such as declining markets and large market fluctuations. On top of these challenging industrial conditions are also the elevated demands of modern industrial society, encompassing such factors as increasing stakeholder concerns related to environmental and social effects of industrial organizations' activities and an increasing pressure to deliver improved services and products without increasing costs or risks. A key aspect in meeting such elevated demands and challenging industrial conditions is the way in which industrial organizations manage their assets and the value they create. The discipline of asset management is interesting in this regard, as it promotes enhanced value delivery from assets, at lower risk and with improved

sustainability. The principles of asset management allow industrial organizations to regularly achieve their organizational objectives and meet stakeholder expectations on a regular basis.

Digitalization of Offshore Wind Farm Systems

Author: Petter Digranes Øydegard

Supervisor: Professor Jayantha Prasanna Liyanage

Abstract: In recent years, the offshore wind industry has contributed to the world-wide expansion of renewable energy. Wind energy is widely viewed as one of the key renewable energy sources that make up the new energy mix that, together with other renewable sources, will relieve the world's dependency on fossil fuels. Offshore wind has seen rapid technological development, with the ever-larger wind turbines most noticeable resulting in increased annual energy output per turbine. Despite this, the industry experiences challenges throughout the value chain and is still largely dependent on state subsidies to make projects economically viable. This thesis investigates how new digital technologies and digitalization can help further evolve the offshore wind industry using the Industry 4.0 concept as a basis, and explores how technologies within this concept can contribute to an offshore wind farm that overcomes some of these challenges.

Assessment method for review of existing maintenance strategies based on reliability, availability, risk, and cost parameters

Author: Olsen, Fredrik Westeng

Supervisor: Professor Jayantha Prasanna Liyanage

Abstract: Maintaining assets is a fundamental part of any industrial facility. Oil and gas operators are often using advanced maintenance strategies, but the strategies are usually built pre-operation and not systematically updated later in-operation. Still, the operators often record the necessary maintenance data that would allow them to optimize these strategies. The lack of this experience has been challenging in the recent years where operators have had to cut back on maintenance without truly knowing the consequence of these cuts. Another issue is the silo thinking between the different disciplines, operator personnel, and service providers. They are often working towards their own solutions, without sharing information and experience that would allow for a more optimal solution. A full overview of economical, technical, and risk figures are of great benefit for the decision maker and subsequently the end result.

How to develop a performance management system to analyse working hours at VSAT installations?

Author: Magnus Lysgård

Supervisor: Professor Jayantha Prasanna Liyanage

Abstract: The price for satellite communications has fallen over the last few years. This has led to more ships having access to internet and telephony when they are at sea. Greater competition, lower margins and new customers, have created an increased cost focus in the industry. It has become much more important to get the equipment installed on board as fast and cheap as possible. Poor preparations and faulty parts are typical examples of what can delay an installation. It is important that all factors that delay the work are reported and documented. This is done through a system for

non-conformance reports (NCR). The objective of this master thesis is to provide greater insight to when and how often deviations are reported, and to evaluate the relationship between the number of jobs and the number of deviations. What type of deviation was reported and the reason why this deviation.

[Lean and TPM Practices in an Industrial Context](#)

Author: Magnus Rasmussen

Supervisor: Professor Jayantha Prasanna Liyanage

Abstract: Today's globalized market place, and rapid changes in businesses environment, brings forth a need for continuous improvement. Businesses all over the world compete against each other, therefore it is essential for manufacturing business to never "stand still". In a high cost country as Norway, it is always a risk for outsourcing. To prevent this from happening, manufacturing companies need to continuously increase their performance, deliver on quality expectations, and remain competitive on cost. To meet these needs, Lean and TPM are vital concepts for success in this industry.

The analysis showed at the Cast House has come a long way seen in a Lean and TPM perspective. However, the results uncovered some improvement possibilities. Based on these, several improvement suggestions were presented and discussed.

[Vedlikeholdsstudie av fiskal instrumentering I Statoil](#)

Author: Vidar Langeland

Supervisor: Tore Markeset

Abstract: Restricted

[Emergency Release of Mooring Lines in the Barents Sea](#)

Author: Sigurd Vestbø Næss

Supervisor: Ove Tobias Gudmestad

Abstract: RESTRICTED

[A Risk Analysis and the Insurance Policies for the Cruise Ships in the Arctic](#)

Author: Konstantinos Trantzas

Supervisor: Ove Tobias Gudmestad

Abstract: The need of human to explore new areas, the climate change and the growing worldwide demand have led to an increasing popularity of the Arctic region the last years. Cruise industry is continuously evolving in this area, creating an important need for more research on the Arctic Ocean.

The challenges associated with the cruise ship voyages in the Arctic and the hazards surrounding and evacuation in the Arctic environment are identified through the participation in a real scale Search

and Rescue Exercise (SARex 2) conducted in waters north of Svalbard. A risk analysis is prepared, where the identification and the weighting of the hazards, as well as different risk mitigation approaches are presented in order to reduce their probability of occurrence and/ or the severity of their consequences.

[Effects of nonlinearities in the Equation of motion for one degree of freedom systems](#)

Author: Karina Hellevik

Supervisor: Ove Tobias Gudmestad

Abstract: Most natural phenomena in the world have a nonlinear behaviour. If systems are to be described by linear equations they must follow the superposition principle. The superposition principle, consisting of additivity and homogeneity, states that the response caused by several inputs are equal to the sum of each input separately. Though a minimal amount of systems in the world follow this principle, linearization of systems is widely used. The classical thoughts that the world could be described linearly were not disputed until the late 19th century. Dynamical systems describe how all points of the system evolve with time. Most nonlinear systems cannot be explicitly solved, so phase diagrams are widely used. Phase diagrams map the velocity and position as time increases, making it possible to investigate how the system travels after some time. Trajectories with different initial values also tells us how sensitive the system is to its starting values.

[Evaluation of Ballast Failures during operations of Semi-submersible rigs](#)

Author: Ihuaku Nneoma Kelechi Unegbu

Supervisor: Ove Tobias Gudmestad

Abstract: The drilling operation is a very sensitive and extremely risky task and can be carried out from a floating vessel, semi-submersible and so on. Ballast systems play a very vital role to ensure vessel stability. The main function of the ballast system is to maintain stability and sufficient draft, and also to retain the sheer forces and bending moments within required limits. This thesis is aimed at evaluating the risks involved in ballast operations, by identifying the various failure modes of semi-submersible ballast systems and we will consider possible barriers and consequences due to the ballast system failure during drilling operation. The thesis focuses primarily on the failure mode effect and criticality analysis (FMECA) of the main components of the semi-submersible's ballast system by determining the failure causes and failure modes that could influence each components performance, and thus identifying the most critical component(s).

[A Full-Scale Study on Traffic Induced Vibrations of a Suspension Bridge](#)

Author: Thomas Ole Messelt Fadnes

Supervisor: Prof. Ove Tobias Gudmestad and Prof. Jasna Bogunovic Jakobsen

Abstract: This thesis focuses on the traffic-induced vibrations of a suspension bridge, and the modal properties embedded in the traffic-induced response data. The purpose of the work has been to study the impact load response from heavy vehicles and estimate the modal damping ratios of the bridge. Findings from this experiment suggest that impact load response is present, but with different magnitude and cause for different vibration modes. The results have relatively large

variations, but are reasonable compared to other methods used for estimating modal damping ratio for Lysefjorden bridge as well as similar structures in existing literature. The findings agree with results from previous studies which show that response from vehicles consists of a combination of both low and higher frequency modes. Also, all identified frequencies agree with those found previously both using analytical methods and the fullscale response measurements with very little deviation.

[Analysis and the possibility of application of the technologies of capture and storage of carbon dioxide used in Norway for Russian offshore](#)

Author: Alexey A. Gurin

Supervisor: Prof. Ove Tobias Gudmestad. External supervisor: Professor Kaplan Saferbievich Basniev

Abstract: Global climate change is long-term risk related to the accumulation of carbon dioxide and other greenhouse gases in the atmosphere. Development and use of capture and storage technology in the underground formations contribute to the reduction of CO₂ emissions to the atmosphere. The objective of this thesis is to analyse technology for capture and storage of carbon dioxide used in Norway. The second objective is to make an application analysis of the technology of capture and storage of carbon dioxide on Russian shelf. Risk analysis connected with carbon dioxide storage is the third objective of the paper. The research is based on technology adopted in the Sleipner gas field in Norway. From an economic point of view, the benefits may not outweigh the extra costs of CO₂ capture, but at the same time, there are known cases in which when injection of CO₂ into declining oil fields increased oil recovery.

[Combined oilfield development in the Pechora Sea by using IRGBS "Prirazlomnaya" as a hub](#)

Author: Aryslan U. Biktiakov

Supervisor: Prof. Ove Tobias Gudmestad and Prof. Muk Chen Ong. External supervisor: Prof. Anatoly Borisovich Zolotukhin (Gubkin University)

Abstract: For a few last decades, the Arctic region is considered to be very wealthy in terms of oil and gas resources. Initial estimations show that roughly 100 billion tonnes of oil and gas reserves might be accumulated under the surface of the Arctic region. Beginning with the general description of the most explored oilfields located in the southeastern part of the Barents Sea (Pechora Sea), the project comprehensively considers conceptual development of the Medynskoe-more oilfield by utilizing the IRGBS "Prirazlomnaya", in particular: development of the optimal oil production strategy for the oilfield; selection of the appropriate offshore structure; selection and justification of the possible oil transportation solution; design and construction of the subsea pipeline from the Medynskoemore oilfield to the IRGBS "Prirazlomnaya"; analysis of the processing, storing and offloading systems in the IRGBS "Prirazlomnaya".

[Operational limits for a stimulation vessel in the Northern Caspian Sea conditions](#)

Author: Roman Shulkin

Supervisor: Prof. Ove Tobias Gudmestad. External supervisor: Prof. Anatoly Borisovich Zolotukhin

Abstract: This thesis describes the concept development of a stimulation and well service vessel and the evaluation of its operational limits in Northern Caspian Sea conditions. Possible options and solutions are discussed on the basis of the analysis of world experience and existing technologies for similar conditions. An integrated approach for solving this problem includes three parts:

- The selection of the optimum vessel, that can be specially constructed or upgraded to carry all the equipment, that is needed to ensure the successful downhole treatments in challenging marine and ice conditions.
- The selection of the optimum deck equipment layout, which will satisfy the necessary parameters, such as vessel stability and efficiency for the chosen downhole operations technology.
- Operational limits discussion and risk evaluation. Suggestion of effective mitigation measures. To solve this problem analysis of up-to-date technologies and several types of calculations were provided, relevant geographical, environmental and reservoir data was examined.

[Underwater robotics in the future of arctic oil and gas operations](#)

Author: Lina Kuzmicheva

Supervisor: Prof. Ove Tobias Gudmestad.

Abstract: Arctic regions have lately been in the center of increasing attention due to high vulnerability to climate change and the retreat in sea ice cover. Commercial actors are exploring the Arctic for new shipping routes and natural resources while scientific activity is being intensified to provide better understanding of the ecosystems. Marine surveys in the Arctic have traditionally been conducted from research vessels, requiring considerable resources and involving high risks where sea ice is present. Thus, development of low-cost methods for collecting data in extreme areas is of interest for both industrial purposes and environmental management. The main objective of this thesis is to investigate the use of underwater vehicles as sensor platforms for oil and gas industry applications with focus on seabed mapping and monitoring.

[Conceptual design of oil and gas transportation system in the Barents and Kara Seas](#)

Author: Denis Simukov

Supervisor: Prof. Ove Tobias Gudmestad. External supervisor: Prof. Anatoly Borisovich Zolotukhin

Abstract: Regardless of the current oil and gas industry sufferings, the Arctic region still stands as one of the most perspective areas for the development of hydrocarbon fields. Therefore, current work is dedicated to evaluate feasible transportation concept for hydrocarbon fields in the Barents and Kara Seas and estimate the possibility of using Novaya Zemlya archipelago as a transportation hub. Main challenges for oil and gas transportation system in the Kara and Barents Seas are analysed. These include environmental conditions, ice features and iceberg occurrence, ice management strategies, navigation possibilities, variation of production technologies and pipeline design peculiarities. The thesis also provides climatic, environmental and infrastructural assessment of the Novaya Zemlya archipelago. In addition, advantages of accessing the archipelago are investigated as well as its relative location towards existing and perspective oil and gas fields.

Mooring Analysis of a Closed Fish Cage

Author: Jørgen Andresen

Supervisor: Prof. Ove Tobias Gudmestad

Abstract: Norway is the second largest seafood exporter in the world after China, and Norwegian seafood is currently exported to more than 130 countries). In conjunction with the present growth of the aquaculture industry in Norway, there is a rising skepticism regarding the sustainability of the industry. Major concerns are fleeing, fish welfare, salmon louse and impact on marine life in close proximity to the fish farms. The aim of this thesis is to investigate the possibility of exchanging a fish net, at an operational fish farm, with a newly proposed closed fish cage concept without altering the existing mooring system. The benefit will be reduced downtime and expenditure during setup, since there is no need to install a new mooring system.

Optimization of the upper completion assembly by using redundant pump exemplified by the well in the Prirazlomnoye field, Pechora Sea

Author: Andrei Andreev

Supervisor: Prof. Ove Tobias Gudmestad. External supervisor: Prof. Anatoly Borisovich Zolotukhin

Abstract: A lot of Russian and foreign oil and gas companies tend to get an experience in offshore field development by establishing pilot projects even in the Arctic. Although oil price is rather low, deal with offshore projects more attractive compare to an onshore, because of higher reservoir productivity of offshore oil fields. Oil companies aim at an operating cost reduction, ensuring the reliability and integrity of all platform systems, and their downtime reduction. The problem, which will be considered in the thesis, is an artificial oil production system failure. In the thesis will be considered the upper completion assembly with two ESP in series, for ensuring work of one of them in case of another failure. This concept may reduce well downtime, but only in case of trouble-free operation of other modules of the upper completions, that also may stop production.

Analysis of drilling wastes disposal methods effectiveness in Russian arctic offshore fields

Author: Mikhail P. Gorbadev

Supervisor: Prof. Ove Tobias Gudmestad. External supervisor: Prof. Alexander Sergeevich Oganov (Gubkin University)

Abstract: Oil and gas wells have been drilled for over a century. In the early years of the industry, little attention was usually given to suitable management of drilling wastes. In accordance with the legislation of the Russian Federation regarding the collection and disposal of drilling wastes, it is necessary to introduce the most environmentally safe methods. A choice of several suitable drilling waste management practices currently exists. Operators select the most appropriate waste management option on the basis of regulatory requirements, cost and the concerns of future environmental liability. The objective of the work is to analyse different methods of drilling waste disposal and make an analysis of effectiveness for these methods regarding Russian arctic offshore conditions.

Design, installation and operation of high voltage cables at sea

Author: Louise Våbenø

Supervisor: Prof. Ove Tobias Gudmestad.

Abstract: Underwater cables have been connecting continents since the 1860s. Over time, the process of laying cables at sea has developed into a state-of-the-art operation. Now these operations are becoming more technologically advanced and it is possible to lay large diameter electric cables over large distances. One method is to lay cables in two or more lengths to have them jointed together mid-sea. A particular challenge will occur in case an unplanned splicing will be necessary. In this thesis, we will explore the design criteria for such cables and the procedures and challenges of installation. Furthermore, the effects of how dynamic motions of the vessel and sea influence the situation in deep water will be explored. The OrcaFlex software will be used to simulate and analyze the effects of waves on vessel motion, and how this may affect the cable during a jointing operation of two cables at different water depths.

Mooring systems analysis for floating wind turbines in the Italian seas

Author: Pietro Re

Supervisor: Prof. Ove Tobias Gudmestad and Prof. Giuseppe Passoni (Politecnico di Milano)

Abstract: In recent years, the interest of exploiting wind power in deep waters has grown, with the realization of floating structures that could accommodate a turbine and produce electricity. One of the many challenges that these projects face, it is the position keeping of the system in a defined part of the sea: this is carried out with mooring systems, designed to withstand extreme marine conditions. The first aim of this work is to analyse these systems, to find a general solution for a floating wind farm in the Italian seas. The model's implementation required environmental and structural parameters: the firsts have been obtained with a statistical analysis of actual recordings of wind speed and wave height and with the official Italian cartography.

Decision Analysis in Contract Type Selection for an Offshore Field Development

Author: Andrés Felipe Medina

Supervisor: Reidar Brumer Bratvold

Abstract: Different contract types means different incentives, burdens and relationships. The contract type responsibilities and price should be in accordance with the project needs and organization capacities, not knowing this could entail less project profitability and chances of success. It is necessary to understand the alternatives and how they behave, in order to develop the right strategies to avoid overruns and improve the project quality. The goal of this thesis is to develop a decision analysis model for contract type selection. This model will become a useful tool for contractor and client preferences in an easy and effective way. There has not been found specific information about this subject (decision analysis in contract type selection), the statements presented, evaluation criteria, and data contained are theoretical. Furthermore, all feedback will be welcome and helpful to improve and validate the model across the time.

Offshore Exploratory Drilling Campaigns During Low Oil Price Period: Maximizing Value Creation from Flexibility

Author: Camilo Andres Cardenas Medina

Supervisor: Reidar Brumer Bratvold

Abstract: During severe oil price downturns, many operating companies reduce or eliminate large investments with long time horizons. This reduction in investments forces rig and drilling services providers to reduce their bids to be competitive. The result of this is lower initial investment in the oil and gas projects. In this research, a valuation approach is implemented to study the impact of this investment reduction on the decision-making process for executing exploratory drilling campaigns during low oil price periods. It is demonstrated that postponing exploration campaigns during low oil price periods does not necessarily maximize value creation. The key contribution of this thesis is the use of option valuating methods to demonstrate that value will be created by initiating the exploratory drilling campaigns during low oil price periods. The real option model developed in this research is applicable to all types of exploration projects in the petroleum industry.

Use of Probability Management in E&P Portfolio Analysis

Author: Jugal Chetankumar Bodawala

Supervisor: Reidar Brumer Bratvold

Abstract: Capital investment decisions are a critical decision that every organization must take in a careful manner to optimize its resources. In the industry driven by uncertainty such as upstream petroleum industry, it becomes vital to consider uncertainties in a proper way while making capital investment decisions. Even if one consider cyclical nature of petroleum industry, the historical financial performance of the industry as a whole has been discouraging. One of the key reason behind this can be attributed to use of average or single value in spreadsheet models used for economic evaluation of a project. We use a field of information management called Probability Management to build a project level and portfolio level model. Probability management, which uses an array of pre-generated random trials as an uncertain variable, provides a standardized way to communicate and model uncertainties across the organization without the need for any special program.

Investigation of Corrosion in Geothermal Wells - A Qualitative Risk Assessment

Author: Kristi Larsdottir Kalvenes

Supervisor: Faculty supervisor(s): Mohsen Assadi Alireza Zare External supervisor(s): Hans Petter Lohne Erlend Randeberg

Abstract: The petroleum industry uses a variety of qualitative risk assessment methods for maintaining well integrity, such as well barrier schematics and barrier diagrams. Identifying barriers and using well barrier schematics are helpful tools in qualitative risk assessments. However, it is not yet clear if these methods can be applied for risk assessments in the geothermal industry. Geothermal wells often produce directly through the casing, instead of through production tubing, making it difficult to identify two independent barrier envelopes in accordance to NORSOK D-010. High temperatures and corrosion are the most common contributors to failure in geothermal wells. In this study, a hypothetical case of a downhole corrosion problem was assessed by means of

conducting a qualitative risk analysis and identifying well barriers in a geothermal well. This study shows that qualitative risk assessment methods from the petroleum industry are applicable using minor adjustments to well barrier interpretation and barrier diagrams.

[Applications of Artificial Intelligence in Petroleum Engineering](#)

Author: Ørjan Bergum

Supervisor: Mohsen Assadi

Abstract: Restricted

[Impact of Well Configuration on CO₂ Injection for Energy Exploitation in Geothermal/Geopressured Reservoirs](#)

Author: Mats Rasmussen

Supervisor: Mohsen Assadi

Abstract: Injecting dissolved CO₂ into deep saline aquifers is one of the more promising methods of alleviating greenhouse gas emissions. By simultaneously extracting the geothermally-heated brine in the aquifer, there is an opportunity to offset the energy consumption required by carbon capture and storage. This study uses a simulation tool to explore the effect of well placement on CO₂-storing efficiency. Eight models with different well configurations were tried on a homogeneous aquifer. The study found that storing efficiency was heavily reliant on distance, especially vertical, between the wells and the vertical to horizontal permeability ratio. For a given aquifer model, there exists a depth differential between wells that optimize injection- and production rates versus gas-breakthrough time

[Flow-Rate Out Measurement from Well During Drilling](#)

Author: Trym Wirgenes

Supervisor: Mohsen Assadi

Abstract: Restricted

[Automatic collection and storage of smart city data with semantic data model discovery and sample data analysis.](#)

Author: Julian Minde

Supervisor: Prof. Chunming Rong

Abstract: Collecting and storing smart city data is a task that requires thorough data exploration, configuring and testing to be of value. Configuring a data collection pipeline for data from a new data provider needs to take into account what the various fields represent, what parts of the data is of interest, which data fields should be stored, and more. In some cases the data follows a predefined, and known schema, in other cases the data may be undocumented.

This thesis presents a framework and a software for automating the process of collecting and storing smart city data, and other event based data sets. The problem, and solution is illustrated in this thesis by a use case where the task consist of storing public transportation data in a structured way in a storage system that can handle big data.

Capacity of a bolted T-stub connection between different materials subjected to tension and thermal load

Author: K. Ydstebø

Supervisors: S. C. Sirwardane, H.G. Lemu, and O. Mikkelsen

Abstract: The purpose of this thesis is to study the behavior of bolted T-stub connections of different materials subjected to tension and thermal load. In the Eurocode, NS-EN 1993-1-8 [1], there are given rules and guidelines for determining the stiffness and capacity of a T-stub connection. In this thesis, the theoretical capacity from the Eurocode is compared to both an experimental and numerical investigation. It is emphasized to study the connections real behavior and thoroughly investigate how well a T-stub connection can be estimated with the Eurocode and a finite element (FE) model.

Evaluation of a nonlinear cumulative creep damage model for design applications

Author: Amanda Joela Rachel Nikolaisen

Supervisor: Prof. Dimitrios G. Pavlou

Abstract: Predicting creep damage and remaining life of an engineering design is a complex task. There are many types of creep material models and they provide significantly different predictions. Furthermore, the necessary material data required for the material models are rarely available. Creep tests are typically performed in uniaxial tension under constant load and temperature. However, such similar conditions are rarely encountered in practical engineering applications where multiaxial stresses and cyclic load and temperature often are present. Creep-fatigue interaction and correlation between uniaxial and multiaxial stress states also add on to the complexity of the damage assessment in creep conditions.

In this thesis, NCCDM will be applied to a X8CrNiMoNb-16-16 pressure vessel designed in accordance with ASME VIII-2 to demonstrate its use in conjunction with practical engineering problems.

Model of optimizing test frequencies and ensuring compliance of safety integrity level requirement of emergency shutdown systems based on condition monitoring: A case study at GASSCO

Author: Helge Nordal

Supervisor: Idriss El-Thalji

Abstract: Restricted

General model for RCA in Manufacturing Industry. Case study from Kverneland Group

Author: Vegard Goa

Supervisor: Idriss El-Thalji

Abstract: There were two main goals of this thesis. The first was to conduct a Root Cause Analysis of a unit called A275 in the facilities of Kverneland Group Klepp. This unit had problems with excessive downtime. Based on that analysis, the second goal was to use the insights gained by in the process of analyzing A275 to develop a new, modified Root Cause Analysis framework that was specifically suited to be used by the Kverneland Group at their facilities. This was important for Kverneland Group as the framework they used previously was too time consuming to be properly used.

Cost-effective model for self-assessment of maintenance management: An update to the "Maintenance Baseline Study" early developed by Norwegian Petroleum Directorate.

Author: Magomed Suleymanov

Supervisor: Idriss El-Thalji

Abstract: The self-assessment method is used to improve the maintenance management system and its related operations. It has the advantage over the maintenance auditing method, as it is a self-driven improvement method, less required work and time consuming, and it keeps the assessment ownership within the department or the family-company. Therefore, the Norwegian Petroleum Directorate have developed a maintenance baseline study as a self-assessment tool for oil & gas industry in 1998. The maintenance baseline study provides a set of questions that help the maintenance manager to assess their whole maintenance management functions from strategic planning, program development, operational planning, execution management, reporting, analysis, until they could up an improvement plan & measures. This process looks like a management loop which has heavy interrelations within its internal functions. In fact, the maintenance baseline study is well known as maintenance management loop within the oil & gas industry.

Logistics in AkerBP; Criteria For Maximizing Flow

Author: Jon, Aaraas

Supervisor: Jan Frick

Abstract: Restricted

Using Drone Technology with Photogrammetry for Surveying within Civil Engineering

Author: Ingrid Omland

Supervisor: Jan Frick

Abstract: Development of innovative solutions within Civil Engineering challenges traditional methods and contributes to possibilities for advantages across different areas of specialisations. Combination of drone and photogrammetry has proven to be an effective method to obtain big data during land surveying. The main focus in this study is to investigate whether drone technology with

camera-based photogrammetry contributes to more efficient land surveying for area planning and design. To investigate the effect of drone and photogrammetry, a case study that investigates a construction project is conducted, which includes processing of the data. The study examines which factors contribute to increased utility value and applicable factors for the method to be suitable within civil engineering.

What critical factors will affect the start-up and further operation of a science center in Egersund, and how may this be profitable in a five-year perspective?

Author: Olav Haraldseid Sævartveit and Eldin Jakupovic

Supervisor: Jan Frick

Abstract: Målet med oppgaven har vært å skrive en forretningsplan forankret i godt analysearbeid, med et overordnet mål om å kunne bidra til et forbedret totaltilbud i Egersund. Basert på de målsetninger og ønsker vi ble presentert for av prosjektgruppen, vendte vi fokus mot etablering av et vitensenter i Egersund.

Gjennom en omfattende analysedel har vi forsøkt å utrede alle elementer som bør tenkes gjennom ved både etablering og drift. Med de økonomiske føringene som ble lagt i starten, har vi gjennomført en kartleggingsprosess hos det lokale næringslivet med mål om å få flest mulig til å fatte interesse og ønske å bidra. Med et sterkt ønsket om lokal forankring i senterets innhold, har vi jobbet for å få lokale aktører til å bidra. Dette fordi disse besitter kompetansen og kunnskapen man ønsker å bygge formidlingen i senteret rundt.

Remote Management: Increased Management Efficiency as a Means to Increased Commitment in Remote Field Personnel

Author: Anette T. Sirevåg

Supervisor: Jan Frick

Abstract: This thesis is an exploratory case study of the Drilling Services product line in Baker Hughes Norway. The purpose of the thesis was to create a framework for evaluating efficiency initiatives in onshore management in terms of effect on remote field personnel's commitment level. To investigate this issue, a problem statement and two corresponding research questions was defined. Problem Statement: How can efficiency initiatives in onshore management increase remote field personnel's commitment level?

For Drilling Services in Baker Hughes Norway, breaking the departments into smaller groups, implementing software for onshore management and improve communication systems internally in onshore management and externally to offshore employees were identified as the efficiency initiatives that would have the strongest effect on remote employees commitment level.

Integrated Governance System for a Service Provider: Process orientation and Interoperability with clients, business partners and suppliers

Author: Dag Nedrum

Supervisor: Jan Frick

Abstract: Restricted

Konsekvensene av økt digitalisering blant framtidens byggetreprenører

Author: Stian Kirkvik Johnsen

Supervisor: Jan Frick

Abstract: The purpose of this paper is to address the consequences of an increased digitalization in the future construction industry, focusing on future digital transformation, the complexity of projects, and the impact this will have on building time, building cost and building quality in future construction projects. A scenario analysis is not a prediction or trend extension of today's situation, but an exploratory instrument for systematic visualization of all credible (and possibly desirable) future situations. The dissertation has also included a literary study, qualitative depth interviews, a PESTEL-analysis of the construction industry's driving forces, and a case study that supports the scenario analysis discussion.

The case study examines the industry-specific key factors in the context of a medium-sized general contractor, and identifies the key factors at a project level. Communication and competence is specifically identified as important aspects of operational and tactical success.