Available Positions for

KTH-CSC joint scholarship programme

Entry 2022

Full PhD student: 48 months

Geoinformatics (Reg. No. 2201)

Type of position Full PhD student: 48 months	**Main supervisor** Gyözö Gidofalvi
KTH School ABE	**Co-supervisor(s)** Anna Pernestål
KTH Department Urban Planning and Environment	**Main email contact** gyozo@kth.se

Specific subject area(s)
Mobility Data Analytics, AI, Optimization, Logistics
Title of project
Electrification of Road Freight Logistics
Number of available position
1
Earliest start date
2022-08-01
Short description of the project
In 2019 the GHG-emission of domestic road transports in Sweden was 16.5 Mton CO2e, of which 61%, 19.7%, and 9.2% were emitted by cars, heavy trucks, and light trucks, respectively. Industry, governments and academia at large agree that in order to reach Sweden's 2030 goal of reducing the CO2-emissions of domestic transports by 70% compared with 2010, a large-scale investment in electrification of the transport sector is required. While static (i.e., charging stations) and dynamic (i.e., electric roads) charging and hydrogen based fuels are all explored as viable solutions for heavy trucks, in the short term, it seems that initially the electrification of heavy freight will be solved with private depot-, semi-public destination-, and public en-route charging stations and hydrogen fueling stations and a mix of electric (BEV, PHEV, FCEV) and biodiesel vehicles, all of which will be largely privately financed by commercial stakeholders (e.g., Logistics Service Providers (LSP), vehicle manufacturers, and/or electric grid companies). But even for such an intermediate solution, a number of logistics questions much be answered to enable to scaling of electrification:

1. How should a fleet of electric vehicles be controlled on a charging / fueling infrastructure (including charging management) to optimally manage a given transport demand of an LSP?
2. What is the optimal fleet configuration (number of different vehicle types with different powertrain configurations (ICE, BEV, PHEV, FCEV), cargo space, and battery configuration)?
3. What is the best charging / fueling infrastructure for a given fleet and its transport demand?

To find answers to these questions, in this PhD study the selected candidate will apply an AI and data-driven approach. This will entail the use, adaptation, and/or development of electrified transport / logistics / traffic simulations, transport route analytics, and AI for prediction (DNN, CNN, GCNN, etc.) and optimization (Actor-Critic Networks, Q-learning, RL, Monte Carlo Tree Search, etc.). The research will build on findings of projects RENO, TRACER, RoSE, and relevant future transport electrification research projects and international research.

Proficient programming, big data processing and analytics, and AI/ML, optimization, traffic engineering (including simulations), control theory are highly desirable skills for this position.

Resources:

- Route Based ERS Network Optimization (RENO): https://www.kth.se/profile/gyozo/page/reno-route-based-ers-network-optimization
- Transport demand centric decision support for electric charging infrastructure planning and operations (TRACER): https://triplef.lindholmen.se/en/projects-triple-f/current-projects (English short abstract) and https://triplef.lindholmen.se/node/86239 (Swedish extended abstract)
- Learning in Routing Games for Sustainable Electromobility (RoSE): https://www.digitalfutures.kth.se/research/c3aidti-projects/learning-in-routing-games-for-sustainable-electromobility-rose/

Transport Science (Reg. No. 2202)

Type of position Full PhD student: 48 months	**Main supervisor** Xiaoliang Ma
KTH School ABE	**Co-supervisor(s)** Junchen Jin
KTH Department Dept. of Civil and Architectural Engineering	**Main email contact** liang@kth.se

Specific subject area(s)
Intelligent Transportation Systems
Title of project
iTensor: intelligent Traffic prediction and controls for smart city
Number of available position
1,2
Earliest start date
2022-09-01
Short description of the project
The overwhelming growth of Internet of Things (IoT) has promoted vehicle-to-everything (V2X) connectivity in transport that enables real-time information exchange among vehicles, and between vehicles and other entities including infrastructure systems, smart devices, and vulnerable road users e.g. cyclists and pedestrians. The omnipresence of mobile phones, with the widespread use of navigation apps, has already provided a useful source of opportunistic sensing data that can support estimating and predicting real-time information of traffic flow. Similarly, even a small share of connected vehicles and things may provide sensing data for advanced applications in Intelligent Transport Systems (ITS). Indeed, connected vehicles may be equipped with more sensors to detect traffic and environment, e.g. Tesla cars are already produced with a full set of sensors that support autonomous driving.

The overall purpose of iTensor project is to accelerate the development and advanced applications of cooperative ITS systems taking advantages of availability of big transport data from various sensors, systems and new technologies. To fulfil the general purpose, this project will develop advanced functionalities for real-time traffic prediction and control based on emerging technologies. Traffic prediction plays a core role for the latest ITS system deriving traffic information from various data sources. The first part of this project will focus on developing robust traffic prediction methods based on deep learning approaches using transport data from various sensors.

Once traffic congestion is predicted in traffic flows, traffic control is the main tool to manage traffic and improve the efficiencies of traffic system. The traditional traffic controls are mostly based on fixed locations. Connected vehicles have big potential to be used as control actuator in a collaborative way for developing various cooperative ITS (C-ITS) services e.g. collaborative driving at signalized intersections. Traffic control using connect vehicles indicates a different traffic sensing and control approach (called

Lagrangian approach), and it may complement, even replace, the current traffic control based on stationary infrastructure that requires installation of a great number of expensive roadside equipment and large annual budget for maintenance. Therefore, another part of this project will develop intelligent traffic control approaches that consider moving connected vehicles as actuators in traffic flow.

Cancer research (Reg. No. 2203)

Type of position Full PhD student: 48 months	**Main supervisor** Cecilia Williams
KTH School CBH	**Co-supervisor(s)** Amena Archer
KTH Department Protein science	**Main email contact** cwil@kth.se

Specific subject area(s)

Molecular Biotechnology, Colorectal Cancer

Title of project

Role of estrogen receptor GPER1 in colorectal cancer

Number of available position

1,2

Earliest start date

2022-06-01

Latest start date

2022-12-31

Short description of the project

Colorectal cancer is the third most common cause of cancer-related death. A truly preventive or targeted therapy against colon cancer does not yet exist. However, hormone replacement therapy in women reduces risk of colorectal cancer, and estrogen has been shown to reduce the formation of preneoplastic lesions in the colon. Estrogen receptor beta (ERbeta) and G-coupled estrogen receptor 1 (GPER1) can both mediate estrogenic effects in the colonic epithelium. These receptors can be activated or inactivated by ligands, and are candidates for therapeutic targeting in colorectal cancer. It is essential to understand the basic mechanistic background of their action in order to identify biomarkers of its activity and design future therapies.

The group has generated significant data using in vivo, ex vivo, and in vitro models and applying omics and focused mechanistic research. We have identified clear roles of ERbeta and GPER1 and have generated a list of lncRNAs associated with colorectal cancer development impacted by estrogen signaling. We now want to clarify the impact of these lncRNAs in the estrogen-mediated signaling and in colorectal cancer development.

The project uses cell lines, large-scale molecular analysis (RNA-seq, ChIP-seq, proteomics), mechanistic assays (ChIP, co-IP, qPCR, Western blot, 3'UTR luciferase assay, ERE luciferase reporter assay), functional assays (proliferation, migration, adhesion, and apoptosis assays), clinical samples and ex vivo cultures, and in vivo animal studies (tissue-specific knock-out mice). The study is performed in collaboration with research groups at KTH, the Texas Medical Center, and the Karolinska Institutet (www.ki.se) and takes advantage of exceptional facilities at SciLifeLab (www.scilifelab.se) and the Human Protein Atlas (www.proteinatlas.org). The goal of the research is to provide a potential new colon cancer prevention and treatment.

The position can be performed within a dual PhD degree program with Karolinska Institutet.

We are looking for a student with a strong interest in cancer research and with previous experience form a molecular biology lab.

Biotechnology (Reg. No. 2204)

Type of position Full PhD student: 48 months	**Main supervisor** Adil Mardinoglu
KTH School CBH	**Co-supervisor(s)** Cheng Zhang
KTH Department Protein Science	**Main email contact** adilm@scilifelab.se

Specific subject area(s)
Systems Biology
Title of project
Development of Novel Diagnosis and Treatment for CVD
Number of available position
1
Earliest start date
2022-07-01
Short description of the project
Cardiovascular disease (CVD), specifically ischemic heart disease and stroke, remains to be the world leading cause of death by a considerable margin. It also remains a challenge to accurately predict who is going to develop CVD. To better elucidate the underlying mechanisms, single omics analyses have been performed. However, the pathophysiology remains unclear. Attempts have therefore been made using systems biology tools to integrate multiple layers of omics profiling both in humans and mice. Systems biology approaches for target selection in combination with development and validation of the small molecules and biological studies, will break new ground in the understanding of the pathological development and progression of CVD.
High-throughput omics technologies experienced a dramatic breakthrough during the last decade enabling simultaneous measurement of interacting molecular components in context of complex cellular structure and characterization of transformed cellular processes at genome-scale. Today, analyzing multi-layer data generated via high-throughput technologies and integrating them into a descriptive unified model is a nontrivial challenge. Systems biology approach in general, and co-expression networks as well as genome scale metabolic models (GEMs) in particular, can facilitate this hurdle and bridge this gap by allowing multi-layer integration of omics data in the context of whole biological system. Detailed insights into the biological functions of the heart and an understanding of its crosstalk with other human tissues and the gut microbiota can be used to develop novel strategies for the prevention, diagnosis and treatment of CVD. Biological network models, including metabolic, transcriptional regulatory, protein-protein interaction, signaling and co-expression networks, can provide a scaffold for studying the biological pathways operating in the liver in connection with disease development in a systematic manner.
In this project, the applicant will adopt an iterative multi-scale, systems biology approach coupled to in vitro and in vivo experimentation to identify several new lead compounds with different scaffolds; this will dramatically increase the chances to obtain an ideal biomarker and drug candidate to diagnose and treat CVD. The identified lead

compounds will also be tested in vitro and in different mouse models. The unbiased approach using biological network models that integrate multi-omics data will also significantly advance our understanding of the pathophysiological responses of complex metabolic disease. The applicant will conduct the study in close collaboration by a highly innovative interdisciplinary research group that combines expertise in human metabolism, cellular and molecular biology, and in vitro and in vivo model systems, systems biology and personalized medicine, generation and integration of multi-layer omics data, and in design, chemical synthesis and development of drug like molecules to be used as tools to break new ground in understanding the pathological processes in CVD and as potential lead compounds for biomarker and drug development.

Analytical chemistry (Reg. No. 2205)

Type of position Full PhD student: 48 months	**Main supervisor** Åsa Emmer
KTH School CBH	**Co-supervisor(s)** Yvonne Hed
KTH Department Chemistry	**Main email contact** aae@kth.se

Specific subject area(s)
A Plastic Circular Economy: Separation and Characterization of Contaminants in Recycled Plastics
Title of project
Analysis of contaminants, degradation products and additives in post-consumer resins
Number of available position
1
Earliest start date
2022-09-01
Short description of the project
A climate neutral and circular economy before year 2050 is a European target. Recycling of plastics is an important part of that transformation. The plastic production is continuously increasing, and 359 million tons were produced in the world in 2018, compared to 1.5 million in 1950. Plastics are needed, for example to extend the lifetime of food and decrease the food waste, and also as a vital part of renewable energy solutions. Another significant feature of plastics is the low material weight to strength ratio, that decreases the weight needed for functional materials. The reduced weight decreases the CO2 emissions from transports since the fuel/energy needed for transportation decreases with the weight carried. Additionally, other materials like glass, aluminum and paper often require much more energy for the recycling process, resulting in an increase in the CO2 footprint and hence the global warming. To utilize plastics to their full capacity, and to apply recycling is thus very important for a circular economy, and at the same time to reduce the CO2 footprint.

Polyolefins (e.g. polyethylene and polypropylene) are the most used plastics, and therefore constitute a major part of the post-consumer recirculate (PCR) in Europe as in the world. Plastic waste in Europe have earlier been exported to other countries, but restrictions of import have been set, and EU is now intensively trying to find climate-friendly ways to manage the plastic waste. Today, 95% of the value of the plastics in Europe is lost to the economy after a short first-use cycle. Therefore, the present project will be focused on PCR from polyolefins.
The main issue, which limits the use of recycled plastics today is lack of quality and performance. The reasons for this deterioration are for example that the result from recycling is a mixture of different grades of plastics, degradation of plastics, and contaminations, which may have migrated into the plastics during use or during waste collection. The contaminants and their degradation products can give rise to unpleasant odors, and toxic substances can even be present. This restricts the recycled plastics from

being used in high value applications, and especially in food contact products and healthcare products. Methods for detection, identification and quantification of contaminants, degradation products and additives are important to know what type of re-design the plastic materials need for their new use. Additionally, it is important to understand the origin of the degradation products contaminants, especially those being toxic and the ones giving contribution to odor. This understanding would give the opportunity to re-design products, recycling schemes and to enable new innovations towards improving the purity and safety of recycled plastic.

The identification of all contaminations within plastic waste is very challenging since it contains a high number of substances of different kinds, originating from both virgin plastics, contamination from outside and/or from the content of the package. These substances are of different chemical structure, of different polarity and molecular weight, and therefore require different analytical procedures. This includes extraction methods to isolate and enrich target substances, analytical separations using gas or liquid chromatography, and mass spectrometric analysis for identification and quantification. In addition to organic molecules making up the major part of the target molecules, recycled materials can contain inorganic substances that can be both toxic and/or require special additives to protect the polymer from degradation.

The purpose of the project is to develop efficient analytical procedures for identification and quantification of contaminants, foreign polymers, degradation products and additives present in PCRs from polyolefins, and to contribute to the understanding of their origin.

Biotechnology (Reg. No. 2206)

Type of position Full PhD student: 48 months	**Main supervisor** Torbjörn Gräslund
KTH School CBH	**Co-supervisor(s)**
KTH Department Protein Science	**Main email contact** torbjorn@kth.se

Specific subject area(s)
Protein Engineering and Design
Title of project
Affibody molecules for medical applications
Number of available position
1
Earliest start date
2022-07
Short description of the project
Affibody molecules are folded and small engineered affinity protein domains, which can be generated to interact specifically with desired targets with high affinity. During recent years our group has focused on the development of affibody molecules for cancer diagnostics and therapy as well affibody molecules to enhance the efficacy of biological drugs. Three key high-impact publications describe some of our efforts:

Xu T, et al. Cancers (Basel). 2020 Dec 30;13(1):85.
Altai M. et al. J Control Release. 2018 Aug 30;288:84-95.
Seijsing J. et al. Proc Natl Acad Sci U S A. 2014 Dec 2;111(48):17110-5.

We now aim to take the therapy applications to the next level where we will:
1. Engineer new drug conjugates based on affibody molecules and investigate their properties in vitro and in animal models of cancer.
2. Select affibody molecules to novel targets for application in oncology, immunity and inflammation.
The student will work with engineering and design of proteins for medical applications. More specifically the student will learn phage-display based selection from combinatorial libraries, rational design of proteins, protein production and purification, protein analysis using a number of state-of-the-art techniques. In collaboration with other groups in Sweden and internationally as well as small biotech companies, studies of the function of the designed proteins will be conducted.

Analytical Chemistry (Reg. No. 2207)

Type of position Full PhD student: 48 months	**Main supervisor** Gaston Crespo
KTH School CBH	**Co-supervisor(s)** Maria Cuartero
KTH Department Chemistry	**Main email contact** gacp@kth.se

Specific subject area(s)
Electroanalysis
Title of project
Microarray for Electrochemical Sensing
Number of available position
1
Earliest start date
2022-09
Latest start date
2022-10
Short description of the project
The four year project aims to establish the selective transport of charged particles through thin artificial membranes modulated by an external potential. As a result, the ability to modulate chemical fluxes anywhere and anytime can possibly be achieved. Owing to the confinement of the sample and by using thin layer membranes, the transported charge should be equal to the initial amount of charge present in the sample (Faraday's law) and thus absolute measurements would be possible. In addition, the uniqueness of coupling the membrane transport with electrochemiluminescence (ECL) generation will provide an excellent readout, which permits us to visualize ion fluxes with temporal and spatial resolution. This concept will be integrated in microarrays such as micro-needles, or microspots. The ECL membrane readout is, in simple words, a universal ion transducer element that will be able to convert any ion flux into ECL-probe redox flux. It is expected to advance fundamental knowledge regarding electrochemical/optical principles in the chemical sciences owing to the ability to modulate chemical gradients, and ultimately will impact on biogeochemical scenarios, biological membrane transport, wearable sensors and implantable devices, among other outcomes.

cybersecurity, privacy (Reg. No. 2208)

Type of position Full PhD student: 48 months	**Main supervisor** Panos Papadimitratos
KTH School EECS	**Co-supervisor(s)**
KTH Department Computer Science	**Main email contact** papadim@kth.se

Specific subject area(s)
IoT Security, Network Security, Machine Learning Security and Privacy, Mobile & Wireless Security, Information Theoretic Security and Privacy, Privacy Enhancing Technologies, Location Privacy,
Title of project
Security and privacy for networked systems
Number of available position
2
Earliest start date
2022-05
Latest start date
2022-09
Short description of the project
We are looking for highly motivated individuals for short term positions involving activities leading to original research and results in peer-reviewed publications. The research topics can relate with any of the areas the Networked Systems Security (NSS) group works on. We design and build trustworthy networked systems. Our research agenda covers a gamut of security and privacy problems a number of our results got significant attention by the research community.
Candidates with experimental/systems or theoretical profiles and research interests in any aspect of security and privacy are welcome to apply. Applicants must hold or be about to receive a PhD degree in computer science, electrical engineering, computer engineering, information and communication technologies, or a related area.
Furthermore, the applicant must have:
- Strong academic credentials, written and spoken English proficiency, communication and team-work skills.
- Interest in several of the following: design, analysis, verification, implementation, or empirical evaluation of secure networked systems.
- Background in several of the following: computer security, mobile computing, networking, Internet security, wireless communications, distributed algorithms and systems, programming languages, performance analysis, operating systems, simulation techniques and tools, software engineering, system and network programming, applied cryptography, privacy preserving or enhancing technologies, optimisation, information theory, machine learning.
- Preparation and readiness to contribute to our research agenda and to work in an internationally oriented group.

Computer science (Reg. No. 2209)

Type of position Full PhD student: 48 months	**Main supervisor** Bob L. T. Sturm
KTH School EECS	**Co-supervisor(s)** Andre Holzapfel
KTH Department Speech, Music and Hearing	**Main email contact** bobs@kth.se

Specific subject area(s)
Artificial Intelligence, Machine Learning, Music Computation
Title of project
Human-in-the-loop Machine Learning for Music
Number of available position
1
Earliest start date
2022-09
Short description of the project
Generating music with computers has been an active research area since at least the 1950s, and has advanced considerably since the advent of data-driven methodologies [1,2]. The state of the art today, such as the Music Transformer [3], involves building and training probabilistic models using large amounts of data. One problem with this is that success depends on the availability of large amounts of data. A more fundamental problem is that training systems in such a way does not consider their users. The dataset is implicitly considered as a proxy representation of the needs of the user. This Ph.D. explores instead building and training music models with the user "in the loop", where they actively participate in guiding the behavior of the system to suit their own needs. The system in a sense grows with the user. While more effort is needed on the part of the human user in the beginning, it is predicted that the resulting models will become more personalized and thus useful for their needs. The Ph.D. will explore and develop several new methodologies for human-in-the-loop machine learning for music, and test them in a variety of different styles.

Additional requirement for candidate:
Please submit a proposal of the project together with all the other required application documents.

[1] L. Hiller and L. Isaacson, Experimental Music: Composition with an Electronic Computer. New York, USA: McGraw-Hill Book Company, 1959.
[2] J.-P. Briot, G. Hadjeres, and F. Pachet, Deep Learning Techniques for Music Generation. Springer, 2019.
[3] C.-Z. A. Huang, A. Vaswani, J. Uszkoreit, N. Shazeer, C. Hawthorne, A. M. Dai, M. D. Hoff- man, and D. Eck, "Music transformer: Generating music with long-term structure," arXiv preprint arXiv:1809.04281, 2018.

Software engineering (Reg. No. 2210)

Type of position Full PhD student: 48 months	**Main supervisor** Cyrille Artho
KTH School EECS	**Co-supervisor(s)** Aristides Gionis
KTH Department TCS	**Main email contact** artho@kth.se

Specific subject area(s)
Software Testing and Diagnosis
Title of project
ECOSYSTEMS: Evolutionary diagnosis of communication systems
Number of available position
1
Earliest start date
As soon as possible
Short description of the project
ECOSYSTEMS will provide a novel approach to diagnose and reproduce crashes on communication systems.

Diagnosing communication systems is difficult because diagnostic information is limited. Time and memory constraints make it impossible to keep much information for later. This limitation often prevents developers from finding out the root cause of a defect or crash, or the bottleneck behind a performance limitation.

In a normal system, developers can usually take a “crash dump”, a complete image of the system, when the software fails. Communication systems do not have enough resources available to store such information. Therefore, a completely new way has to be taken to deal with this problem.

In a first step, we will log partial information during execution, and combine information from several crashes (using machine learning) to put these puzzle pieces together using data fusion (see the figure). This will increase the amount and quality of data available to the developer, while also classifying the observed problem reports such that efforts to diagnose them can be prioritized.

In a second step, we will synthesize small programs that yield the same result as the one that we observed from the earlier crashes. To achieve this, we will use a search algorithm, for example an evolutionary algorithm that has been inspired by biological evolution. At first, a set of random tests will not produce the right results, but they will be successively refined (“evolved”) until we have a test, and thus a plausible explanation, of the crash. Once the crash can thus be reproduced, finding and testing a solution for it is much easier than without any way to know if a fix actually works. We

will also consider variants such as making the tests as small and simple as possible, or changing the way data is recorded after early observations have been evaluated.

The academic lead of this project, Cyrille Artho, has two decades of experience with static and dynamic program analysis techniques, including run-time analysis and testing. He has successfully created several of his own open-source program analysis tools, which then have attracted a diverse user community. He is also the lead maintainer of the widely used Java Pathfinder tool that was originally developed by NASA.

The co-supervisor at KTH, Aristides Gionis, is WASP professor at KTH Royal Institute of Technology and an adjunct professor at Aalto University. He is an expert on algorithms, data mining, and graph mining.

This project will be co-sponsored by Huawei Sweden Technology AB, one of the world's leading telecommunication equipment companies.

Electrical Engineering (Reg. No. 2211)

Type of position Full PhD student: 48 months	**Main supervisor** Sailing He
KTH School EECS	**Co-supervisor(s)** Oscar Quevedo-Teruel
KTH Department Electromagnetic Engineering (EME)	**Main email contact** sailing@kth.se

Specific subject area(s)
6G Antenna Systems and EMF Exposure
Title of project
Electromagnetic field exposure assessment research for 6G technologies
Number of available position
1
Earliest start date
2022-09
Short description of the project
The ongoing deployment of 5G cellular systems is continuously exploiting the inherent limitations of this system. With demands of increasing network traffic and new user cases, worldwide activities are focused on defining the unprecedented 6G technologies that can truly integrate far-reaching applications ranging from autonomous systems to extended reality. Before mobile communication equipment is put on the market, manufacturers normally need to conduct EMF (electromagnetic field) exposure assessments to ensure the compliance with regulatory limits. With the pre-studies of 6G technologies ongoing worldwide, the relevant EMF assessment methodologies need to be studied to ensure the EMF testability of relevant technologies. The project aims at studying the implications of potential 6G technologies on EMF compliance assessment research, developing EMF assessment methodologies for 6G, and promoting EMF standardization towards 6G. The research topics may include but not limited to EMF exposure assessment for THz equipment and systems, for distributed MIMO system and networks, and for next-generation massive MIMO radio base stations.

The applicant should have background and knowledge about electromagnetic fields and/or wireless communications, or relevant.

Electrical Engineering (Reg. No. 2212)

Type of position Full PhD student: 48 months	**Main supervisor** Qianwen Xu
KTH School EECS	**Co-supervisor(s)** Hans-Peter Nee
KTH Department Electrical Engineering	**Main email contact** qianwenx@kth.se

Specific subject area(s)
Power Electronics and Power Systems
Title of project
Coordinated protection and control of DC microgrids
Number of available position
1
Earliest start date
2022-05-01
Latest start date
2022-11-01
Short description of the project
DC microgrids have attracted significant attention in recent years, due to their advantages over their AC counterparts in efficiency, control simplicity, reliability, and integration of renewables, energy storage and DC loads. Thus DC microgrids have been widely applied in smart buildings, rural and islanded areas, data centers, as well as electrical transports (e.g., electric ship, electric aircraft, electric vehicles). However, the protection in DC microgrid is a significant challenge due to the nature of dc fault current that can increase dramatically and rapidly after fault inception and has no naturally occurring zero crossing point for detection like AC, as well as the low system inertia (i.e., very little overload capacity). The wide integration of converters in DC microgrids make fault analysis more complicated, and require more dedicated protection strategies. On the other hand, the full controllability of power converters provide opportunity to design advanced control strategies for protection.
This PhD project aims to develop coordinated protection and control strategies for power converters to achieve reliable protection and resilient operation of DC microgrids against faults. It consists of analyzing system dynamics under faults, developing novel control and coordination strategies, as well as exploring new topologies. The developed solutions will be validated with hardware experiments.

Electrical Engineering (Reg. No. 2213)

Type of position Full PhD student: 48 months	**Main supervisor** Oscar Quevedo-Teruel
KTH School EECS	**Co-supervisor(s)** Martin Norgren
KTH Department Electrical Engineering	**Main email contact** oscarqt@kth.se

Specific subject area(s)
Microwave Engineering
Title of project
Design and analysis of geodesic lens antennas
Number of available position
1
Earliest start date
2022-09-01
Latest start date
2023-01-01
Short description of the project
In this project, the student will conduct research on geodesic lens antennas.
The main goals of the project are:
- To produce a ray tracing code for the fast analysis of the radiation properties of geodesic lens antennas.
- Design a number of demonstrators of this type of antennas in the millimetre wave regime.
- Manufacturing and testing of these antennas.

Energy Technology (Reg. No. 2215)

Type of position Full PhD student: 48 months	**Main supervisor** Andrew Martin
KTH School ITM	**Co-supervisor(s)**
KTH Department Department of Energy Technology	**Main email contact** andrewm@kth.se

Specific subject area(s)
Heat and Power Technology
Title of project
Enabling Circular Industrial Processes through Membrane Distillation
Number of available position
1
Earliest start date
2022-09
Short description of the project
Membrane distillation (MD) is a heat-driven technology for water purification and wastewater treatment and has been a subject of research at KTH for the past two decades, in partnership with Scarab Development AB and subsidiaries. Research efforts at KTH and Scarab have successfully advanced MD technology in terms of understanding and improving module performance, and in finding optimal integration strategies for a variety of applications. The next phase of joint activity aims to help industry achieve circularity for energy efficient and cost-competitive water and resource recovery. Envisioned applications include the following: supply of purified water to electrolyzers for clean and reliable hydrogen production; development of next-generation wastewater treatment and critical raw materials recycling in nanoelectronics manufacturing; and readying biofuel-fired cogeneration facilities for CO2 capture through advanced flue gas and flue gas condensate treatment. Methods include modeling and simulation along with experimental investigations at laboratory and pilot scales.

We seek applicants with MSc degrees in mechanical, chemical, or energy engineering, who have solid backgrounds in engineering thermodynamics, heat transfer, and fluid mechanics.

Scarab Development AB will provide top-up financing for the selected PhD student.

Engineering Mechanics, Fluid Mechanics (Reg. No. 2217)

Type of position Full PhD student: 48 months	**Main supervisor** Luca Brandt
KTH School SCI	**Co-supervisor(s)** Outi Tammisola
KTH Department Engineering Mechanics	**Main email contact** luca@mech.kth.se

Specific subject area(s)
Multiphase Flows, Computational Fluid Dynamics
Title of project
Interface-resolved simulations of fibres and cells in homogenisers
Number of available position
1
Earliest start date
2022-04-01
Short description of the project
The (valve) high-pressure homogenizer (HPH) is the most common unit operation for emulsion formation of low to intermediate viscosity systems in food and pharmaceutical processing. A substantial amount of research has been put into understanding the HPH hydrodynamics and turbulent drop breakup taking place in HPHs. However, HPHs are also used for breakup and dispersion of cells (production of extracellular biomolecules, non-thermal pasteurization) and fibres (production of fruit juices, plant "milk" etc.). Due to a fast increase in the interest in producing green vegan alternatives, this is an increasing application base for HPHs. However, little is known about how cells, solid particles and fibres break in HPHs.
The objective of this project is to use numerical simulations to study the dynamics of fibers and flakes in more complex flows, similar to those obtained in industrially relevant emulsification devices. Recent developments in computational multi-phase flow and computer hardware have enabled researchers to fully simulate a solid rigid or deformable phase dispersed in a liquid, up to several thousands of particles/fibers. These studies, however, have mainly considered canonical configurations, e.g. plane channels and pipes. In this project, we will investigate the fiber and flake deformation and the stresses due to the fluid-structure interactions in a configuration of interest for several industrial processes, i.e. plane jet in a chamber to start with. The numerical simulations will use an in-house solver where the immersed-boundary boundary method is used for the fluid-solid coupling. The deformation will be modelled as those of an elastic material.

Engineering Mechanics (Reg. No. 2218)

Type of position Full PhD student: 48 months	**Main supervisor** Lanie Gutierrez Farewik
KTH School SCI	**Co-supervisor(s)**
KTH Department Engineering Mechanics	**Main email contact** lanie@kth.se

Specific subject area(s)

Biomechanics, Human Movement Mechanics, Exoskeleton Design, Human Strength Augmentation

Title of project

Active assistive exoskeletons for persons with motor disorders; design, simulation, control and sensors

Number of available position

1

Earliest start date

2022-09-01

Short description of the project

KTH MoveAbility Lab, at the Department of Engineering Mechanics, is offering a PhD student position in Biomechanics, with a focus on assistive devices that augment motion in patients with motor disorders. People with disabilities are the largest minority group in the world. Despite this, we as scientists have relatively little ability to prevent the long-term downward spiral which occurs when their primary disability causes secondary consequences on the body. This PhD project aims to design and develop robotic assistive devices for the lower extremities that complement one's physical function and give one the opportunity to locomote and perform daily activities optimally according to one's abilities. These can be comprised of hard materials, with or without a combination with soft, compliant materials. The doctoral student shall, through simulation-based design and prototyping, develop devices that sense and provide assistance-as-needed that complements the user's own abilities, within a closed loop that includes the user’s biosignals. The devices should take advantage of users’ inherent capabilities, yet still reduce the users' metabolic energy demands and increase their ability to perform daily activities.

The project focus could include any or all of the following methodologies, among others: detection and identification of motion intention using wearable biosensors, recognition of motion phases, simulation-based biomechanical modelling of the person-device system, hybrid device control which balances inputs based on the user’s muscle activation signals with automatic control, intrinsic or extrinsic device control, human-in-the-loop optimization. Specific methods can include simulation, motion prediction using biomechanical modelling, motion prediction using machine learning algorithms, prototyping, and experimentation on human subjects.

The project will be partially financed through the Promobilia Foundation. The target group includes individuals with physical disabilities due to pathology, injury or age.

Physics (Reg. No. 2219)

Type of position Full PhD student: 48 months	**Main supervisor** Mats Danielsson
KTH School SCI	**Co-supervisor(s)** Mats Persson
KTH Department Physics	**Main email contact** md@mi.physics.kth.se

Specific subject area(s)
Biological and Biomedical Physics
Title of project
Deep-learning image reconstruction methods for photon-counting x-ray computed tomography
Number of available position
1
Earliest start date
2022-01-01
Short description of the project
The Physics of Medical Imaging division at the Department of Physics, KTH, is one of the leading research groups in the world within the field of photon-counting spectral x-ray computed tomography, an emerging technology which will be the next major advancement in medical x-ray imaging. Our division has developed a photon-counting x-ray detector for computed tomography that has been integrated in a prototype computed tomography scanner. We are now doing research on data processing and reconstruction methods that can generate images with the best possible image quality from measured data. In this project we will use large sets of images to train a reconstruction algorithm that can reconstruct images with better diagnostic quality, more well-defined quantitative accuracy and shorter computation time compared to the present state of the art.
We are now looking for a PhD student with a strong interest in the medical imaging science, mathematics and computational science. As a member of a cross-disciplinary team in close collaboration between academia and industry, the candidate will take part in the development of the next generation of image reconstruction methods for photon-counting spectral computed tomography based on deep learning. This research includes development of physics-informed deep neural network reconstruction methods that are able to reconstruct high-quality images while also characterizing the degree of uncertainty of the resulting pixel values. The project includes both theoretical work and evaluation of algorithms using experimental data and is carried out in combination with x-ray detector developers.

Applied Physics (Reg. No. 2220)

Type of position Full PhD student: 48 months	**Main supervisor** Joydeep Dutta
KTH School SCI	**Co-supervisor(s)** Fei Ye
KTH Department Applied Physics	**Main email contact** joydeep@kth.se

Specific subject area(s)
Materials Engineering
Title of project
Seawater Battery
Number of available position
1
Earliest start date
2022-08
Short description of the project
To combat climate change it is necessary to utilize all sources of sustainable energy. One of these sources is Salinity Gradient Power (SGP), where fresh and seawater mix together. This work will aim at furthering the knowledge and understanding of how to increase the electricity output in sea-water batteries. This will be achieved by modeling and building a lab-scale prototype. Research will be focused on modeling the adsorption/desorption processes of salt on the electrodes (thus presenting charging/discharging sequences of the devices) through the construction of a device suitable for energy extraction. Operating schemes suited to improve the charging capacity of the electrode prior to double layer expansion to enhance energy gain will be designed. A major objective of the project will be to consider developing device structures that could eventually be scaled up for large scale energy production through the application of ion-insertion materials on carbon electrodes. The overarching scheme will be covering the prediction, optimization and improvement of device utilization factor through a rational advancement of the research group's current expertise in predictive modeling, material modification and device engineering.

Biomedical Engineering (Reg. No. 2221)

Type of position Full PhD student: 48 months	**Main supervisor** Ruoli Wang
KTH School SCI	**Co-supervisor(s)** Lanie Gutierrez-Farewik
KTH Department Department of Engineering	**Main email contact** ruoli@kth.se

Specific subject area(s)
Biomechanics
Title of project
Real-time parameter prediction of human neuromusculoskeletal system: a new paradigm of personalized medicine in rehabilitation
Number of available position
1
Earliest start date
2022-09-01
Short description of the project
There are a wide number of pathologies that affect a person's ability to move in daily life and participate fully in society; primary conditions can be neurological, orthopaedic, muscular or of other cellular nature, besides the commonplace instances of trauma, age-related muscle weakness, overuse injuries and idiopathic pain. The functional restoration largely relies on rehabilitation. The overall goal of this project is to create a computational framework of human neuromusculoskeletal system which can function as a real-time high-fidelity prediction of non-measurable individualized neuro-biomechanics quantities, which potentially can serve as biofeedback during rehabilitation in an actual clinical environment. A hybrid data-driven and model-based approach will be explored.

In this project, we will particularly focus on investigating the role of one neurological mechanism, stretch-reflex, in the movement performance using the computational framework. The stretch reflex is an involuntary muscle contraction in response to stretch, which plays an important and distinct role during movement by instilling a neurological feedback mechanism. Also, it is believed that hyper-excitability of the stretch reflex is a primary cause of spasticity, a common symptom of neurological disorders, such as cerebral palsy, stroke, and multiple sclerosis, that affect 12 million people worldwide. When a muscle is stretched, the muscle spindle (the sensory receptor within the muscle belly) is also stretched. This increases alpha-motor neuron activity, causing the muscle fibers to contract and thus resist the stretching. A secondary set of neurons (inhabitation) also causes the opposing muscle to relax. Clinically, the joint resistance and its individual component (i.e., contributions from elasticity, viscosity and hyper-active neural activity) are of importance in quantification of the severity of spasticity. The understanding of more detailed aspects of neuromuscular control, secondary musculoskeletal changes and their coupled influences on the movement performance are important for developing proper clinical intervention strategy.

In this project, the Ph.D. student will be part of MoveAbility Lab, which is a state-of-art biomechanics/human movement laboratory equipped with a 10-camera motion capture system, 3 force plates, wireless electromyography, inertial sensor system, pedograph, diagnostic ultrasonography and high-density electromyography etc. The student will work closely with other PhD students and postdoc from the MoveAbility lab as well as national and international experts in biomedical engineering, physicians, and physiotherapists in rehabilitation from Karolinska Institutet and Karolinska University Hospital, to develop neural-driven musculoskeletal models and evaluate its application in neurophysiological assessment, assistance device design and intervention evaluation in various neurological affected groups.

Applied and Computational Mathematics (Reg. No. 2222)

Type of position Full PhD student: 48 months	**Main supervisor** Xiaoming Hu
KTH School SCI	**Co-supervisor(s)**
KTH Department Mathematics	**Main email contact** hu@kth.se

Specific subject area(s)
Mathematical Systems Theory
Title of project
Emergence in Multi-agent systems
Number of available position
1
Earliest start date
2022-08-01
Latest start date
2022-11-01
Short description of the project
The synergy of multi-agent systems (MAS) is based on interaction among individual agents, leading to the formation of artificial groups and communities. Depending on the number of interacting agents and the inherent characteristics of their interactions, various directions of development and types of MAS can be distinguished.

The studies of interaction and cooperation of a small number of intelligent agents, for example, the classical intelligent systems, including knowledge bases and solvers, compose the kernel of Distributed Artificial Intelligence (DAI). In other words, group intellectual behavior in DAI is based on individual intellectual behaviors. This means a congruence of the objectives, interests and strategies of different agents, coordination of their actions, and the resolution of conflicts through negotiations. In many scenarios, agents in a MAS model can act cooperatively, competitively or exhibit neutral behaviors. To handle those complexities, it is very useful to borrow ideas from non-cooperative game theory in which emergence of the MAS can be tightly connected to a Nash equilibrium.

In this project we will further develop these existing approaches and integrate them with graphic models and mean field games. With the incorporation of graphic models we will study how interaction topology will shape the emergence; Mean field games, on the other hand, will facilitate not only the interaction between individual agents but also track the decision-making process in huge groups of agents.

Nuclear Power Safety (Reg. No. 2223)

Type of position Full PhD student: 48 months	**Main supervisor** Sevostian Bechta
KTH School SCI	**Co-supervisor(s)** Andrei Komlev
KTH Department Physics	**Main email contact** bechta@safety.sci.kth.se

Specific subject area(s)
Melt-structure Interactions in Severe Accidents
Title of project
Ex-vessel melt-structure interactions in severe accidents of boiling water reactors
Number of available position
1
Earliest start date
2022-09-01
Short description of the project
The proposed work is intended to pursue an understanding on the influence of the structures below the reactor pressure vessel of a boiling water reactor on the corium melt ejection following vessel failure, and on the resulting fuel coolant interactions, debris formation and corium coolability during a severe accident of the reactor. Both experimental and computational studies are expected to address this issue. The project will leverage on the previous development of infrastructure and ongoing research programs at KTH, i.e., the DEFOR facility at KTH may be adapted to investigate the influence of the structure on melt jet delivery and the resulting melt coolant interactions in a water pool.

Nuclear Power Safety (Reg. No. 2224)

Type of position Full PhD student: 48 months	**Main supervisor** Weimin Ma
KTH School SCI	**Co-supervisor(s)** Walter Villanueva
KTH Department Physics	**Main email contact** weimin@kth.se

Specific subject area(s)
Fuel Coolant Interactions in Severe Accidents
Title of project
Investigation on oxidation of metallic melt during fuel coolant interactions in severe accidents
Number of available position
1
Earliest start date
2022-09-01
Short description of the project
The proposed work is concerned with a study on fuel coolant interactions (FCI), with an emphasis on the oxidation of metallic melt during FCI and its impacts on steam explosion, debris bed formation and coolability. The understanding and quantification of the topic are important not only to the assessment of ex-vessel corium risk but also the qualification of the ex-vessel melt retention strategy adopted in Nordic boiling water reactors (BWRs). The study involves the contents of multi-phase flow and multi-physics. Both analytical and experimental approaches are expected in the study. The project will leverage on the previous development of infrastructure and ongoing research programs at KTH.

Engineering Mechanics (Reg. No. 2263)

Type of position Full PhD student: 48 months	**Main supervisor** Ricardo Vinuesa
KTH School SCI	**Co-supervisor(s)**
KTH Department Engineering Mechanics	**Main email contact** rvinuesa@mech.kth.se

Specific subject area(s)
Fluid Mechanics, Machine Learning
Title of project
Deep reinforcement learning control of turbulent flows
Number of available position
2
Earliest start date
2022-03
Latest start date
2022-09
Short description of the project
Over the past decades, aviation has become an essential component of today's globalized world: before the current pandemic of coronavirus disease 2019 (COVID-19), over 100,000 flights took off everyday worldwide, and a number of studies indicate that after the pandemic its relevance in the transportation mix will be similar to that before COVID-19. Aviation alone is responsible for 12% of the carbon dioxide emissions from the whole transportation sector, and for 3% of the total CO2 emissions in the world. Due to the major environmental and economical impacts associated to aviation, there is a pressing need for improving the aerodynamic performance of airplane wings to reduce fuel consumption and emissions. This implies reducing the force parallel to the incoming flow, i.e. the drag, and one of the strategies to achieve such a reduction is to perform flow control.

In this project we aim at using high-fidelity simulations and deep reinforcement learning to develop a framework for real-time prediction and control of the flow around wing sections and three-dimensional wings based only on sparse measurements. We will first perform high-order spectral-element simulations of wing sections and three-dimensional wings at high Reynolds numbers. Using sparse measurements at the wall, we will reconstruct the velocity fluctuations above the wall within a region of interest. To this end, we will employ a generative adversarial network (GAN), together with a fully-convolutional network (FCN) and modal decomposition. Then, we will perform flow control based on deep reinforcement learning (DRL), which will enable discovering novel solutions in terms of flow actuation and design of winglet geometry.

Main outcomes of the project:
- A framework to predict and control the flow around turbulent wings from limited measurements. This framework will allow obtaining flow patterns, and devising the

optimal control strategy (based on deep reinforcement learning) in real time, based on limited measurements.
- High-fidelity simulations of the turbulent flow around three-dimensional wings. The simulations will help to understand the details of these complex flows, as well as the effect of active flow control. These mechanisms will be studied in the light of the identified coherent structures. The synergistic use of high-resolution simulations and deep reinforcement learning to optimize the wing-tip geometry will lead to innovative aerodynamic designs.

Visiting PhD student: 6 - 12 months

Transport science (Reg. No. 2225)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Erik Jenelius
KTH School ABE	**Co-supervisor(s)**
KTH Department Civil and Architectural Engineering	**Main email contact** jenelius@kth.se

Specific subject area(s)
Transport Planning and Decision Theory
Title of project
Transport project appraisal under climate goal constraints
Number of available position
1
Earliest start date
2022-01
Short description of the project
Planners and policymakers from international down to local levels decide on which transport projects are given a green light. The principle and process for reaching these decisions vary depending on the context, but a common approach is to do a cost-benefit analysis (CBA). In a CBA, different types of effects such as changes in travel time, traffic accidents and emissions are converted into monetary values and summed. This allows high gains in one dimension (e.g., travel time savings) to compensate for losses in another dimension (e.g., emissions).
In some situations, however, there are specific goals for how large certain effects can be. In particular, the focus of this project is on greenhouse gas emissions, where goals have been set at various levels for how much CO2 can be emitted from the transport sector in the coming years. If we are serious with such a goal, it should be handled as a hard constraint in the project selection decision process. This implies that CO2 emissions cannot be traded against other effects, such as travel time savings, in the same way as before. On the contrary, there is a need for a new project selection methodology that maintains many of the advantages of CBA while safeguarding against violation of the emission goals.
The aim of this project is to develop and demonstrate a methodology for project appraisal under climate goal constraints. Depending on data availability, the methodology should be applied to a real case study of transport project selection.
The project requires skills and interest in transport planning, policy and economics, including quantitative and mathematical analysis.

Sustainable buildings (Reg. No. 2226)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Wei Liu
KTH School ABE	**Co-supervisor(s)**
KTH Department Civil and Architectural Engineering	**Main email contact** wei.liu@byv.kth.se

Specific subject area(s)
Fluid and Climate Technology
Title of project
Covid-19 laden bioaerosol generation, transport, and its removal in public washroom
Number of available position
1
Earliest start date
2022-04-01
Latest start date
2022-12-31
Short description of the project
Transmission of airborne infectious diseases in indoor environments has been a major public health concern for decades. The infectious viruses such as coronavirus spread from person to person via droplets or respiratory droplet nuclei. The infectious particles are not only generated from the respiration system, but also from the human excreta. In using the washroom, multiple behaviours, such as collision of the human excreta with surface or water, flushing toilet bowl, and drying hands with hand dryers, would aerosolize pathogens. The generated airborne particles induce exposure to the user himself or herself and the subsequent users. In order to develop strategies to block the path of person-to-person and fecal-oral particle transmission in public washroom, this project proposes to innovatively investigate the particle splash and atomization mechanism, track and analyze the infectious particles' transmission and deposition, quantify the risk of exposure, and design novel ventilation system for best removing the infectious particles and reducing the infection risk. This project will be of great help for suppressing the spread of coronaviruses within the public washrooms, enhancing health education and policy on the toilet hygiene practice, and improving the sanitary safety in the inevitable recovery of the society.

Indoor Air Prediction (Reg. No. 2227)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Wei Liu
KTH School ABE	**Co-supervisor(s)**
KTH Department Civil and Architectural Engineering	**Main email contact** wei.liu@byv.kth.se

Specific subject area(s)
Fluid Mechanics. Inverse problem. Neural network. CFD
Title of project
Prediction of indoor airflow based on artificial neural network and CFD
Number of available position
1
Earliest start date
2022-05-01
Latest start date
2022-12-31
Short description of the project
This project will focus on the indoor flow field prediction using PINN (Physics-informed neural network) and CFD (computational fluid dynamics). Due to the poor interpretability of pure data-driven machine learning, a lot of data and a great amount of trainings are required for accurate prediction of indoor flow field. How to enhance training accuracy and efficiency will be the key point to use neural network in practice. Moreover, solving inverse problems (for quantitatively identifying pollution source location and unsteady release regulation) are often prohibitively expensive and required complex formulations, new algorithms and elaborate codes. Coupling physical law (for example N-S equations) with neural network will make meaningless data constrained. In the specific research, CFD and PINN will learn from each other, making accurate and fast indoor air prediction, to further serve the research of inverse problems in built environment.

Building environment and energy application engineering (Reg. No. 2228)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Wei Liu
KTH School ABE	**Co-supervisor(s)**
KTH Department Civil and Architectural Engineering	**Main email contact** wei.liu@byv.kth.se

Specific subject area(s)
Ventilation of Industrial Buildings
Title of project
Ventilation in large-scale industrial workshops
Number of available position
1
Earliest start date
2022-04-01
Latest start date
2022-07-30
Short description of the project
Industrial workshops such as machining workshops and painting plants can produce great amounts of pollutants and heat. Ventilation is a major approach to improve the workshop environment. Mixing ventilation and displacement ventilation are two commonly used ventilation strategies. However, modern industrial workshops generally have large space. Mixing ventilation in such workshops requires extremely large ventilation rate to obtain well indoor environment. Compared with mixing ventilation, displacement ventilation may save energy and have higher ventilation efficiency. However, for the large space industrial workshop with displacement ventilation, the air temperature of the occupied zone is very high in summer because supply airflow is heated by machining equipment. Therefore, high-efficiency air distribution systems still need to be developed for large-scale industrial workshops. This project will use the method of experiment and CFD simulation to develop high energy-efficient ventilation systems and propose ventilation design guideline for large-scale industrial workshops.

Evolutionary genetics and genomics (Reg. No. 2229)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Peter Savolainen
KTH School CBH	**Co-supervisor(s)** Pelin Sahlén
KTH Department Department of Gene technology	**Main email contact** savo@kth.se

Specific subject area(s)
Origin and Evolution of the Domestic Dog: Phylogeographic and Selection Analysis
Title of project
Evolution of the domestic dog: identification of selected genes and geographic origin
Number of available position
1
Earliest start date
2022-06-01
Short description of the project
This project is based on a long-established collaboration between Sweden and China, with the research groups of Professor Ya-ping Zhang and Professor Guo-Dong Wang at Kunming Institute of Zoology, Chinese Academy of Sciences. In a number of prominent papers, we have previously, based on large-scale genetics and genomics, indicated South China as the probable region of dog origins, and identified genes under selection in the first phase of dog evolution, affecting e.g. digestion and behaviour.

We have now increased sampling in South China and Southeast Asia, for refined phylogeographic analyses. We analyse all types of genetic markers: nuclear genomes as well as mitochondrial, Y-chromosomal and X-chromosomal DNA. Since most mutations are situated in regulating regions far from the affected genes, we also identify regulatory sequences under selection in the domestication, by mapping of promoters and enhancers and of their interactions. Based on these analyses, we continue our studies of gene evolution and phylogeography, with the aim of describing how, when and where the wolf developed into the domestic dog.

Because of the broad aims of this study, students with different backgrounds are welcome to apply; molecular biology, bioinformatics or phylogeographic analysis.

Chemistry and Biology (Reg. No. 2230)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Yaoquan Tu
KTH School CBH	**Co-supervisor(s)**
KTH Department Theoretical Chemistry and Biology	**Main email contact** yaoquan@kth.se

Specific subject area(s)
Theoretical Chemistry and Biology
Title of project
Molecular recognition in protein-ligand binding for ligand/drug optimization and design
Number of available position
2
Earliest start date
2022-09-01
Short description of the project
The knowledge of protein-ligand interactions and the role of water molecules in protein-ligand binding are essential for understanding many biological processes and for structure-based drug design. With the development of computer technologies, theoretical modelling has become an increasing powerful tool in the study of protein-ligand binding. In this project, we will use theoretical modelling to study molecular recognition in protein-ligand binding. In particular, we will use thermodynamic signatures to identify the characteristics of protein-ligand binding and the inhomogeneous solvent model to study the role of water molecules in some important drug targets with the aim to design/optimize ligands/drugs, such as through replacing unfavorable water molecules with new ligand groups complementary to the protein surface.

Molecular biology, cancer biology, cancer therapy (Reg. No. 2231)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Johan Nilvebrant
KTH School CBH	**Co-supervisor(s)** Per-Åke Nygren
KTH Department Protein Science	**Main email contact** johanni@kth.se

Specific subject area(s)
Protein Engineering
Title of project
Affibody-mediated immunooncology
Number of available position
1
Earliest start date
2022-05
Short description of the project
This project aims to expand the toolbox of small non-antibody affinity proteins directed against target proteins within immunooncology. Tumors often exploit an immunosuppressive microenvironment to evade destruction by the immune system. Monoclonal antibodies targeting immuno-modulatory molecules such as PD1 and PDL1 (checkpoint inhibition) have demonstrated significant success in the clinic and related approaches to activate co-stimulatory signals to immune cells are being developed. It is expected that the combination of several functionalities, e.g. tumor targeting, prevention of immune cell inhibition, engagement (activation) of immune cells and activation of co-stimulatory molecules (e.g. 4-1BB), into one therapeutic entity can boost these powerful local immunological responses. Ongoing efforts using multispecific antibodies have indeed shown much promise in augmenting anti-tumor immunity via such principles. However, the understanding of the complex interplay between antibody-mediated tumor antigen engagement and immune cell modulation has been hampered both by the difficulties in generating multi-specific antibodies that effectively engage more than two target proteins and by the multitude of effects/side-effects that can be linked to antibody Fc domain interaction with Fc-gamma receptors. Thus, there is a need for modular, non-antibody, systems where the effects of tumor targeting, immune checkpoint blockade, immune cell engagement or co-stimulation can be re-combined in a flexible manner to better elucidate design principles for multi-functional therapeutic molecules with enhanced synergistic anti-tumor effects.

Specifically, this project aims to generate affibody molecules targeting CTLA4, PD1 (checkpoint inhibition) and 4-1BB (co-stimulation) and combine these with existing affibody binders to well-validated tumor antigens (e.g. EGFR, HER2, PSMA). The small size (58 amino acids, 6.5 kDa) and flexible engineering of affibody molecules compared to recombinant antibodies provide easy access to multimeric constructs with defined valency, varying linker length/rigidity as well as control constructs where specific modules are replaced by non-binding versions of the same affibody. Such tailored “null-

affibodies" will be generated via mutagenesis of the binding surface of developed and used affibody molecules using established procedures.

The binding proteins generated within this project will provide a foundation for further engineering and characterization of multifunctional therapeutic proteins in immunooncology. Importantly, it will enable future collaboration between the visiting PhD student´s home university and KTH as well as independent investigations at the Chinese university. The tools developed within the project may also be used in studies focusing on engagement of immune cells (e.g. T-cells and NK cells) and cancer cells, which is outside the scope of the initial project.

Medical Engineering (Reg. No. 2232)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Dmitry Grishenkov
KTH School CBH	**Co-supervisor(s)**
KTH Department Biomedical Engineering and Health Systems	**Main email contact** dmitryg@kth.se

Specific subject area(s)

Contrast Enhanced Medical Imaging and Therapy

Title of project

Theranostic microdevice for contrast enhanced ultrasound imaging and controlled drug delivery

Number of available position

1

Earliest start date

2022-09-01

Short description of the project

A continuous development of new therapeutic agents has made novel drugs available for a variety of diseases. However, a wide spectrum of active molecules alone does not guarantee optimal therapic effect as other relevant factors, such as bioavailability and release mechanism, come into play. The “drug” has rather become a “complex” whose therapeutic efficacy is obtained with the collaborative action of a compound and a delivery system.

The current project introduces a new class of microdevices providing integrated diagnostic and therapeutic applications, i.e., theranostics using microbubble-based ultrasound contrast agent loaded with therapeutic compound. A gas core makes microbubbles to an efficient ultrasound contrast agent. Application of perfluorocarbone opens new possibilities for local, specific drug delivery triggered by ultrasound.

The main goal of the project is to design the set-up for controlled ultrasound mediated drug delivery. The second part of the work address characterization of the response from MBs.

The specific tasks of the project include but not limited to:

1. Fabrication of MBs loaded with gas or perfluorocarbone
2. Microscopy tests on the size distribution
3. Design of the set-up for Acoustic Droplet Vaporisation (ADV) and controlled ultrasound mediated drug delivery using single crystal ultrasound transducers, signal generator and oscilloscope.
4. Transfer this findings towards programmable ultrasound system Verasonics to identify imaging biomarkers of ADV initiation and define strategy for efficient drug delivery.
5. Assessment and optimisation of the protocol.

Organic Chemistry (Reg. No. 2233)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Fredrik Schaufelberger
KTH School CBH	**Co-supervisor(s)** Markus Kärkäs
KTH Department Chemistry	**Main email contact** fresch@kth.se

Specific subject area(s)
Supramolecular Chemistry, Molecular Machines, Coordination Chemistry, Photophysics
Title of project
Molecular Machines with Luminescent Lanthanide Reporters
Number of available position
1
Earliest start date
2022-01
Short description of the project
The use of artificial nanomachines to improve human health has been a scientific dream since it was first suggested in Richard Feynman's classic 1959 lecture "There's Plenty of Room at the Bottom".[1] Nature uses biological molecular machines in nearly every conceivable aspect of molecular construction, from creating peptides in the ribosome to controlling energy flow in our bodies through the molecular pump ATP synthase.[2] Fine-tuning the position and movement of molecular components relatively to one another allows nature to achieve exceptional selectivity in recognition, construction and transport of both small molecules and biomacromolecules. Chemists have long strived to control molecular motion in similar fashion, and artificial molecular machines (AMMs) that mimic the function of biological machinery have hence been developed during the last decades (Figure 1).[3] Spectacular applications of AMMs in areas as diverse as materials science, catalysis, sensing and drug delivery have since followed,[3a] and as a testament to this, the 2016 Nobel Prize in Chemistry was awarded to the field.[4]
Despite nature's reliance on molecular machinery, very few artificial machines have however been utilized in biology.[5] Our group develops artificial molecular machines that directly interface with biosystems for applications in biomedicine. We construct AMMs that operate in biological environments and undergo programmed interactions with biomacromolecules such as proteins and polysaccharides to achieve nanoscale mechanical motion. This will eventually allow for development of biosensors and drug delivery systems with supreme sensitivity and selectivity, just like in the natural systems that continue to inspire our work.

In this project, we are interested in equipping molecular machines with simple so-called reporting functions to facilitate translation to biological applications. Though movement of molecular machines is usually quite straightforward to analyse by NMR spectroscopy, such advanced instrumentation is not universally available. The development of simple reporting molecules for diagnostic point-of-care purposes is a major scientific issue with

massive real-world impact. Reporter systems based on the movement of molecular machinery has never been used in biological systems before, but could in theory be extremely sensitive due to the precise control that can be exercised over conformation and movement in AMMs.
Lanthanide emission is one of the most attractive readout methods in chemical biology, as many lanthanide complexes based on for example europium or terbium give strong emission with sharp bands and also allows for multiplex imaging.[6] However, due to the forbidden 4f-4f transition, lanthanides need sensitization by an antenna-molecule to exhibit luminescence. In this project, we will synthesize a molecular machine where lanthanide luminescence is used to “read” and “report” on the molecular conformation in the machine by utilization of antenna effects.

Aside from the core subject of supramolecular chemistry, the student working on this project will receive extensive training in multistep organic synthesis, coordination chemistry, lanthanide photophysics and molecular modelling, as well as training in data visualization and scientific presentation. This project will thus produce a simple and efficient readout method for correlating molecular movement with luminescence. This could lead to new classes of multiplexed diagnostic devices, and open the door for future venues like switchable magnetic resonance imaging contrast agents.

References:
[1] Eng. Sci. 1960, 23, 22.
[2] Proc. Natl. Acad. Sci. USA, 2018, 115, 9397.
[3] a) Chem. Rev. 2015, 115, 10081; b) Chem. Soc. Rev., 2012, 41, 19; c) Chem. Soc. Rev., 2014, 43, 99.
[4] a) Angew. Chem. Int. Ed. 2017, 56, 11080; b) Angew. Chem. Int. Ed. 2017, 56, 11094; c) Angew. Chem. Int. Ed. 2017, 56, 11060.
[5] a) C. R. Chimie, 2016, 19, 103. b) Eur. J. Org. Chem. 2021, 10.1002/ejoc.202100749.
[6] Chem. Soc. Rev. 2010, 39, 189.

Theoretical Chemistry and Physics (Reg. No. 2234)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Victor Kimberg
KTH School CBH	**Co-supervisor(s)**
KTH Department Theoretical Chemistry and Biology	**Main email contact** kimberg@kth.se

Specific subject area(s)
X-ray Spectroscopy for XFEL Applications
Title of project
Time-resolved X-ray pump-probe spectroscopy for nuclear dynamics studies
Number of available position
2
Earliest start date
2022-04-01
Short description of the project
Description of the research field: Strong field X-ray physics is at the frontier of modern X-ray spectroscopy, promoted by the recent advances of X-ray free electron laser (XFEL) radiation facilities, opens the door to nonlinear X-ray physics and ultrafast pump-probe techniques. The first experiments at modern XFELs have given fascinating results and a lot of intriguing observations [1-4]. Theory plays a crucial role as a tool to simulate future experiments and to investigate where novel effects might be expected [2-5]. However, so far only a fraction of the predictions have been put to experimental test, and we foresee rapid progress in this field. New XFELs have reached intensities and wavelengths that hitherto have not been utilized and we expect effects that have not been encountered before. Time-resolved X-ray spectroscopy for investigation of photo-excited molecular processes have recently gained significant focus.

Project description: A key idea of the present project is to use the ultrashort wavelength-tunable XFEL pulses to study the rotational and vibrational dynamics of molecules in real time. The project is devoted to theory development for new spectroscopic techniques utilizing short X-ray and UV (ultraviolet) pulses and to model the dynamics of a coupled ro-vibrational wave packet triggered by electronic excitations of molecules. Our theoretical description, software development and accurate modeling will give guidelines to experimental studies to be performed. We will focus on theory of recoil-induced molecular rotation and alignment, studied with X-ray pump-probe spectroscopy, as well as on evolution of rotational and vibrational wave packets in molecules photo-excited by short X-ray and UV pulses [6,7].

Job and conditions: The candidate will be involved in discussion and development of theory, which requires some basics of quantum mechanics. Writing of small computer codes using scientific programming is essential part of the work, given that the candidate has some basic knowledge of programming languages, preferably Python. A part of simulation will be performed at high-performance computing clusters. As a

results of this visiting PhD position we expect publication of one-two scientific papers in high impact journals. For our resent research outcomes please refer to the reference list below. Candidate will be provided with all KTH employees privileges through Theoretical Chemistry and Biology group resources.

References:
[1] F. Gel'mukhanov, M. Odelius, S. Polyutov, A. Föhlisch, and V. Kimberg, Rev. Mod. Phys., 93, 035001 (2021).
[2] V. Kimberg and N. Rohringer, Phys. Rev. Lett., 110, 043901 (2013).
[3] V. Kimberg, et. al, Faraday Discuss., 194, 305 (2016).
[4] V. Kimberg and N. Rohringer, Structural Dynamics, 3, 034101 (2016).
[5] Y. R. Liu, V. Kimberg, Y. Wu, J. G. Wang, O. Vendrell, S. B. Zhang, J. Phys. Chem. Lett., 12, 5534 (2021).
[5] V. Savchenko, F. Gel'mukhanov, T. Laarmann, S. P. Polyutov, and V. Kimberg, Phys. Rev. A 104, 013114 (2021).
[6] V. Savchenko, J.-C. Liu, M. Odelius, N. Ignatova, F. Gel'mukhanov, S. Polyutov, and V. Kimberg, Phys. Rev. A 104, 032816 (2021).

Cybersecurity and privacy (Reg. No. 2235)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Panos Papadimitratos
KTH School EECS	**Co-supervisor(s)**
KTH Department Computer science	**Main email contact** papadim@kth.se

Specific subject area(s)

Network Security; Wireless Security; Mobile Security; Information Theoretic Security and Privacy; Privacy Enhancing Technologies; Location Privacy; IoT Security; ML Security and Privacy

Title of project

Security and privacy for networked systems

Number of available position

2

Earliest start date

2022-03

Latest start date

2022-09

Short description of the project

We are looking for highly motivated individuals already pursuing a PhD in security and privacy to join our group for a short-term visit. The position involves activities leading to original research and results in peer-reviewed publications. The research topics can relate with any of the areas the Networked Systems Security (NSS) group works on. We design and build trustworthy networked systems. Our research agenda covers a gamut of security and privacy problems a number of our results got significant attention by the research community.

Candidates with experimental/systems or theoretical profiles and research interests in any aspect of security and privacy are welcome to apply. Applicants must hold an MSc degree in computer science, electrical engineering, computer engineering, information and communication technologies, or a related area, and be already in a PhD program. It is preferable if they are at the late stage of their PhD and their research is aligned with or complements the work at NSS. Furthermore, the applicant must have:

- Strong academic credentials, written and spoken English proficiency, communication and team-work skills.
- Interest in several of the following: design, analysis, verification, implementation, or empirical evaluation of secure networked systems.
- Background in several of the following: computer security, mobile computing, networking, Internet security, wireless communications, distributed algorithms and systems, programming languages, performance analysis, operating systems, simulation techniques and tools, software engineering, system and network programming, applied cryptography, privacy preserving or enhancing technologies, optimization, information theory, machine learning.
- Preparation and readiness to contribute to our research agenda and to work in an internationally oriented group.

Computer science (Reg. No. 2236)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** György Dán
KTH School EECS	**Co-supervisor(s)**
KTH Department CS	**Main email contact** gyuri@kth.se

Specific subject area(s)
Applied Optimization
Title of project
Online learning for resilient edge computing
Number of available position
1
Earliest start date
2022-09-01
Short description of the project
Edge computing is emerging as a new infrastructure layer for providing computational and storage resources for high bandwidth and latency constrained applications in a variety of critical infrastructures. For it to become successful, it is essential that it is resilient to attacks and failures, while ensuring efficient and flexible resource utilization. In this project we aim to explore novel approaches and design novel algorithms for edge computing resource management, with applications in IoT systems, federated machine learning, and cyber-physical systems. Our focus is on decentralized approaches incorporating online multi-agent learning, possibly in a game theoretical framework, including aspects of resilience to adversarial input.

Computer Science (Reg. No. 2237)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Yuan Feng (SJTU, Shanghai) and Pawel Herman (KTH, Stockholm)
KTH School EECS	**Co-supervisor(s)**
KTH Department Division of Computational Science and Technology	**Main email contact** fengyuan@sjtu.edu.cn (Yuan Feng at SJTU, Shanghai); paherman@kth.se (Pawel Herman at KTH, Stockholm)

Specific subject area(s)
Biomedical Imaging
Title of project
Quantitative evaluation of deep brain stimulation after interventional MRI with magnetic resonance elastography
Number of available position
1
Earliest start date
2022-05-01
Latest start date
2022-09-01
Short description of the project
The main aim of the project is to integrate machine learning techniques with fast imaging sequences and image processing algorithms to achieve real-time interventional magnetic resonance imaging (i-MRI) of brain. This approach is expected to help improve the current surgical performance of deep brain stimulation (DBS) commonly used for Parkinson's patients. Furthermore, to evaluate the effects of DBS treatment, we intend to develop and employ novel neural network methods allowing for fusing local field potential (LFP) and magnetic resonance elastography (MRE) data collected for prognostic purposes after the surgery.

Information Science and Engineering (Reg. No. 2238)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Ming Xiao
KTH School EECS	**Co-supervisor(s)**
KTH Department Information Science and Engineering	**Main email contact** mingx@kth.se

Specific subject area(s)
Communication, 6G and Learning
Title of project
Machine Learning for Wireless Networks
Number of available position
1
Earliest start date
2022-09-01
Short description of the project
In the project, we will investigate emerging technologies for future wireless networks, e.g., 5G advanced or 6G. One key tool will be machine learning, e.g., deep learning, reinforced learning and distributed learning. The learning algorithms will be developed to improve the performance of wireless networks, such as latency, capacity and security. You should have solid results on communication technologies. You should have experience in learning theories and related programming.

space physics (Reg. No. 2239)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Andris Vaivads
KTH School EECS	**Co-supervisor(s)**
KTH Department Electrcal Engineering	**Main email contact** vaivads@kth.se

Specific subject area(s)
Space plasma, Satellite observations, Solar wind
Title of project
Kinetic scale processes in solar wind
Number of available position
1
Earliest start date
2022-05-01
Short description of the project
Two spacecraft missions have been launched in recent years with a goal to fly closer to Sun and to study the physics of solar wind and it's source regions, NASA Parker Solar Probe and ESA Solar Orbiter. This has opened new possibilities to study the fundamental plasma processes controlling the development of the solar wind evolution from global scales down to the smallest kinetic scales. The guest PhD student would address the kinetic scale physics of solar wind that can be of importance for solar wind heating and acceleration. Of particular interest would be to study the boundaries of switchbacks for possible magnetic reconnection signatures. Where possible, a comparative study with the multi-spacecraft missions of MMS and Cluster in the near Earth solar wind will be carried out.

Electrical engineering (Reg. No. 2240)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Hans-Peter Nee
KTH School EECS	**Co-supervisor(s)**
KTH Department Electrical Engineering	**Main email contact** hansi@kth.se

Specific subject area(s)
Power Electronics
Title of project
Small-signal stability investigation of hybrid dual-infeed HVDC system
Number of available position
1
Earliest start date
2022-01-01
Short description of the project
Aim
i) investigating the impact of the interaction between LCC and VSC converters on the high-frequency oscillatory modes of the overall system, considering the time delay of the control loop.
ii) further analyzing the interaction between LCC and VSC and proposing an effective control approach to improve the system stability.

Research methods
i) establish the small-signal model of the hybrid dual-infeed HVDC stystem, adopting state-space modeling and the transfer function approach.
ii) The participation factor is used to identify the main participators which highly affect the dominant modes. Based on the results, the small-signal model is reasonably simplified to further investigate the interaction mechanism of the dominant factors of the oscillatory modes.
iii) An effective method to improve the system stability is proposed through theoretical deductions and numerical simulations.

Time plan
Start: 1st of January 2022
End: 31st of August 2022

Electrical Engineering (Reg. No. 2241)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Qianwen Xu
KTH School EECS	**Co-supervisor(s)**
KTH Department Electrical Engineering	**Main email contact** qianwenx@kth.se

Specific subject area(s)
Power Systems and Power Electronics
Title of project
Sustainable power systems with smart converters
Number of available position
2
Earliest start date
2022-08
Short description of the project
Driven by environmental concerns and development towards a sustainable society the future power systems will have a high penetration of renewable energy sources such as wind and solar power. This in turn leads to a high penetration of power electronics converters as they form the interface to the grid from the renewable energy sources. Power electronic converters enable full controllability, high efficiency and flexibility. However, due to their characteristics of low inertia, fast dynamics, high order nonlinearities and strong interactions, they are vulnerable to disturbances and attacks, which may result in system failures and collapse. Recent advancements in artificial intelligence, big data and advanced control/optimization technologies provide possible novel approaches to address the challenge.
This project aims to develop advanced control and coordination strategies for smart converters to achieve stable and secure operation of sustainable power systems.

Energy Economics (Reg. No. 2242)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** M. R. Hesamzadeh
KTH School EECS	**Co-supervisor(s)**
KTH Department EPE	**Main email contact** mrhesa@kth.se

Specific subject area(s)
Electricity Market
Title of project
Mechanism design for the joint carbon-energy market
Number of available position
1
Earliest start date
2022-09-01
Latest start date
2022-12-30
Short description of the project
With increasing desire to reduce carbon emissions and the popularization of renewable generation technology, encouraging the development of green energy and limiting carbon emissions through market mechanisms have been widely used. Accordingly, the clearing and operation of the multi-energy market has also undergone great changes. For example, prosumers, as the active participants in future energy systems who produce and consume energy, need to study their carbon-emission behaviors in the new multi-market environment. They need to actively participate in the carbon and energy markets while respecting their privacy issues. This project is intended to study the interaction between the carbon market and the energy market, proposing a kind of trading mechanism that meets the dual constraints of energy balance and low-carbon emissions. As well as, designing a distributed incentive-based operation mechanism of the joint carbon-energy market, which can increase the interest of prosumers to participant in the market and also protect the privacy of prosumers in the trading process. The guest Ph.D. student would have a solid knowledge on Convex Optimization, Game Theory, Basic Theory of Electricity Market and master a variety of distributed algorithms.

Energy (Reg. No. 2243)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Björn Laumert
KTH School ITM	**Co-supervisor(s)** Wujun Wang
KTH Department Department of Energy Technology	**Main email contact** bjorn.laumert@energy.kth.se

Specific subject area(s)
Renewable Energy
Title of project
Dynamic performance analysis of a load flexible combustor for micro gas turbine based polygeneration system
Number of available position
1
Earliest start date
2022-08-01
Latest start date
2022-10-01
Short description of the project
Due to the natural intermittency of renewable energy and the load fluctuation from the demand side, a renewable energy based distributed energy system usually has to be integrated with either energy storage system or a load flexible combustor to achieve a hybrid system for adapting the output power to meet the various requirements. Comparing to the distributed systems that with electrical storage, renewable fuel based hybrid systems are capable to use the renewable energy more efficiently through polygeneration, e.g. electricity, heat, cold, fresh water and so on. Among the components in a hybrid distributed energy system, the load flexible combustor is one of the most important key components. In KTH solarlab, a load flexible combustor together with a gas turbine simulator has been developed with the funding support from Swedish Energy Agency. In order to improve the performance of the load flexible combustor, more study and optimization work is still required. This project mainly aims for the dynamic performance analysis of the load flexible combustor, and experimental validation could be included as well if it is required. Our industrial partner COMPOWER will offer necessary technical support.

Machine Design (Reg. No. 2244)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Mats Magnusson
KTH School ITM	**Co-supervisor(s)**
KTH Department Machine Design	**Main email contact** matsmag@kth.se

Specific subject area(s)
Integrated Product Development
Title of project
Innovation ecosystem building in periods of technological disruption
Number of available position
1
Earliest start date
2022-03-01
Latest start date
2022-06-01
Short description of the project
With the continuous emergence of new technologies, new markets, new rules and various exogenous forces (such as health emergencies and natural disasters), the external environment for many enterprises is becoming increasingly uncertain. A potential way for incumbent firms to improve their resilience is to actively engage in the development of new innovation ecosystems addressing new and disruptive technologies together with different external stakeholders.
Disruptive innovators need to obtain complementary resources from the outside to ensure the development of new technologies and the commercialization of new products. In the process of searching and acquiring complementary resources, the innovation subjects gradually connect to overcome inertia and resistance and enhance the competitiveness of enterprises under uncertain environment.
In the young field of innovation ecosystem studies, most extant theory is based on the assumption that the innovation ecosystem already exists. Relaxing this assumption open up for investigating innovation ecosystem formation mechanisms, which currently are still unclear. Moreover, although disruptive technologies may create unknown markets and form new innovation ecosystems, little is known about the specific role of disruptive technologies in ecosystem . In addition, due to the particularities of innovation ecosystem, such as openness, diversity of members and heterogeneous symbiosis, traditional research methods pay less attention to the synergistic effect of multiple factors.
By combining theories on innovation ecosystem and disruptive innovation, respectively, this project aims to contribute to the understanding of how disruptive innovation affects the emergence and design of innovation ecosystems. More specifically, the project will contain the following three activities:(1) Build an integrated analytical framework for analyzing disruptive innovation processes based on a comprehensive literature review and bibliometrical analysis.

(2) Explore the interaction of multiple factors affecting the emergence and design of innovation ecosystem through case studies and qualitative comparative analysis (fsQCA).
(3) Generate practical implications for how to promote disruptive technological innovation in technology-follower incumbents, and how these can actively engage in forming disruptive innovation ecosystems to improve resilience.

Materials Science (Reg. No. 2245)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Song Lu
KTH School ITM	**Co-supervisor(s)** Levente Vitos
KTH Department Materials Science and Engineering	**Main email contact** songlu@kth.se

Specific subject area(s)
Computational Materials Science
Title of project
Atomistic insights on various types of interfaces in metallic alloys
Number of available position
1
Earliest start date
2022-01-15
Short description of the project
During the past decade, metallic alloys containing multiple principal alloying elements, known as high-entropy alloys (HEAs), have created a growing interest in exploring the property limits of metals. Despite of the great success achieved with this alloying concept, the fundamental mechanisms of the extraordinary mechanical properties are usually elusive, hindered by the complicated composition and microstructure. There is an increasing demand in using advanced atomistic approaches for characterizing and understanding the physical and mechanical properties of HEAs. Particularly, internal interfaces including stacking fault, twin boundary, precipitate/matrix interface and chemical boundary, play prominent roles in activating novel strengthening mechanisms. Investigating their physical and mechanical properties by nowadays experiments is extremely difficult, but they can be suitable subjects for advanced ab initio calculations. In this project, I will use advanced ab initio methods and alloying theories to quantitatively study the physical and mechanical properties of internal interfaces in HEAs and reveal their roles in activating the novel strengthening mechanisms. The knowledge obtained in this study will effectively guide the discovery of novel HEAs.

Machine Design (Reg. No. 2246)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Dejiu Chen
KTH School ITM	**Co-supervisor(s)**
KTH Department Mechatronics and Embedded Control Systems, Department of Machine Design	**Main email contact** chen@md.kth.se

Specific subject area(s)
Mechatronics and Embedded Control Systems
Title of project
Design of Situation-Aware Self-Adaptive Embedded Control Systems
Number of available position
2
Earliest start date
2021-11
Latest start date
2022-01
Short description of the project
Embedded Control Systems (ECS) constitute a key enabling technology behind Cyber-Physical Systems like self-driving cars and smart medical devices. This project is related to the development of AI-based methods for the situation-awareness and self-management capabilities of such systems with operational conditions dominated by complex stochastic dynamic behaviors. The research seeks to combine data scientific methods with model-based systems engineering, embedded software and hardware technologies.

Machine Design (Reg. No. 2247)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Dejiu Chen
KTH School ITM	**Co-supervisor(s)**
KTH Department Mechatronics and Embedded Control Systems, Department of Machine Design	**Main email contact** chen@md.kth.se

Specific subject area(s)
Mechatronics and Embedded Control Systems
Title of project
Design of Situation-Aware Self-Adaptive Embedded Control Systems
Number of available position

Earliest start date
2021-11
Latest start date
2022-01
Short description of the project
Embedded Control Systems (ECS) constitute a key enabling technology behind Cyber-Physical Systems like self-driving cars and smart medical devices. This project is related to the development of AI-based methods for the situation-awareness and self-management capabilities of such systems with operational conditions dominated by complex stochastic dynamic behaviors. The research seeks to combine data scientific methods with model-based systems engineering, embedded software and hardware technologies.

Computational Materialdesign (Reg. No. 2248)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Levente Vitos
KTH School ITM	**Co-supervisor(s)** Song Lu
KTH Department Materials Science and Engineering (MSE)	**Main email contact** levente@kth.se

Specific subject area(s)

Computational Materialdesign Based on First Principles Quantum Theory

Title of project

Atomistic simulation of plasticity of complex alloys

Number of available position

2

Earliest start date

2022-09

Short description of the project

Plasticity is a fundamental property determining the mechanical behavior of materials. The complexity of plastic deformation and the lack of a unified theory have seriously limited the exploration of the full capacity of complex alloys, such as stainless steels or high entropy alloys. Elastic deformation involves small lattice distortions and is described by the well-known Hooke's law. However, the plastic deformation implies transitions over a series of unknown energy barriers. A phenomenological description of the plastic regime using the so called stacking fault energy (SFE) has been widely accepted in engineering sciences. However, the SFEs are very sensitive to a series of factors. For an effective optimization of the mechanical properties, a quantitative prediction of the SFEs and in-depth understanding of the stacking faults are important. Experimental techniques such as X-ray or TEM are commonly used to determine the SFE, but unfortunately the measured SFEs are often very scattered due to the failure of the conventional experimental techniques in systems with very small or negative SFE. Another important aspect is that materials classification based merely on the SFE shows serious limitations the case of complex alloys. The reason is that an equilibrium property cannot capture the complexity of plastic deformation. However the generalized planar fault energy comprises several intrinsic energy barriers (IEBs) and thus provides information on the deformation process itself barriers. For a better understanding and prediction of the plastic deformation mechanism one requires as input both the SFEs and IEBs. This type of modeling has not been available for metallurgists because of the inherent difficulty of experimental determination of IEBs.The present proposal focuses on assessing the composition and temperature dependence of the SFEs and IEBs using ab initio methods, and establishing the composition regimes for various deformation mechanisms such as dislocation networks, twinning and martensite formation. A correlation between the theoretically predicted SFE and the deformation response will also be in the focus, through collaboration with experimentalists and industrial units.

Vehicle Engineering (Reg. No. 2249)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Lars Drugge
KTH School SCI	**Co-supervisor(s)**
KTH Department Engineering Mechanics	**Main email contact** larsd@kth.se

Specific subject area(s)
Vehicle Dynamics of Over-actuated Autonomous Electric Vehicles
Title of project
Motion control strategies for autonomous electric vehicles
Number of available position
1
Earliest start date
2022-06-01
Short description of the project
Energy efficient operation of autonomous vehicles is of high importance due to environmental awareness and for economic reasons. Furthermore, safe motion planning and control of autonomous vehicles is important to consider especially in safety-critical manoeuvres. The introduction of vehicles with more advanced drive systems consisting of multiple electrical actuators will open up for new and cost-efficient solutions for motion control, which makes it possible to develop vehicle control strategies that can enhance for example energy efficiency without compromising comfort and safety.
A vehicle with more control outputs available than required to control the number of degrees of freedom is often referred to as an over-actuated vehicle. The aim is to analyse the potential of over-actuation and to develop control strategies that can handle possible conflicts between e.g. energy efficiency, environmental impact, safety and comfort for different transportation tasks and in different driving conditions. Several different active chassis systems are considered, for example electric wheel hub motors, individual steering, active suspension, camber control as well as different combinations of over-actuation. To solve this, a combination of optimisation techniques, vehicle modelling, knowledge of intended transportation mission, relevant requirements and boundary conditions are needed.

Vehicle engineering (Reg. No. 2250)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Mats Berg
KTH School SCI	**Co-supervisor(s)** Zhendong Liu
KTH Department Department of engineering mechanics	**Main email contact** mabe@kth.se

Specific subject area(s)
Rail Vehicle Technology
Title of project
Impact of Different Climates on Energy Consumption of Rail Vehicles
Number of available position
1
Earliest start date
2022-09-01
Latest start date
2022-12-31
Short description of the project
Transport sector consumes one-fourth of total energy, and it is essential for all transport modes to control and lower energy consumption and CO2 emissions to meet the global climate-neutral goal. For the railway sector, rail vehicles are designed for a service life as long as 30 years, which is much longer than other transport modes. Different from other energy-consuming objects, the rail vehicles are movable and subject to different climate conditions within the daily operation. Due to the very long service life of rail vehicles, the energy consumption is expected to be significant. However, the temporal and spatial variations of climate are not taken into account in the current railway transportation (from train designing to daily operation). Nowadays, regional climate models can run as high as km-scale and bring large benefits in physically consistent climate projections, which can provide more appropriate climate information. This provides us opportunities to evaluate the energy consumption of existing train designs based on reliable climate information. The outcome of the study will benefit the development of rail transport to energy-efficiently operate the rail vehicles.

Engineering Mechanics (Reg. No. 2251)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Sebastian Stichel
KTH School SCI	**Co-supervisor(s)** Saeed Hossein Nia
KTH Department Engineering Mechanics	**Main email contact** stichel@kth.se

Specific subject area(s)
Rail Vehicle Technology
Title of project
Understanding Railway Wheel and Rail Polygonization Respectively Corrugation with Help of Computer Simulation
Number of available position
1
Earliest start date
2022-09
Short description of the project
Both high-speed and metro vehicles in China suffer from wheel polygonization and the rails from corrugation. In recent years several researchers have been working on finding the root causes of the phenomena, often with help of simulation models. These simulation models include time domain simulations, contact modelling and wear calculation.
The time domain simulations include both rigid and flexible bodies. Up to now the only flexible body that has been considered in most of the studies is the wheelset flexibility. Measurements and field studies, however, suggest that the bogie flexibility should be taken into account as well.
Almost all researchers have used Hertz and Fastsim to solve the contact problem. However, recent studies show that this combination has considerable shortcomings and should be replaced by more correct methodologies such as ANALYN and FASTRIP which recently have been developed at KTH.
The idea for the project is to modify an MBS software to be able to use the recently developed contact models to calculate wear online while the simulations are running. Only then one can consider the effects of polygonization and corrugation on the dynamic behaviour including the excitation of the modes of vehicle and track components.

Nuclear Engineering (Reg. No. 2252)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Pavel Kudinov
KTH School SCI	**Co-supervisor(s)** Dmitry Grishchenko
KTH Department Physics	**Main email contact** pkudinov@kth.se

Specific subject area(s)
Multiphase Flows, Direct Contact Condensation, Turbullence
Title of project
Direct steam condensation phenomena in a large water pool
Number of available position
1
Earliest start date
2021-10-31
Short description of the project
Important element of a Boiling Water Reactor (BWR) safety system is the pressure suppression pool (PSP). The pool is used to condense steam released from the primary coolant system and prevent containment from overpressure. Pool temperature affects both pressure suppression capacity and operation of the safety systems that use the PSP as a water source for emergency core cooling and containment spray. Direct steam condensation induces sources of heat and momentum in the pool. Depending on the injection condition the competition between the sources can lead to complete mixing of the pool or development of thermal stratification. Increased temperature of the top layer in the stratified pool will lead to higher partial pressure of steam in the containment and thus reduces pressure suppression capacity of the pool. Mechanistic models with predictive capabilities are needed for the analysis of the direct contact condensation phenomena. We use Effective Heat Source (EHS) and Effective Momentum Source (EMS) models to analyze the effect of steam injection on the pool. In this work we use Computational Fluid Dynamic (CFD) to study characteristics of the jets induced by direct steam condensation on subcooled water. Namely, we address the questions about spatial distributions of turbulence characteristics, momentum and temperature in such jests. That will require modeling of gas-liquid interface which phase transitions, and modeling of turbulence induced by the interface motion.

Applied and Computational Mathematics (Reg. No. 2253)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Xiaoming Hu
KTH School SCI	**Co-supervisor(s)**
KTH Department Mathematics	**Main email contact** hu@kth.se

Specific subject area(s)
Mathematical Systems Theory
Title of project
Cooperative Multi-Agent Systems and Reinforcement Learning
Number of available position
1
Earliest start date
2022-08-01
Latest start date
2022-11-01
Short description of the project
In this project we will explore the connection between cooperative multi-agent control for unmanned systems and Reinforcement Learning. Specifically we will focus on problem domains in which the multiple agents are cooperating to solve a joint task or to maximize a utility in self-organized ways.

Mathematics (Reg. No. 2254)

Type of position Visiting PhD student: 6 - 12 months	**Main supervisor** Petter Brändén
KTH School SCI	**Co-supervisor(s)**
KTH Department Mathematics	**Main email contact** pbranden@kth.se

Specific subject area(s)
Combinatorics
Title of project
Lorentzian polynomials in enumerative and algebraic combinatorics
Number of available position
1
Earliest start date
2022-03-01
Short description of the project
Petter Brändén (KTH) and June Huh (Princeton) have recently developed a theory of Lorentzian polynomials as a framework for positivity problems in combinatorics, algebra and geometry. This theory is currently under further development and many important families of polynomials in enumerative and algebraic combinatorics are conjectured to Lorentzian. The goal of this project is to study problems in enumerative and algebraic combinatorics and to apply for example (and further develop) the theory of Lorentzian polynomials to settle positivity questions in the area.

Visiting scholar: 3 - 12 months

Evolutionary genetics and genomics (Reg. No. 2255)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** Peter Savolainen
KTH School CBH	**Co-supervisor(s)** Pelin Sahlén
KTH Department Department of Gene technology	**Main email contact** savo@kth.se

Specific subject area(s)
Origin and Evolution of the Domestic Dog: Phylogeographic and Selection Analysis
Title of project
Evolution of the domestic dog: identification of selected genes and geographic origin
Number of available position
1
Earliest start date
2022-06-01
Short description of the project
This project is based on a long-established collaboration between Sweden and China, with the research groups of Professor Ya-ping Zhang and Professor Guo-Dong Wang at Kunming Institute of Zoology, Chinese Academy of Sciences. In a number of prominent papers, we have previously, based on large-scale genetics and genomics, indicated South China as the probable region of dog origins, and identified genes under selection in the first phase of dog evolution, affecting e.g. digestion and behaviour.

We have now increased sampling in South China and Southeast Asia, for refined phylogeographic analyses. We analyse all types of genetic markers: nuclear genomes as well as mitochondrial, Y-chromosomal and X-chromosomal DNA. Since most mutations are situated in regulating regions far from the affected genes, we also identify regulatory sequences under selection in the domestication, by mapping of promoters and enhancers and of their interactions. Based on these analyses, we continue our studies of gene evolution and phylogeography, with the aim of describing how, when and where the wolf developed into the domestic dog.

Because of the broad aims of this study, students with different backgrounds are welcome to apply; molecular biology, bioinformatics or phylogeographic analysis.

Chemistry (Reg. No. 2256)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** Magnus Johnson
KTH School CBH	**Co-supervisor(s)**
KTH Department Chemistry	**Main email contact** magnusj@kth.se

Specific subject area(s)
Nanoscale Infrared Microscopy Studies of Cellulose
Title of project
Nano infrared microscopy studies of nanocellulose
Number of available position
1
Earliest start date
2022-04-15
Short description of the project
The project concerns nanoscale infrared spectroscopy studies of various types of nanocellulose. Nanocellulose has proven to be a highly interesting material for research as well as in industrial applications since it is a biodegradable and sustainable material that has great mechanical properties, heigh strength, and low weight. However, since the nanocellulose particles only have a diameter of some nanometers, advanced instruments with a high sensitivity and spatial resolution are required in order to study individual particles in detail. Such an instrument is the novel technique “nano infrared (FTIR) microscopy”, which will be the main tool in the project. This technique can provide chemical and topographical information with a spatial resolution of around 20 nanometers in terms of vibrational spectra, thus considerably better than for conventional infrared microscopy and confocal Raman microscopy. Areas that will be studied on the nanoscale are how different nanocelluloses are structured, how nanocellulose interacts with water, and how various wood components such as lignin and cellulose are distributed in wood-based products.

Cybersecurity and Privacy (Reg. No. 2257)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** Panos Papadimitratos
KTH School EECS	**Co-supervisor(s)**
KTH Department Computer Science	**Main email contact** papadim@kth.se

Specific subject area(s)
Network Security; Wireless Security; Mobile Security; Information Theoretic Security and Privacy; Privacy Enhancing Technologies; Location Privacy; IoT Security; ML Security and Privacy
Title of project
Security and Privacy for Networked Systems
Number of available position
2
Earliest start date
2022-02
Latest start date
2022-09
Short description of the project
We are looking for highly motivated individuals for short term positions involving activities leading to original research and results in peer-reviewed publications. The research topics can relate with any of the areas the Networked Systems Security (NSS) group works on. We design and build trustworthy networked systems.Our research agenda covers a gamut of security and privacy problems a number of our results got significant attention by the research community. Candidates with experimental/systems or theoretical profiles and research interests in any aspect of security and privacy are welcome to apply. Applicants must hold or be about to receive a PhD degree in computer science, electrical engineering, computer engineering, information and communication technologies, or a related area. Furthermore, the applicant must have:
- Strong academic credentials, written and spoken English proficiency, communication and team-work skills.
- Interest in several of the following: design, analysis, verification, implementation, or empirical evaluation of secure networked systems.
- Background in several of the following: computer security, mobile computing, networking, Internet security, wireless communications, distributed algorithms and systems, programming languages, performance analysis, operating systems, simulation techniques and tools, software engineering, system and network programming, applied cryptography, privacy preserving or enhancing technologies, optimisation, information theory, machine learning.
- Preparation and readiness to contribute to our research agenda and to work in an internationally oriented group.

Hardware security (Reg. No. 2258)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** Gunnar Malm
KTH School EECS	**Co-supervisor(s)**
KTH Department Electrical Engineering, Electronics and Embedded System	**Main email contact** gunta@kth.se

Specific subject area(s)
Simulation of Hardware Security Primitives Based on Non-volatile Spintronic Memory
Title of project
Hardware security meets spintronics
Number of available position
1
Earliest start date
2022-08-01
Latest start date
2023-01-01
Short description of the project
In the next 10 years, the nano-electronics or integrated circuits research area will need to go beyond the current paradigm of continuous scaling and increased number of transistors according to Moore's law. In today's connected society, new circuit functionality is getting into focus. One example of such functionality is security embedded in the actual hardware. Hence hardware security becomes a timely and relevant scientific and technical field.
The main classes of hardware security countermeasures that are used in silicon CMOS integrated circuit design today include hardware security primitives, such as physical unclonable functions (PUFs) and true random number generators (TRNGs).
Embedded non-volatile memories such as spintronic eMRAM have very large potential since they exhibit a natural ENTROPY source and hence are directly applicable as random number generators. In this project, such circuits should be designed using process design kits (PDK) from leading foundries that have this type of technology as an emerging option in their portfolio. A successful candidate should be familiar with the design flow in Cadence which is our main tool at KTH. Spintronics is also a suitable candidate for PUF circuits and the target here would be to realize circuits with small additional footprint and strong resilience to any type of side channel attack, including machine learning. In addition, my group is pursuing e.g. encrypted communication schemes based on microwave spintronics. The target here is energy efficient solutions for 6G future networks.
Finally, we want to benchmark hardware security solutions in various emerging technologies, including but not limited to resistive RAM, phase change RAM and eMRAM. The study should identify the most promising technology candidate out of these options.

Computer science (Reg. No. 2259)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** György Dán
KTH School EECS	**Co-supervisor(s)**
KTH Department CS	**Main email contact** gyuri@kth.se

Specific subject area(s)
Applied Optimization
Title of project
Online learning for resilient edge computing
Number of available position
1
Earliest start date
2022-09-01
Short description of the project
Edge computing is emerging as a new infrastructure layer for providing computational and storage resources for high bandwidth and latency constrained applications in a variety of critical infrastructures. For it to become successful, it is essential that it is resilient to attacks and failures, while ensuring efficient and flexible resource utilization. In this project we aim to explore novel approaches and design novel algorithms for edge computing resource management, with applications in IoT systems, federated machine learning, and cyber-physical systems. Our focus is on decentralized approaches incorporating online multi-agent learning, possibly in a game theoretical framework, including aspects of resilience to adversarial input.

Machine Learnig, Wireless Communications (Reg. No. 2260)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** Carlo Fischione
KTH School EECS	**Co-supervisor(s)**
KTH Department NSE	**Main email contact** carlofi@kth.se

Specific subject area(s)
Machine Learning, PHY and MAC Wireless Communications
Title of project
Machine Learning over Wireless Networks
Number of available position
2
Earliest start date
2022-01-01
Short description of the project
One of the main characteristics of the IoT and 5-6G technological revolution is the huge data generation. Such wealth of data is forcefully motivating the development of data analysis methods, namely machine learning. Currently, machine learning needs big datasets and very huge computational and communication resources. However, in the fourth technological revolution, data sets of any size will be distributed among several nodes (people, devices, objects, or machines) that might not be able to perform the computations and to share data. Unfortunately, existing machine learning methods are mostly intended for proprietary and high performing networks as in data centres, and would greatly stress communication networks such as IoT and 5-6G wireless networks. In these wireless networks, machine learning methods will encounter new challenges in terms of computation, bandwidth, scalability, privacy, and security. Meanwhile, wireless communications methods are not yet intended to support Machine Learning services. Machine learning over wireless networks face a lack of understanding of the fundamental methods. In this research project, we propose to contribute to investigate a new fundamental theory for wireless communications supporting machine learning over networks.

Machine Design (Reg. No. 2261)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** Dejiu Chen
KTH School ITM	**Co-supervisor(s)**
KTH Department Mechatronics and Embedded Control Systems, Department of Machine Design	**Main email contact** chen@md.kth.se

Specific subject area(s)
Mechatronics and Embedded Control Systems
Title of project
Behavior Reasoning and Learning for Intelligent Cyber-Physical Systems
Number of available position
2
Earliest start date
2021-11
Latest start date
2022-01
Short description of the project
Intelligent Cyber-Physical Systems (CPS) exhibit complex behaviors in operation that are often only partially observable or incompletely defined. This project is related to the development of novel framework for the modeling, reasoning and learning of such behaviors with automotive and medical applications. The research seeks to combine data scientific methods with model-based systems engineering, embedded software and hardware technologies.

Computational Materialdesign (Reg. No. 2262)

Type of position Visiting scholar: 3 - 12 months	**Main supervisor** Levente Vitos
KTH School ITM	**Co-supervisor(s)** Stephan Schrönecker
KTH Department Materials Science and Engineering (MSE)	**Main email contact** levente@kth.se

Specific subject area(s)
Computational Materialdesign Based on First Principles Quantum Theory
Title of project
High-entropy magnetocaloric materials
Number of available position
4
Earliest start date
2022-09
Short description of the project
The magnetic refrigeration technique based on magnetocaloric effect (MCE) represents the most promising alternative to gas compression refrigeration. The MCE can generate substantial temperature changes around room-temperature, particularly in materials undergoing simultaneous both magnetic and structural transitions. In magnetocaloric materials (MCMs) the alignment of randomly oriented magnetic moments by external magnetic field at adiabatic conditions results in heating. This heat is removed by heat transfer. Then turning off the magnetic field, the magnetic moments randomize again, leading to cooling of the material below the ambient temperature.
Practical implementation of the magnetic refrigeration technique requires the development of innovative MCMs, having superior magnetic, chemical and mechanical properties and at the same time admissible cumulative cost and low environmental burden.
The richness of the magnetic properties of the multi-principal element alloys (MPEAs) offers unique possibility for magnetocaloric engineering. Today the magnetic MPEAs are among the most promising candidates for combined magneto-structural transitions at ambient and elevated pressures due to the outstanding mechanical characteristics. Revealing and understanding the atomistic mechanism behind the structural and magnetic properties, one will be able to tailor the magnetic transition temperature, the entropy and adiabatic temperature changes, and connect the magnetic transitions with structural changes in order to reach large MCE in new magnetocaloric materials.
The present project will use first-principles quantum mechanical tools to deliver high quality data in order to rigorously investigate specific magnetic MPEAs for magnetocaloric applications.